EFFECTIVENESS OF DEMONSTRATION AND GUIDED DISCOVERYMETHODS ON INTEREST AND ACHIEVEMENT OF UPPER BASIC SCIENCE STUDENTS IN TARABA STATE, NIGERIA

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DECLARATION

I hereby declare that the work in this thesis titled ‘‘Effectiveness of Demonstration and Guided Discovery Methods on Interest and Achievement of Upper Basic Students Science’’ has been carried out by me in the Department of Science Education Ahmadu Bello University, Zaria. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at this or any other institution.

Aaron Nenji Datom _____ _____

Signature Date

CERTIFICATION

This thesis entitled EFFECTIVENESS OF DEMONSTRATION AND GUIDED DISCOVERY METHODS ON INTEREST AND ACHEIVEMENT OF UPPER BASIC SCIENCE STUDENTS IN TARABA STATE, NIGERIA by AARON NENJI DATOM meets the regulations governing the award of degree of Master of Education (M.ED) in Science Education of Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated first to my Heavenly Father (God) for the fulfillment of His purpose over my life that through His Grace and Mercy has made me what I am in the field of Science Education. Also to my late parents Mr and Mrs. DatomDakop for bringing me up in the ways of the Lord which was the purpose for which God created me through them. I also appreciate the rigorous training they gave me to withstand every difficulty in the face of challenges.

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List of Abbreviations

AC: Academic Achievement

AIDS: Acquired Immune Deficiency Syndrome

ANOVA: Analysis of Variance

BSCAT: Basic Science Concept Achievement Test

C.G: Control Group

DF: Degree of freedom

E.G; Experimental Group

EFA: Education For All

FME: Federal Ministry of Education

FRN: Federal Republic of Nigeria

HIV: Human Immune Virus

ICT: Information Communication Technology

IT: Interest

JETS: Junior Engineers, Technicians and Scientists

JSS: Junior Secondary School

JSSCE: Junior Secondary School Certificate Examination

M.O.E: Ministry of Education

MDGs; Millennium Development Goals

N.C.E: Nigeria Certificate in Education

N.P.E: National Policy on Education

NASEI: National Agency for Science and Engineering Infrastructure

NCE: National Council on Education

NECO: National Examination Council

NEEDS: National Economic Empowerment and Development Strategy

NERDC: Nigerian Educational Research and Development Council

NOUN: National Open University of Nigeria

NS: Non Significant

S.T.A.N: Science Teachers Association of Nigeria

SISBS: Students' Interest Scale in Basic Science

SSS: Senior Secondary School

STI: Sexually Transmitted Infection

T.R.C.N: Teachers' Registration Council of Nigeria

UBE: Universal Basic Education

UNESCO: United Nation Education, Scientific and Cultural Organization

USA: United States of America

USSR: Union of Soviet Socialist Republic

WAEC: West African Examinations Council

OPERATIONAL DEFINITIONS OF TERMS

Academic Achievement – The scholastic standing of a student at a given moment; it refers to how an individual is able to demonstrate his/her intellectual abilities successfully, especially when using his/her own efforts or skills.

Achievement – Attainment of set objective of instruction

Advance Organizers -- These are defined by Ausubel as consisting of those introductory materials that are presented in advance of an actual learning at a higher level of abstraction and generality. The function of advance organizers is to provide a background that will ensure a stable incorporation and retention of subsequent learned materials that are apparently more detailed and differentiated into learners' cognitive structure.

Basic Science – It refers to the basic training in scientific Skills required for human survival, sustainable development and society transformation.

Control Group – Group of study participants that were exposed to the Lecture Method on Nutrition Concepts

Demonstration Method – The display of event or process; it involves a student showing activities in front of a class and explaining as he/she proceeds.

Effectiveness – A measure of the impact achieved through the instructional instruments (strategies) applied

Enepther– A word used by Jerome Bruner to describe the inability of the teacher to apply the most relevant materials and strategies of teaching a learner to attain mastery of the concept.

Experiment Group 2 – Study participants that were taught Nutrition Concepts using the Guided Discovery Method

Experimental Group 1 – Study participants that were taught Nutrition Concepts using the Demonstration Method

Guided Discovery Method -This is student-centred, activity-oriented teaching strategy in which the teacher provides the setting, structure and materials and guides thelearners' progress through problem solving approach to discover answers to the instructional topics at hand.

Lecture Method– This is a teacher-dominated or teacher-centred approach to teaching. It involves the teacher telling the students what he knows about a concept, while the students remain as passive listeners taking down notes.

Meaningful Learning - In this theory, Ausubel acknowledge that the various domains of learning are made of disciplines, each of which comprises of hierarchically arranged set of concepts. At the base are the fundamental concepts but these become increasingly differentiated as one goes up the hierarchy to the top.

Set Induction - It comprises a series of activities, a combination of which a teacher may engage in for the purpose of getting the students ready or 'turned up' for an instruction. Specifically, it aims at sensitizing students to the topic or materials for instruction.

Stimulus Variation – Introducing varieties in the instructional process to remove the burden that is associated with a monotonous pattern of class room teaching. The ultimate aim is to introduce variety in the instructional process thereby engage the enthusiastic attention of the learners for a greater part of the instructional process.

ABSTRACT

This study was undertaken to investigate the Effectiveness of Demonstration and Guided Discovery Methods on Interest and Achievement of Upper Basic Science students in Wukari Educational Zone, Taraba State Nigeria. A quasi- experimental-control group design involving pre and posttest intact classes were used. The population of the study comprised 5109 Junior Secondary School (JSSII) students of public Schools in Wukari Educational Zone, out of which 159 students were randomly sampled from three Junior Secondary Schools that were part of the population to form the participants for the research work. Two instruments were used for data collection which were: Basic Science Concept Achievement Test (BSCAT) and Students Interest Scale of Basic Science (SISBS). The instrument BSCAT had a reliability coefficient of 0.75 using Kuder- Richardson K-R 20 method. BSCAT consisted of 50 multiple choice items objective tests. On the other hand, SISBS was found to have a reliability coefficient of 0.78 using Kuder- Richardson K- R 21 method. SISBS was developed based on Likert's 5-points interest scale. The instruments were validated by four experts. An intensive teaching session which lasted for five weeks for both experimental and control groups was undergone. The participants in EG_1 were taught nutrition concepts using demonstration method while participants in EG_2 were taught the same concept using guided discovery method. The control group was taught the same concept using the lecture method after which posttest was administered to the participants to find out the effects of demonstration and guided discovery teaching methods on interest and achievement of Upper Basic Science students. Three research questions corresponding to three null hypotheses were formulated and tested at $P \leq 0.05$ levels of significance. Analysis of Variance (ANOVA), Scheffe's Post Hoc Tests as well as Kruskal-Wallis interest analysis was used for testing the hypotheses. The analyses of the variables were done using computer statistical software. Findings from the study showed that out of the three methods of teaching tested, guided discovery method (EG_2) performed best, with an F value of 61.15 at $P \leq 0.05$ levels of significance, followed by demonstration method (EG_1) and the lecture method (CG) performed low. Also the interest level of participants showed significant difference after exposure to demonstration method while there was no significant difference in interest level of participants after exposure to guided discovery and lecture methods of instruction. Based on these findings, relevant recommendations were made. A major highlight of the recommendation is that stakeholders in the education sector should make concerted effort to see that government at all levels should encourage the use of guided discovery teaching method by sponsoring teachers to attend in-service training, seminars or workshops so as to be acquainted with this activity–oriented teaching strategy in the teaching and learning of Basic Science in our Junior Secondary Schools.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

The term "Science" evokes a wide variety of meanings among various authors, specialists or professionals. In its broadest sense, it constitutes the totality of what those who are organized and recognized as scientists and who also engage in the practice of science as a profession say it is (Uche & Umoren, 1998). This definition underlines the fact that science is a human activity and those who practice it are ordinary human-beings. It may also be seen as a system of thought that requires the application of a thinking process. The ultimate end product is new knowledge which is applied by the scientist and other alike in furthering human understanding of the world. This enhanced understanding of the world is achieved through inquiry and discovery processes. Carin and Sund (1964) defined science as an accumulated and a systematized learning about the natural phenomena; Also Shaibu (1992) defined science as a "complex human activity that leads to the production of a body of universal statements called laws, theories or hypotheses which serve to explain the observable behaviour of the universe or some aspects of the universe". As a body of knowledge, science is organized, systematic and it aims at providing man with the intellectual means to explain, and the capacity to control the forces and exploit the natural resources that occur in nature around him (Shaibu, 2005).

From the above definitions of science by various scholars the researcher, therefore, defines science as a systematized body of knowledge about the universe and the process of enquiry for obtaining and building up knowledge of natural phenomenon, first by observations and the utilization of the individual's mental powers or process to mediate on the data in order to generate meanings or new information. Science is a

systematized knowledge and collection of human activities carried out by the scientist. The history of science education shows that between antiquity and the 19th century, natural philosophy metamorphosed into modern science which was compartmentalized or fragmented into several disciplines. Thus, the various branches of science had their origin between 1820 and 1920 (Uche & Umoren, 1998).

As the theories of science became clearly defined due to knowledge explosion between the 16th and 20th century from the various contribution of Copernicus, Kepler, Galileo, Harvey, Newton, Einstein and others, the subject boundaries between disciplines became de-emphasized (Uche & Umoren, 1998). The result of this was the emergence of hybrid disciplines or subjects such as: biogeography, biophysics, biochemistry, geophysics, and astrophysics. Today it is difficult to assume that a topic in science exists in isolation, and without collateral knowledge from other areas of science. Hence, this forms the centre piece or the philosophy of the emergence of Integrated Science which is now known as Basic Science.

It is worth noting that, the Universal Basic Education (UBE) was launched in Zamfara State on 30th September 1999. It was legalized by the Compulsory Free Universal Basic Education Act of 2004 (Dauda & Udofia, 2010). UBE derived its justification from the 1999 constitution of the Federal Republic of Nigeria 5.18 (1) which says that; 'government shall direct its policy towards ensuring that there are equal and adequate educational opportunities at all levels'; and in S.18 (3) of the constitution among other things says 'that government shall; as and when practicable provide: Free, compulsory and universal primary education, Free secondary education'. The Universal Basic Education (UBE) covers the Primary and the first three years of Secondary School usually known as the Junior Secondary School (JSS).

Similarly, the curriculum review became imperative followed the decision of the Federal government to introduce the nine-year basic education and the need to attain the Millennium Development Goals (MDGs) by 2015 together with the need to meet the critical targets of the National Economic, Empowerment and Development Strategies (NEEDS) summarized as: values re-orientation, poverty eradication, job creation, wealth generation and using education to empower the people (Nnorom, 2012). It became obvious that the existing curricula for primary and J.S.S should be reviewed, restructured and re-aligned to fit into a 9-year of Basic Education. The National Council on Education (NCE) at its meeting in December 2005 directed the Nigerian Educational Research and Development Council (NERDC) to carry out this assignment. The NCE also approved the new curriculum as Basic Education Curricula. Consequently, a high level policy committee on curricula development met and produced the guidelines for the curricula re-structuring. When this was done NERDC convened between January and March 2006, where experts from various fields and works of life work assiduously to produce the curricula (Federal Republic of Nigeria, 2004 & 2006). These curricula were to take effect from September 2007. In the restructuring Basic Science replaced Integrated Science based on 9-3-4 Policy of Education (Nnorom`, 2012).

Basic Science by conception and definition emphasized the content as well as the process of science, the development of mental skill, acquisition of appropriate motor capabilities and the evolution of positive attitude amongst others. The Vienna congress, 1968 of the United Nation Education, Scientific and Cultural Organization (UNESCO) in Uche and Umoren (1998) defined Basic Science as approaches in which concepts and principles of science are presented so as to express the fundamental unity of scientific thought and to avoid premature or undue stress on the distinction between the various scientific fields. This definition emphases that Basic Science is a composite all

embarrassing course, it lays no emphasis on the traditional boundaries of the various science subjects. It is a course that serves as a good foundation for scientific literacy, personal growth, social relevance, process of enquiry and general education. This definition shows that presentation of the course by teachers for effective comprehension requires specialized skills. The Federal Ministry of Education (FME, 2004) core-curriculum for Basic Science from JSS I – JSS III emphasized the need for planned learning experience to be child centred.

The design of the core-curriculum of Basic Science also includes some basic assumptions. These assumptions are, that:

- The pupil entering the junior secondary school programme had no prior knowledge of science.
- The basic professional qualification for those who will teach the course will be the Nigeria Certificate in Education (NCE).

With reference to the National Policy on Education FME (2004), the teaching of Basic Science from the pre-secondary through the Junior Secondary School levels is intended to achieve the following aims:

- Inculcate in the learners, the spirit of inquiry and creativity through exploration of nature and local environment.
- Laying sound basis for scientific innovation and reflective thinking.
- Develop in the child the ability to adapt to the child's changing environment.
- Give the child opportunities for developing manipulative skills that will enable the child to function effectively in the society within the limits of the child's capacity.
- Provide the child with basic tools for further educational advancement, including preparation for trades and crafts of the locality.

Based on these guiding principles, Basic Science course is to be taught beginning with the understanding of the meaning of science and how the scientist works; since it is an activity – based programme. Thus, Basic Science has come to be a core subject in the Nigerian junior secondary schools system. The course therefore, has been offered to enhance laboratory activity, provide concrete experience, stimulate interest in school and increase scientific literacy. It also understands the process of science, maintaining flexibility and showing relationship of science to society.

Basic Science serves as a base for further scientific study in higher levels of education and consequently, transformation of the Nigerian society through science and technology. In addition to these it was the opinion of scholars like Haggis (1973) and Gagne (1977) who opined that poor Basic Science teaching and learning could emanate from lack of activity-oriented method of teaching, inability of teachers to improvise learning materials and the inability also to involve students in Basic Science activities both outside and inside the class. Other problems identified include low morale and poor preparation of teachers, overcrowded classroom/inadequacy of laboratory and workshop facilities, poor attitude of students to work, gross under-funding and inadequacy of rewards for excellence in science teaching and learning among others (Okebukola, 1986; Obomanu & Nbina, 2010).In addition, pieces of research evidence show that Basic Science teachers are poorly trained in both content knowledge, assessment techniques and pedagogy (Ibe, 2008). The case of Basic Science is peculiar because most teachers of the subject have their specialization in Biology, Chemistry, Physics, Geography and in Agricultural Science (Adejoh, 2006). If Basic Science programme will give the desired benefits to learners there is a need for aggressive in-service training and re-training of teachers.

As multi-dimensional' as the problems associated with this trend are, the issue of emerging result-oriented delivery system appears to occupy a conspicuous position (Olayiwola, 2002). Also among the problems militating against the appropriate teaching of Basic Science are: lack of appropriate teaching methods and aids, lack of specialized, trained and qualified teachers in Basic Science (Usman, 2010).

Researchers such as Obiekwe (2008) and Oludipe (2011) have independently shown that the teaching of science in Nigerian secondary schools falls short of the standard expected of it. Most of the teaching methods used have been described as inappropriate and uninspiring (Ibe, 2004; Madu, 2004; Shaleigh, 2004; Igboegwu, 2012). These methods include drill, lecture, diagnosis, direct observation, field trip, group work, manipulation, modelling, reading and recitation. Also various studies such as those of Akbani and Allvar (2010) Jekayinfa (2007) and Usman (2007& 2010) have shown that teachers of Basic Science are not qualified and this in turn affects academic performance. One major problem of the teachers is that of inability to use appropriate activity–based teaching strategy. They often resort to the usual traditional lecture method that has been shown to lead to poor academic performance in junior secondary schools in Basic Science. Nnaobi (2007) and Igboegwu (2012) asserted that there is no best method of teaching but that effective scientific teaching should be laboratory-centred and activity-oriented rather than textbook or lecture dominated methods which seem to characterize Nigerian schools.

Achievement in the teaching and learning process has to do with attainment of set objectives of instruction (Nnaobi, 2007). In science instructions for instance, if a learner accomplishes a task successfully and attains the specified goals for a particular learning experience, he is said to have achieved his/her aims. The attainment of the goals in science education is a major concern of education policy makers and one of

such goals is the inculcation of scientific literacy (FME, 2004). The use of equipment and materials in science teaching will enable the learner to develop problem solving skills and positive attitude, acquire scientific appreciation and interests, as well as to develop functional knowledge and manipulative skills (Shaibu, 2013).

The concepts of nutrition is an activity-based concept that intends to develop in the students' intellectual capacities and manual skills, to teach the hand and eye to work in unison and to involve the students in practicing science rather than reading about it. The component of this curriculum demands the provision of materials, reagents and equipment for the learners to interact with and to utilize first-hand experience in their science learning (Alawode, 2010).

Given this information, the need to try out some experimental methods of teaching like demonstration and guided discovery methods towards improving teaching and learning becomes obvious. Demonstration method can be briefly defined as a teaching method in which sight rather than hearing is a major means of communication (Obeka 2010). Though the two senses are often combined, it is often effective because most people more easily remember what they see than what they only hear or read about. It is a method where the teacher illustrates with demonstration and relevant examples all the concepts involved in a given lesson (Ametefe, 2012).

More importantly, the teacher can group the class and led a discussion on the concept that is being demonstrated. Under a classroom setting, discussion is an interactive process involving the teacher and the students or among the students themselves. In this case, a problem or topic for the lesson is presented for discussion

while the teacher helps to direct their views towards the lesson objectives. The importance of discussion method as stated by NOUN (2004) is as follows:

- Discussion method encourages students learning through active participation in the classroom.
- It enables the teacher to have better knowledge of his students' abilities and attitude.
- There is greater interpersonal relationship between the teacher and the students and among the students themselves.
- Discussion can lead to the development of leadership qualities.
- Discussion aids in problem solving.

On the other hand, in guided discovery, teaching and learning involve helping the learner to discover certain facts or answers to a given problem. Often times, learners depend on their teachers to provide all the answers they need. This practice is not always helpful to the learners. This strategy helps to develop in learners thinking and decision-making abilities. In guided discovery the answer to the problem is already known to the teacher but he/she wants the learner to discover it. The teacher guides the learner's progress by means of commands and cues (Mkpa, 2009).

In Nigeria, most junior secondary school students are unaware of some common scientific concepts that exist in our environment. These include nutrition concepts, energy, interaction in the ecosystem, erosion, flooding, acid rain, water and industrial pollution and the challenges they pose to human existence. This is an obvious challenge to scholars, secondary school teachers and students alike (Obeka 2010). The concept of nutrition is an activity-oriented method of teaching which involves practical activities; most science teachers normally "shy-away" from this teaching strategy. Thus students

continue to record low performances as reported by Shaibu and Mari (1997 as cited in Ogunleyi & Babajide, 2011) and also the study of Osuala and Ogomaka (2005) and that of Dura (2007 as cited in Opara & Eze-Odurukwe, 2011). Hence, a need to try out other instructional strategies such as demonstration and guided discovery on the concept of nutrition in Upper Basic Science as contained in the syllabus toward improving teaching and learning at the Junior Secondary School level.

Equally important is the role of interest on students' academic achievements. Predictions of academic success or failures are based upon information about cognitive and non-cognitive pre-requisites of learning that generally co-relate with academic achievement, consequently, it serves to explain the variability of academic performance (Hillsdale & Erlbaum, 2009). With this goal in mind the search for likely predictors of academic achievement centres around behavioural characteristics of the students that can be shown to exert a significant effect in many learning situation and in a stable manner over time. It is on the realization of this, that Parajes and Schunk (2002) added that 'teachers should pay as much attention to students' motivation as to actual competence, for it is the belief that may accurately predict students' motivation and future academic choice'. In a similar vein, Krapp, Schiefele and Winteler (2009) opined that regardless of the theoretical foundations and particular goals of different approaches one usually find three broad classes of factors that are considered to be especially relevant to a successful prognosis of academic success:

- general cognitive factors (for example, verbal ability)
- general motivational factors (for example, achievements motivation)
- specific preferences for particular subject areas.

The latter group is commonly referred to as 'interest'.When a learner is not psychologically ready for a task, he or she losses interest or benefit nothing from a

learning process (Okene, 2002). Also, a learner's attention span determines the extent of learning and this is highly connected to the age of the learner. This implies that the teacher must organize learning activities in such quantities that those we teach are able to cope with and have interest in the subject (Attamah, 2012). Now, researchers around the country are calling for changing the method of teaching Basic Science classes which is the foundation of all sciences related subjects. The current techniques of teaching Basic Science classes are out dated and no longer keep student interest and involvement (Agoro & Oyediran, 2009). This technique should be one that keeps the learner actively involved as this would help student develop hypotheses, design and conduct experiments, collect and interpret data, and write about the results (Dougiaumas, 1998; Yezhao, 2003). Teaching and learning of science involves 'hands-on minds-on exercise', when science is taught with materials and demonstration it arose learners interest and they tend to learn better.

In addition, gender is also another area of concern to researchers and educators. This is evident from the report of Okebukola (2002), Longe and Adedeji (2003), Yoloye (2004), and Ezirim (2006) and a host of others. They noted that gender has impacted on science education. Male supremacy and gender stereotyping are factors among others that were identified to influence occupational choice. Hence, Longe and Adedeji (2003) are of the opinion that science and technology is a male-dominated subject and that females tend to shy away from scientific and technological fields. Therefore, boys appear to have a natural positive attitude to technical and science subjects. However, girls showed negative attitude. This negative attitude of girls appears to be due to the acceptance of the myth that boys are better in science subjects than girls. Babajide (2010) further admitted that science subjects such as physics and chemistry are given masculine outlook by education practitioners

1.1.1 Theoretical Framework

The theoretical framework for this study is based on Bruner's Theory of Discovery Learning which was formulated out of Bruner's strong commitment not only to elucidate how children acquire and use information but also to ascertain how such knowledge may be applied to improve the practice of education. In the theory, Bruner insisted that the key to an effective understanding on how children think can be found in the process of representation. Representation consist of a system of rules by which an individual represents or conserves for future use his or her encounters and experiences with the events in his environment. It reflects those cognitive behaviours that are evident when the individual receives, codes and store information that are later retrieved for the purpose of making some sense out of the environment (Bruner, 1966 as cited in Schmidst, Loyens, van Gog and Paas, 2007). Indeed, representation is an individual's construction of the world, his model of reality.

There are three major modes of representation in Bruner's Theory of Discovery Learning. These are:

- The enactive or action mode.
- The iconic or imaginery mode and
- The symbolic representation.

The enactive mode commences at about the second half of the first year of an individual's life. During this stage period, the child represents past experiences through motor acts. Thus, for a child, a stimulus in the environment is known and reckoned by the actions that are associated with it.

Bruner (1966) noted that, at the symbolic mode, language stands out as the most prominent and specialized form of symbolic representation. The child's thought processes become more flexible and abstract without indications of their being tied

down to concrete images. Language is categorical and has the characteristic of remoteness and arbitrariness that offers some opportunity to the child to go beyond the immediate experiences and there by translate his personal experiences in novel ways. Bruner sees language as the most fundamental aspect of cognitive development which internalized thought that offers the child the ability to solve problems.

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On the place of biological maturation in cognitive growth Bruner stress on the need for encouraging maturity through the provision of appropriate learning experiences(Brunner, 1966 in Tobin, 1990). According to Bruner, the school does not need to wait for a child to become ready for a particular type of learning. Rather, the school owes the responsibility of teaching a child in order to make him ready for learning. It was in relation to the issue of readiness that Bruner made his famous dictum: Any subject can be taught effectively in some intellectually honest form to any child at any stage of development. Bruner's theory of readiness states that a child is always ready to learn any subject matter but the responsibility of ensuring learning mastery falls on the teacher who must structure the learning experiences in a manner that is consistent with the maturity and growth level of the child (Bruner, 1966 in Schmidst *et al*., 2007). In essence, Bruner implied that when a child fails to attain an appropriate

learning, it is essentially due to the enepthers of the teachers to apply the most relevant materials and strategies for the purpose of teaching the child to attain the mastery.

Demonstration and guided discovery teaching methods fall under Cognitive and Motor Skill Development teaching methods in which proponents of guided discovery are: Gagne (1977); Ausubel (1968). The method ensures that the learning materials, facts, problems, are presented to the learner step by step, systematically and in a gradual process. It incorporates discussions, questions and cues intended to guide the learner to move from one step to the next, it provides feedback to the learner (Mkpa, 2009).

Gagne (1977) stated that learners must commence with the simple pre-requisite skills and gradually move up the pyramidally structured hierarchy of learning skills or capabilities in order to acquire the needed complex skills. As Gagne stresses, for such acquisitions to be effectively attained the learning objective must be stated in behavioural terms. Ausubel (1968) theory of meaningful verbal learning is made up of two components. First, the elaboration of what he called "advance organizers" that serves the purpose of increasing clarity and stability of learning materials. The second is a formulation of a procedure for the attainment of meaningful learning. This requires that the learner on acquiring a new learning searches and retrieves from his cognitive structure or knowledge base those elements that are related to the new information.

In a similar development, Metzler (2000) stated that the basic tenet in demonstration and guided discovery methods of teaching is that, rather than the teacher showing and telling students how to perform a task, the teacher uses a series of questions to prompt students' engagement in both the cognitive and psychomotor domains (Metzler, 2000). Essentially the teacher asks a question that lead to some type of student thinking, which in turn leads to a "movement answer" displayed by students (Metzler, 2000). In this study therefore, Bruner theory of discovery learning was used.

Demonstration teaching method on the other hand is built on the theoretical framework of Piaget's theory of Cognitive Development. According to Piaget, there is a need to provide school children with concrete materials for the purpose of manipulation and interaction that occur mostly through demonstration (Uche & Umoren, 1998). It is through such manipulation and interaction that children build up and develop their thought processes. They can also explore their environment using various activities. This study is adapting Piaget theory of Cognitive Development because Piaget stated that there is the necessity to place the learner in an active initiating role since Piaget's formulation is that knowledge is acquired by active process that requires an interaction between the child and the world around him.

Demonstrating the skill also allows the students to see the skill in context, which O'Connor (2006) argued enhances learning because students can understand the relevance of the skill by noting its application. Metzler (2000) suggested that instructors can more effectively engage the cognitive domain with their students by encouraging them to consider the potential application of the skill.

1.2 Statement of the Problem

On the various studies such as Akbani and Allvar (2010), Jekayinfa (2007) Usman (2007 & 2010) and that of Igboegwu (2012), it was observed that the problem of teaching and learning Basic Science especially at the Junior Secondary School levels still persists, despite various innovations on the issue of effective activity based teaching strategy. The poor performance of students persists in Basic Science at the Junior Secondary School levels despite several studies (ERC, 2008). This has been attributed to constant use of lecture method and negative attitude towards Basic Science teaching (Usman, 2000).

The present study is aim at investigating whether demonstration and guided discovery instructional methods will have any effect on the academic achievement and interest of Upper Basic Science students. The motivation to conduct this research is the dwindling poor performance of students in Basic Science examinations as confirmed by the Junior Secondary School Certificate Examination (JSCE 2009-2013) report. Moreover, the statistics of students' performance in JSCE (Basic Science) examinations in Taraba State over the years indicated a failure rate of over 70% as reflected in Table1.1

The failure rate mentioned above is mostly attributed to the complex nature of Basic Science concepts among others. For instance the Basic Science concepts considered in this study: Types of nutrition and test of starch in leaf and yam tissues which deals with different types of nutrition and testing for starch in green leaf and yam tissues that involve the use of laboratory apparatus and reagents is a major sub-topic under the concepts of nutrition at the Junior Secondary School (JSS) level is perceived by students as abstract and difficult in nature (Edopkayi & Suleiman, 2011)

This has led to the development of negative attitude towards the subject by the students, which has led to many of them not showing interest in offering core science subjects at the Senior Secondary School and science-oriented courses at the nation's tertiary institutions because of their decimal performance in Basic Science examination at the JSCE (Junior Secondary Certificate Examination). It is against this background that the present study review past JSCE result in some schools in Wukari Educational zone of Taraba State to ascertain the performances of students in Basic Science from 2009 to 2013. This is represented in the Table 1.1 below.

Table 1.1: Students' performance Trend (in percentage) in JSCE Result in Basic Science 2009- 2013 in Wukari Educational Zone

YEAR	NO SAT FOR EXAM	NO &%PASSED WITH CREDIT	NO &% PASSED WITH E	NO &%OF CANDIDATE FAILED
2009	976	69(7.10%)	276(28.23%)	631(64.67%)
2010	992	60(6.06%)	254(25.64%)	678(68.30%)
2011	924	38(4.10%)	212(23.00%)	674(72.90%)
2012	807	25(3.13%)	147(18.27%)	634(78.60%)
2013	695	22(3.10%)	126(18.23%)	547(78.67%)

Source: (Wukari Zonal Education Office, 2014)

From Table 1.1, it can be observed that there is a dwindling performance of students in Basic Science as only few of them had passed at credit level with majority having lower grades of E. Disturbed by this ugly development, therefore, there is a needto provide alternative teaching methods such as the Demonstration and Guided Discovery teaching methods to find out whether these instructional methods could curb down under achievement in Upper Basic Science.

An instructional strategy that could allow the students to increase their creative thinking and self-confidence in solving problems may likely enhance their academic achievement. Danjuma (2005) observed that activity based instructional strategy such as discovery method, inquiry method, demonstration and problem-solving instructional strategy could enhance academic achievement, self-confidence and creative thinking in learners. As dexterity in problem-solving builds self-confidence, it may be an indication that exposure to demonstration and guided discovery instructional methods could affect self-efficacy among learners

If education is to serve as an instrument for effective national developmentthere is need for science educators to device means of eliminating or at least minimizing the incidence of mass failure in public examinations. The need therefore arose to search or investigates the method of instruction that will address the problems of students under achievement in science courses, Basic Science in particular. This is with a view to establishing what might be considered appropriate instructional strategy that would promote meaningful learning. The focus of this study is to investigate students' interest and achievement in Upper Basic Science and to find out whether Basic Science teaching and learning through demonstration and guided discovery instructional methods can affect students ability to perform significantly better than others of the same group taught via the lecture method.

1.3 Objectives of the study

The objectives of the study are to:

1. Determine the effects of demonstration, guided discovery and lecture methods on academic achievement of students taught nutrition concepts in Basic Science.
2. Investigate the interest of students taught nutrition concepts using demonstration, guided discovery and lecture methods.
3. Determine the effects of demonstration, guided discovery and lecture methods on academic achievement of boys and girls who are taught nutrition concepts.

1.4 Research Questions

The following research questions are formulated for answering:

1. What are the differences in the mean academic achievement scoreswhen students are taught nutrition concepts using demonstration, guided discovery and those taught with Lecture Method?

2. How do demonstration, guided discovery and lecture methods influence students' interest in nutrition concepts of Basic Science?
3. What is the difference in academic achievement of boys and girls who are taught nutrition concepts using demonstration, guided discovery and those taught with lecture method?

1.5 Hypotheses

The following null hypotheses are stated and tested at $P \leq 0.05$ levels of significance:

Ho_1: There is no significant difference in the mean academic achievement scores of students taught nutrition concepts using demonstration method, guided discovery method and those taught with lecture method in Basic Science.

Ho_2: There is no significant difference in Basic Science students' interest before and after exposure to demonstration method, guided discovery method and those taught with lecture method.

Ho_3: There is no significant difference in the mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with demonstration method, guided discovery method and those taught with lecture method in Basic Science.

1.6 Significance of the Study

This study aims at investigating the effectiveness of demonstration and guided discovery teaching methods on academic achievement and interest in nutrition concepts of Upper Basic Science. The findings of the study will hopefully be useful to:

Students: The study may help boost students' interaction in Basic Science class because it is an activity-based instructional strategy that may lead to positive and meaningful learning of the subject.

Science teachers: The findings might help science teachers in organizing their instructional activities in such a manner that will provide a background that would ensure a stable incorporation and retention of the concepts that will be learned in Basic Science.

Policy makers: The study may help educate the policy makers for a suitable activity – based approach for studying Basic Sciences at the Junior Secondary School (JSS) level.

Curriculum Planners: The study may equally give the planners and developers of curriculum an insight on the kind of teaching strategy that is effective for Junior Secondary School sciences.

Fellow researchers: This study may hopefully help other researchers to further investigate on demonstration and guided discovery methods and other methods of teaching that would improve teachers' repertoire of technical skills in the teaching of science. Also add to existing literature which may be a foundation for further study.

1.7 Scope of the Study

The study is delimited to three (3) public Junior Secondary Schools (JSS) in Wukari Educational Zone of Taraba State. JSS II was chosen by the researcher because they are more stable than JSS 1 due to the fact that they have been acquainted with some Basic

Science concepts in their JSS I. However, JSS III would have been the most stable classes for the research work, but no school administrator would be ready to lend out JSS III students for the research purpose as they were busy preparing for their Junior Secondary School Certificate Examination (JSSCE). The concepts that were taught under nutrition were:

- Types of nutrition and test for starch in leaf and yam tissues.
- Conditions necessary for starch formation.
- Introduction to proteins and test for proteins.
- Introduction to fats and oil and test for fats and oil.
- Types of vitamins and mineral salts.

These concepts were selected for the study because they are perceived to be difficult and abstract topics by the JSS students which invariably led to poor performances in their JSCE (Edopkayi & Suleiman, 2011). As presented in Table 1.1 previously.

The methods of teaching that were used are demonstration and guided discovery teaching methods. This is because the methods are activity-oriented and students' centred that will consequently develop in students the acquisition of process skills in which many science teachers normally shy away from such innovative teaching methods (Okoli, 2006).

1.8 Basic Assumptions

The following basic assumptions are made:

1. The study participants are familiar with activity-based teaching methods such as demonstration and guided discovery.
2. Teachers of Upper Basic Science are familiar with the use of demonstration and guided discovery teaching methods.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

Teaching and learning are two important processes required for the development of man and affect the society when both the teachers and students actively participate in the process. It predisposes the society to economic, social, scientific and, in fact, overall development of its citizenry. Learning is a process of association or connection of stimulus responses, knowledge and skill acquisition, attitudes, concepts or ideas which brings a permanent change in behaviour (Okeke, 2012). Currently, there seems to be no conclusive study that clearly shows the effect of teaching and cognitive achievement generally and, in particular, Basic Science.

In this chapter, literatures relevant to the study will be reviewed under the following sub-headings:

- History of Universal Basic Education (UBE)
- Nature and Teaching of Upper Basic Science in Junior Secondary Schools
- Science Teaching Methods and Academic Achievement
- Demonstration Method of Teaching Basic Science
- Guided Discovery Method of Teaching Basic Science
- Lecture Method of Teaching Basic Science
- Academic Achievement in Basic Science
- Gender and Academic Achievement in Science Education.
- Interest as a Factor in Academic Achievement in Science Education.
- Overview of Similar Studies
- Implication of the Literatures Reviewed on the Present Study.

2.2 History of Universal Basic Education

In 1948, the Universal Declaration of Human Rights asserted that everyone has the right to education. Over 40 years later, it is clear that many people are still being denied this basic human right. Indeed, the 1980s saw more backward than forward movement in most countries of the world. It was at that point that a World Conference on Education for All was held in Jomtien, Thailand, for the purpose of forging a global consensus and commitment to provide basic education for all. Universal Basic Education (UBE) is the programme which grew out of that Conference (Dike, 2000).

President Olusegun Obasanjo formally launched the UBE in Nigeria on 30th September, 1999. The programme is intended to be universal, free, and compulsory. Since the introduction of western education in 1842 (Eya, 2001), regions, states, and federal government in Nigeria have shown a keen interest in education. This can be seen in the introduction of the Universal Primary Education (UPE) in the western region on 17th January, 1955, its introduction in the eastern region in February, 1957, and in Lagos (then Federal Territory) in January, 1957. Other developments include the publication of a National Policy on Education in 1977, launching Universal Free Primary Education on 6th September, 1976, and the subsequent launch of UBE in 1999. The goal of all these programmes is providing functional, universal, and quality education for all Nigerians irrespective of age, sex, race, religion, occupation, or location.

UBE is broader than UPE, which focused only on providing educational opportunities to primary school age children. UBE stresses the inclusion of girls and women and a number of underserved groups: the poor, street and working children, rural and remote populations, nomads, migrant workers, indigenous peoples, minorities,

refugees, and the disabled. The formal educational system is only one of six components included in basic education in the implementation guidelines of the Federal Government. Others relate to early childhood, literacy and life skills for adults, nomadic population, and non-formal education or apprenticeship training for youth outside the formal education system (Nigeria 2000).

In 2000, Nigeria's literacy rate was 52 percent (Babalola, 2000). In 1998, only 40% of all heads of households in Nigeria had any education at all, 21% had only primary education, 14% had up to secondary education, while only 5% had post-secondary education (UNDP, 1998). Data from the Federal Ministry of Education, Education Statistics (1996) showed that only 14.1 million out of 21 million school-age children are enrolled in primary school. UBE was born from these startling statistics, to promote education among all citizens.

The Millennium Development Goals (MDGs) positioned universal primary education as one of the eight major goals. As the second goal of the MDGs, it anticipates achieving universal primary education by 2015. It stipulates that by 2015, children everywhere, boys and girls alike, will be able to complete a full course of primary schooling. The goal also recommends eliminating disparity in primary education, preferably by 2005, and in all levels of education not later than 2015.

The inclusion of primary education in the MDGs must have been prompted by the 1990 Jomtien World Conference on Education for All (EFA), as well as New Delhi Declaration (1991) which requires strict effort of the E-9 countries (nine countries of the world with largest concentration of illiterate adults) to drastically reduce illiteracy within the shortest possible time frame. It is also a demonstration of commitment of the

Durban statement of commitment (1998) and Organization of African Unity (OAU) Decade of Education For Africa(1997-2006), which also requires African states to generalize access to quality basic education as a keystone for sustainable socio-economic development(Federal Ministry of Education, 2000).

In Nigeria, the Universal Basic Education (UBE) programme was launched in September 1999, but actually took off in 2000/2001 school year. The programme was with a sole purpose of ensuring that illiteracy is reduced to its barest minimum among adult population of Nigeria in the nearest future. In the pursuit of this goal, the UBE programme aims at making education compulsory for the first circle of nine years for every Nigerian child. The specific objectives of the UBE programme, as outlined in the implementation guideline of the Federal Ministry of Education (Federal Ministry of Education, 2000), are as follows:

- Ensuring unaltered access to 9 years of formal basic education;
- Provision of free, universal education for every Nigerian child of school going age;
- Reduce drastically the incidence of dropout from the formal school system through improve relevance, quality and efficiency;
- Ensuring the acquisition of appropriate levels of literacy, numeracy, manipulation, communication and life skills as well as the ethical, moral and civic values needful for laying a solid foundation for lifelong learning (UBE, 2000).

A Universal Basic Education commission (UBEC) was established by an Act of the National Assembly as a way of ensuring proper implementation of

the objectives of the UBE programme. It is the responsibility of this commission to coordinate the activities of the programme throughout its first nine- year gestation period from 2001 to 2009 and beyond (Federal Ministry of Education, 2000).

The incessant political changes in the past constituted the problem of ineffective implementation of the policy statement of the Education For All (EFA) in Nigeria. Therefore, several recommendations were made to the federal government for example the Dike and the Taiwo Commisions, the federal government approves the third National Development Plan (1975-1980) UBE in 2006. The quality of a nation's education is a process and product of its educational policies as education is an instrument of change and a major instrument for socio-economic as well as political development. The general chorus of disapproval in the falling standard of basic education and a sharp decline in the moral of primary school children brought about the introduction of the UBE. The UBE challenged with the problems facing education in Nigeria before its introduction include: dearth of facilities, inadequate supervision, shortage of personnel, lack of funds, high prices of text books, incoherent implementation of the curriculum, dropout rate (Denga, 2000; Edho,2009).

2.3 Nature and Teaching of Upper Basic Science in Junior Secondary Schools

The introduction of Integrated Science now known as Basic Science in Nigeria came as a challenge after the former Union of Soviet Socialists' Republic (USSR) launch an artificial satellite called the "Sputnik" into space (earth's orbit) to observe the earth in 1957 (Inyang & Mkpanang, 2004). This essentially awakened the government,

scientists and the general public of other nations especially the United States of America (USA). Thus, development points to the inadequacies of school science and technological education curriculum. This decision was on the fact that USA was beaten in space development programme by their rival country, the USSR (Shaibu, 2005). As a result USA felt challenged and responded to the challenge by revising and restructuring its science curriculum with the central aim of attaining greatness in national development. Within two decades after, USA achieved that aim through its science programmes that were in existence in their schools.

In Nigeria, Basic Science emerged at the same time during the world-wide curriculum reform movement in 1968 (Bajah, 1983). At this time, the West African Examination Council (WAEC) reviewed its syllabus in Biology, Chemistry and Physics, when it called on the Science Teachers' Association of Nigeria (STAN) to assist in this review, the three curriculum development committee of STAN felt that there should be a solid foundation of the three science subjects which should be taught in the first two years in the then five-year secondary school education, later changed to three years due to 6-3-3-4 education policy and now changed to 9-3-4 policy of 2008 (Adekunle, 2012). Otherwise no meaningful learning of Basic Science would be possible. The STAN gathered and used the experiences of Aiyetoro of Basic Science programme of the USA (Ford Foundation) to give birth to the Nigerian Integrated Science Project. In this regard, the three committees of STAN suggested topics from three individual subjects and blended the topics together to form the then Integrated Science curriculum now known as Basic Science.

Teaching is a process of giving an instruction to impart knowledge, facts, skills, attitudes, interest and aptitude by a knowledgeable and more experienced person to a

less knowledgeable and an inexperienced individual (Mkpa, 2009), for example, to teach someone, a learner, how to read and write. A teacher is one who teaches for a living and takes it as a profession. Furthermore, teaching as an activity, consists of a body of "actions intended to induce learning through the conscious and deliberate efforts" of a mature and an experienced person to impart knowledge, information, skills, attitudes and believes to an immature and inexperienced individual (Mkpa, 2009). In this process of teaching, a person is deliberately and consciously doing the teaching and this person is called a teacher. A teacher as defined by Teachers' Registration Council of Nigeria- TRCN, (2002) is a person who possesses the ability to impart the acquired competency to learners in given subject area. Uche and Umoren (1998) described a teacher as a person who has acquired special competency required to effectively teach a particular subject area to a group of learners.

Learning generally, cannot take place without the learners, the teacher and some teaching, learning-oriented activities. There is need to mention that learning take place in various forms and places for specific aim and objectives. Basic Science learning, in particular, involves helping the child to explain the events in nature, inculcating in children how to think and reason logically, helping the children to identify and solve simple problems they encounter on a daily basis. It involves helping the children to develop physical and social skills (NTI, 2009).

Teaching and learning of science involve a hands-on and minds-on exercises, when science is taught with materials and demonstration the learners tend to learn better (Attamah, 2012). At the UBE level teaching of science does not require a sophisticated laboratory and equipment. A child's first laboratory is his environment and the child is expected to be at home with his environment whether at school or in the parents' house

and should be able to identify those things around him or her and utilize them appropriately.

Furthermore, the teacher teaching Basic Science should have knowledge that learners learning science utilize all the available materials around his learning environment as resource materials (Attamah, 2012). These materials include the school garden, field, reaching the school compost section. In these places, materials that the teacher can use to teach Basic Science at the JSS level can be found. Examples of these materials are old radios, magnetic materials, papers, cans and so on. A class room where Basic Science is learnt should be made attractive with educative posters that pass scientific knowledge. This will help the learners to learn unconsciously while still playing (Nnorom, 2012).

In order to achieve a holistic presentation in science and technology contents to learners the thematic approach to content organization was adopted (Nnorom, 2012). Four themes were used to cover knowledge, skill and attitudinal requirements. Those themes are:

- You and Environment
- Living and non-living things
- You and Technology
- You and energy

At the Upper Basic Science level theme ‘You and Technology’ was changed to ‘Science and Development'. The topics under each theme were sequenced in spiral, beginning with the simple to complex across the nine years of Basic Education in order to sustain the interest of learners and promote meaningful learning. The use of guided enquiry

method of teaching and learning is implied in the activities prescribed under each topic in order to promote learning by doing and skill development.

The National Policy on Education (FME, 2004) recognizes education as an instrument per excellence for individual and national development. In Nigeria as it is in the world over, education is an inalienable right of every child. Through education, every child is expected to acquire a desirable and functional knowledge, develop appropriate skills both intellectually and physically as well as positive attitude and values to live successfully and become a useful member of the society (Mustapha, 2012). The overall purpose of basic education is to produce a literate society in which the individuals can apply their literacy in terms of knowledge, skills and values to enhance their survival (Mustapha, 2012). The Universal Basic Education (UBE) was introduced into the Nigerian educational system to produce a 9-year free and compulsory education to achieve the purpose of producing a literate society. In the context of the NPE (2004) and the philosophy of UBE, every Nigerian child shall have an access to free and compulsory basic education for 9 years; 6 years of primary education and 3 years of Junior Secondary (JS) education irrespective of social, economic, political or religious status of his/her parents (Duada and Odofia, 2012). One of the goals of UBE in the context of the goals of education at the primary and junior secondary levels among others, is the ensuring of acquisition of appropriate level of literacy, numeracy, manipulative, communication and life skills, as well as ethical, moral and civic values needed for laying a solid foundation for a life-long learning (FME, 2004).

However, it was observed that the whole Junior Secondary School (JSS) curriculum which was prepared over two decades earlier needed revision and total

overhauled to go in line with the demand of the 9-year basic education (Federal Republic of Education, 2006; Udofia, 2001). The revision commenced in 2003 but was caught up with enactment into law of the Universal Basic Education Commission in 2004, the adoption of the National Economic Empowerment and Development Strategy (NEEDS), the global reform which brought the Millennium Development Goals (MDGs) and the goals of Education For All (EFA) (Udofia and Salami, 2012). This caused the revision to be tailored to meet higher academic standards, civic, ethical and moral responsibilities, entrepreneurship, the overall goals of basic education, and the challenges of NEEDS as well as the MDGs.

Critical observation of the curriculum was that those living the JSS level were ill-prepared to face the challenges of the work as they lack basic life-long skills, functionally literacy and numeracy. Additionally, those that proceeded to the Senior Secondary Schools (SSS) were found to have coping problems. In the secondary school, science is taught through two main categories, Basic Science (Junior Secondary) and the separate science subjects of chemistry, physics and biology (Senior Secondary). The need for continuity and smooth sail through the tide of science courses has made our policy makers and curriculum experts to make Basic Science a core and compulsory subject. This makes 'school science' a national project (Onwukwe & Chinwe, 2009)

With the introduction of the 9-year UBE there was a need to restructure and review the curriculum contents. There was also the need to realign the primary and JSS curriculum contents into a continuous context and the need to discard obsolete contents that do not meet the challenges of the 21st century in an ICT-driven globally competitive world. JSS leavers ought to have acquired the functional skills to overcome poverty, create their own jobs and wealth and demonstrate positive values in consonance with the ideas of NEEDS. In summary, there was a need to revise and

upgrade the JSS curriculum (Federal Republic of Education, 2008). It became obvious that the existing curricula for primary and JSS should be reviewed, restructured and re-aligned to fit into a 9-year Basic Education. The essence was to ensure that every learner who has gone through the 9-year basic education should have acquired appropriate levels of literacy, manipulative, communicative and life-long skills, as well as laying solid foundation for life-long learning; as a basic for scientific and reflective thinking (NERDC, 2008). The National Council on Education (NCE) at its meeting in December 2005 directed the Nigerian Educational Research and Development Council (NERDC) to carry out this assignment. The NCE also approved the new curriculum as a basic education curriculum (Duada and Udofia, 2010). Consequently, a high level policy committee of curricular development met and produced the guide line for curricular re-structuring. When this was done, NERDC convened between January and March 2006. Experts from various fields and works of life worked assiduously to produce the curricula (Federal Republic of Nigeria, 2004 & 2006). These curricula were to take off from September 2007. In the restructuring Basic Science replaced Integrated Science.

The new curricula were to start off simultaneously in primary 1 and JSS 1 classes such that by June 2010 the whole JSS curricula must have been phased out and by 2015 the old primary school curricula had been phased out (Duada & Udofia, 2010). It was later restructured for primary 1, junior secondary school (JSS) 1 to start its implementation in 2008.

The general goal of the curricula reform was to reflect depth, appropriateness and inter-relatedness of the curricular contents. Emerging issues which cover value orientation, peace, and dialogue including human right education, family life and HIV/AIDS

education, entrepreneurial and skills were infuse into the 9-year of basic education curriculum (Udofia and Salami, 2012). Additionally, the curriculum planners agreed that major issues shaping national and global development such as globalization Information/Communication Technology were the rhetoric of the basic education curricula. Hence, the following themes were infused into Integrated Science to form the Basic Science curriculum. They are:

- Environmental education
- Drug abuse education
- Population and family life education
- Sexually Transmitted Infection (STI) including HIV/AIDS (Federal Republic of Nigeria, 2006)

One of the cardinal precautions in the production of Basic Science curriculum was to ensure continuity. For instance, the Basic Science properly evolved from the Integrated Science. That is, some relevant themes in the Integrated Science are still maintained in Basic Science curriculum (Duada & Udofia, 2010). Integrated Science is a science presented to the child such that the child gains the concept of fundamental unity of science, the commonality of approach to problem of a scientific nature and understanding of the role and function of science in everyday life and the world in which he/she lives (FGN, 1984). Basic Science, on the other hand, is the basic training in scientific skills, requirement for human survival, sustainable development and society transformation. Basic Science combines science and technology. It attempts to provide a holistic presentation of science and technology with the theme "You and Technology". This was designed to expose students to developing science and technological skills, which will assist them to make informed decisions, develop survival strategies and learn to contribute and live quantitatively in the global community (Duada & Udofia, 2010).

The introduction of the then Integrated Science in the 1980s which later metamorphosed into Basic Science started after the September 1970 conference organized by the Federal Ministry of Education on curriculum (Arigbabu & Oludipe, 2004). The rationale for its introduction was to bring about mode of teaching science that reflects child-centred activities rather than the traditional lecture and the factual contents which the books in use then presented. It also aimed at correcting the mode of behaviour of the pupils in both their approach to problems in their science studies at school and in the outside world which was unsatisfactory. The conference, therefore, emphasized the following:

- The use of discovery tactics
- The inclusion of problem solving activities
- The involvement of students in open field or laboratory exercise

Basic Science curriculum is a proper review of the Integrated Science content that makes it a holistic science which is relevant in today's world. Instructors must be holistic in their approach. Instructors should, therefore, formulate objectives based on the demand of their environment but not abusing the curricular objectives (Dauda & Udofia, 2010).

The teaching and learning of Basic Science is essentially activity-based and thus required appropriate facilities or resources for carrying out such activities. This activity-based approach to teaching Basic Science is partly dictated by and it is in keeping with the nature of science itself (Shaibu, 2013). The contemporary constructivist paradigm supporting this approach stipulates that knowledge is not transferred from one head to another, and that individuals construct their own knowledge when given the appropriate stimulus/stimuli (Driver & Erickson, 1983 in shaibu, 2013). This psychological explanation of the teaching and learning process inevitably calls for exposing Basic

Science students (learners) to guided use of an interaction with appropriate instructional materials to enable them construct knowledge for themselves, while the instructional materials or resources used serve as the stimulus agents.

Such resources often used to maximize conceptual understanding of Basic Science are found, substantially in the science laboratory and local environment. Research findings in general indicate that laboratory resources are grossly inadequate for the teaching and learning of Basic Science in schools. For example, the findings from the studies of Alawode (2010), Musa (2000) Adeyegbe (1998) showed, in the main that availability of laboratory resources (both human and materials) are seriously inadequate in most of the schools. It was also reported that in relatively fewer cases, there is total absence of such resources. This low level of resources availability was also found to impact negatively to the general academic achievement of the students in Basic Science.

In summary, it should, however, be observed that the use of Basic Science to target the Millennium Development Goals (MDGs) is appalled. Moreover, MDGs has a time clause which is 2015. Basic Science is required to achieve these goals within this stipulated period. But one has to be very careful when using a visionary goal which is global to build a curriculum. This is because global interest may not tally with national needs. Incidentally the consideration of the NEEDS while forming the objectives has gone a long way in creating the necessary relevance and impact of the curriculum at our national level. What the Basic Science instructors should note is that Basic Science must precede national goals. Also of note is that if the national goal is not achieved there will be some contradictions especially as the UBE graduates are not main players in the national development. In addition, they must be alert to rate of technological

development and teach progressively to keep the pace of technological development, so that the hindrances which hampered the implementation of the Integrated Science curriculum are not transferred over to the Basic Science curriculum. In other words, apart from curricular reform there is need for systemic overhaul. Certainly reform should start from somewhere but care should be taken to produce such changes or create an enabling environment for it to occur. The researcher is of the view that methods of teaching such as Demonstration and Guided Discovery Teaching Methods on Academic Achievement and Interest in Upper Basic Science should be sorted and recognized as quality assurances, this is done in order to investigate the effectiveness of the teaching methods in the teaching and learning of Upper Basic Science in schools within Wukari Educational Zone.

2.4 Science Teaching Methods and Academic Achievement in Science

In our scientific age, a critical goal of the science teacher is to achieve competence in teaching science to the students. Competence implies that the teacher is able to help students to learn and understand the fundamentals of science efficiently and effectively (Uche & Umoren, 1998). In the same vein, Imogie (2010) emphasized that Nigeria would spend the rest of the 21st century comfortably if she would have good number of adequately trained, devoted and committed teachers who would maintain high educational standards. It is on this note that Ugwu, Ofuebe & Etiubon (2011) suggested that UBE curriculum implementers (teachers) should look at the prevailing circumstances at the schools and attempt to predict the achievement goals and formulate curricular/lesson objectives. Afe (2002) opines that even the best educational policy, curriculum design and expenditure of colossal sum of money on education, the ultimate realization of any set of aims for education depends on the teacher as he will ultimately

be responsible for translating policy into an action and principle into a practice in his interaction with students and their programme.

Evidence abound that science and technology are not only tools but also vehicle for all-round development of any nation. Therefore, to a very great extent, the level of scientific and technological development of any nation determines the standard of living of the citizens of that nation (Ahmed, Abimbola, Omosewo & Akanbi, 2012). For this, any nation that wishes to be recognized globally must ensure she is sound fated in science and technology. However, any nation that does not develop scientifically and technologically is risking the future of her youths and will continue to dwarf among the developing and the developed nations (Uche & Umoren, 1998; Shuaibu, 2005; Usman, 2012). If today's youth are not properly equipped with the rudimentary knowledge of modern science, they will grow up only to discover that haphazard knowledge of science is not sufficient to understand the sophisticated operation of the present information age in science and technology (Uche & Umoren, 1998).

To be effective, the teacher must adopt varying strategies to satisfy the varying capabilities of students. There is no single method that meets the requirements. The teacher needs a combination of methods in order to achieve the goal of a particular lesson. To this end, this sub-heading discusses the different methods of teaching science which include: demonstration, guided discovery and lecture teaching methods. Others are experimental, discussion and project method and how best these methods can be applied in classroom situation.

2.5 Demonstration Method of Teaching Basic Science

Demonstration method is a teaching strategy which involves experimentation (Igboegwu, 2012). The basic method of instruction for teaching skill-type subject matter

is the demonstration-performance method of instruction in which Obeka (2010) opines that this method is recommended for teaching skills because it covers all the necessary steps in an effective learning order. According to him, the demonstration steps give trainees the opportunity to see and hear the details related to the skill being taught. Those details include the necessary background knowledge, the steps or procedures, nomenclature and the safety precautions.

Demonstration may be defined as display of an event or process. It involves the teacher or the student showing activities in front of a class and explaining it as he proceeds (Uche & Umoren, 1998). Though demonstration activities are often defined to embrace laboratory experiments, however, there is a distinction between the two practices. The mode of communication prevalent in demonstration strategy is a two way communication in which the teacher communicates with the students and the students also communicate with the teacher. In this method, the teacher encourages minimal participation from students. Demonstration is essentially a teacher activity aimed at showing how a skill, procedure or a process works or is done. The purpose is to ask students to acquire the requisite skills or to procure related knowledge. In the discipline of science, demonstration has a long history of usage and it basically entails showing how certain scientific equipment operates or a certain operation in science serves to explain a given concept. In class room, demonstration may be subjected to uses including to pose a problem that requires a solution or to illustrate a problem in order to ensure a quick arrival at the solution. Similarly, a demonstration may be applied to precede or to follow a discussion, or it may be used to illustrate the application of a principle. As a rule, demonstration is jointly used with other skills such as explaining, discussing and performing. It can be considered as a valuable instructional method if it adequately or significantly serves to improve students' learning.

If demonstration is to exercise its effect on the degree of students' learning, the Basic Science teacher must do a number of things including specifying the objectives to be attained as a result of the demonstration, preparing for and trying the demonstration in advance in order to be confidently sure that it works, carrying out the demonstration at a point or surface that is clearly visible to the entire class, employing the use of simple apparatus or equipment, conducting the demonstration at a pace that is meaningful to the students, and having them adequately involved throughout the demonstration sequence or process. It must also be added that the teacher must prepare for possible questions to ask students and those that may be asked by the students. He must also anticipate probable areas of difficulty with respect to the concepts and principle that relate to the demonstration, emphasize safety precautions, afford students an opportunity of trying their hands on the demonstration and finally evaluate students' learning that results from the demonstration experience. Given the dearth of equipment and other materials that are essential for effective study of Basic Science, it is obvious that most teachers of the subject will devote a significant amount of their time to the instructional method of demonstration.

The teacher can employ demonstration in the following ways according to Uche & Umoren (1998):

- As a set induction (at the beginning of the lesson) to initiate critical thinking for further studies and to stimulate interest
- As stimulus variation (along the development of the lesson)
- As a lesson closure (that is; at the end of the lesson) to summarize the vital points to arouse further critical and analytical thinking
- To introduce experimental methods and techniques

- To do simple experiment which do not warrant the time needed to distribute supplies for a class experiment
- To carry out complex experiments
- To verify a scientific concept
- To solve problem

Some merit of demonstration as opined by Obeka (2010) and Ametefe (2012), are as follows: It can be used as a facilitator to arrest the attention of students and to improve their sense experiences, thus enhancing learning; It permits students to observe the process in nature; It prevents the occurrences of an accident and loss of facilities through breakages when utilize by the teacher to depict the correct use of the facilities; Demonstration may depict how a phenomenon or an event can be expertly demonstrated by the teacher who has a greater competence than the students; It is economical as a teaching technique since less materials and equipment are required; Demonstration allows students to observe scientific activities which otherwise would have been impossible simply because it is expensive, difficult or hazardous for the students to handle themselves.

However, there are many science teaching method which are being used in the teaching and learning of Basic Science such as the use of Analogy, Concept mapping, Constructivism, Cooperative learning and many others, yet, it could not solve the problem of poor performances in Basic Science. There is the need to try out Demonstration Method of teaching science as in this study to see whether or not it would prove more effective in the teaching and learning of Basic Science at Junior Secondary School (JSS).

2.6 Guided Discovery Method of Teaching Basic Science

The foundation of scientific literacy is laid in schools, especially secondary schools, through the use of innovative teaching methods such as the guided discovery method (Igboegwu, 2012). It is a method of teaching that encourages a student to solve problems by seeking and asking questions so as to gather information (Akensete, 2006). Guided discovery involves discovery in which there is creativity and students' participation in a well-equipped laboratory (Adamu, 2001). This method of teaching aids conceptualization, memory and helps to develop students' understanding of science. In summary this methods makes activities enjoyable, accessible and promote students' language and communication skills.

The guided-discovery method is student-centred, activity-oriented teaching strategy in which the teacher guides the students through problem solving approach to discover answers to instructional topics at hand (Abdulahi, 2007). Discovery method is a student-centred method in which the learner uses his mental process to mediate, or find out thing for himself. Discovery method involves two extremes, that which is guided and that which is free (Uche & Umoren, 1998). In guided discovery, the teacher provides the setting, the structure and the materials and guides students to discover answers to problems.

The advantages of Guided Discovery Method according to Uche & Umoen (1998) are as follows:

- Being a heuristic method, students are active participants rather than passive listeners.
- Since students initiate their learning, what is learnt is retained; hence, there is conservation of memory.
- Guided Discovery Method allows students to build their self-concept.

- This method allows students to acquire manipulative skills, and develop scientific attitudes.
- It provides students with both extrinsic and intrinsic motivation and help to reinforce learning.
- It helps students to take self-initiative on their work.
- It encourages analytical and logical thinking among students.

Guided Discovery Method should be undertaken with small groups where the teacher can offer guidance. Large classes should be sub-divided into small groups for efficient supervision.

- Precede a Guided Discovery lesson with a discussion in order to sensitize students with what they are supposed to discover.
- At the closure of Guided Discovery activity, discussion should be used to provide a forum for questioning the students' discovery activities.
- Guided Discovery Method should be used in collaboration with other methods of teaching science to meet individual differences within the classroom.

Learning is a process requiring effort in which the learner actively constructs his meaning that is consistent with prior ideas (Nwagbo & Obiekwe, 2010). The ability of learner to learn well depends on his/her ability to connect or integrate the previous knowledge with new ones and also apply it to real life situations. Such learning is described as meaningful learning. For meaningful learning to take place, the concept presented to the learners must be potentially meaningful and hence must provide opportunity for the learner to form non-arbitrary relationships with the existing conceptual framework (meaningful tasks) (Uche & Umoren, 1998). The learner must have a conceptual framework to which the new concepts can be linked (relevant prior

knowledge). The learner must manifest the meaningful learning set. Meaningful learning set also implies that learner must have the desired or tendency to make connections among concepts. The learner must actively attempt to relate what is known to substantive aspects of new concepts (Novak, 1990).

There is a relationship between students' epistemologies and their approach to learning which in turn determines whether they would learn meaningfully or not(Edmondson & Novak, 1993). Constructivists believe that learning is an active process with learner being active in knowledge construction of the situation at hand based on the already existing knowledge (Oyedekun, 1998). Several constructivists instructional strategies exist, some of which include guided discovery approach which Olagunju (2002), describe it as a process that allows students to solve problems in logical and systematic manner. It is also described as one that offers learners the opportunity to discover scientific facts, concepts and principles for themselves. The process of discovery according to Olaguju (2002) is carried out through mental processes such as observation, measurement, classification, communication, hypothesizing, experimentation, data collection, data interpretation and deduction (inference). Guided discovery may play a role in the production of new knowledge but it is never more than just one of the activities involved in creating new knowledge (Novak & Gowin, 1984). The construction of a new knowledge begins with our observation of events or objects through the concept we already possess. Okebukola (2002) opined that the purpose of learning is for an individual to construct his/her own meaning and not just to memorize the "right" answers and regurgitate someone else's meaning. Jegede (1997) had earlier joined the crusade of meaningful learning as a panacea for enhanced performance. He proposed that meaningful instructional strategy, that is, a teaching

strategy that is child-centred and activity-oriented will lead to improved performance. One of such strategies could be the use of guided discovery.

Guided discovery teaching and learning involve helping the learners to discover facts or answers to a given problem (Mkpa, 2009). This strategy helps to discover in learners thinking and decision-making abilities. The teacher guides the learners' progress by means of instructional scaffolding and cues. Hammond (2001) described instructional scaffolding as "support that is designed to provide assistance necessary to enable learners to accomplish and develop understanding that they would not quite be able to manage on their own". It is the support and assistance given in any learning situation when the teacher provides temporary support structures that will assist the learners to develop new understanding, skills, concepts and abilities (Nzewi & Ibeneme, 2011). As a learner gains the control of this new learning, the teacher withdraws gradually while the learner becomes increasingly able to complete the task alone. The teacher plans and provides further support on new learning. Such support structures could be helping the learner to complete a task by using cueing questions, discussions, concept maps or explanations. In using cueing questions, for example, a teacher can ask the students to differentiate between plants and animals. The teacher starts by asking the students to mention some physical features of an animal. The expected response may include eye, nose, legs and hands. The teacher acknowledges the answer when the student says leg. He then asks the students to state what the legs are used for. An expected answer will be movement. The teacher then asks the students whether plants move about. Further questions and answers may follow. At the end, the students may be able to decipher that animals move from place to place while plants do not. An essential factor in scaffolding is the active participation of the learner. This can be encouraged by the teacher as early as the planning stage of a new unit of work. A study conducted by

Flick (2000) revealed that teacher's scaffolding highlight critical association and opportunity for reflections that help students make meaningful use of investigation process and results.

Related to meaningful learning is the way students approach learning. Biggs and Moore (1993) identified three approaches to learning used by secondary and tertiary school students. These are: surface, deep and achieving approaches. Students who use the surface approach try to avoid both working too hard and failing assessment. They tend to limit their targets to bare essentials, reproduce essentials for assessment purpose through memorizing or rote learning. They are passive in their learning, have negative emotions about learning and prefer to learn in isolation. They set a balance between failure and working more than necessary. They satisfy the external (assessment) requirements only (Biggs, 1989; Gibbs, 1992). Students who adopt the deep approach on the other hand, aim to satisfy their interest in what is being learned, develop high level of competency in examining various points of views and become involved in creating knowledge and understanding through discussion (Biggs, 1989). Students who adopt achieving approach come from the "ego trip that comes from achieving high marks" (Biggs & Moore, 1993). Achievers choose strategies which will give them the best rewards from the teacher and the highest marks, so they strategize depending on the task and situation. Appleton and Beasley (1994) stated that there is an element of efficiency in their choice "which can involve either deep or surface approach"(Schmeck 1988 in Nzewi & Ibeneme, 2011) believes that students have predisposition to adapt deep or surface approaches that persists over different situations and refers to this consistency as a learning orientation. According to Biggs (1993), students can change their approaches to learning according to demands of each situation and the extent to which the change occurs is affected by each student's disposition and the

events in the classroom. Biggs (1989) and Gibbs (1992) had listed the factors affecting students' approach to learning to include: students' awareness to task demand, teacher's style of teaching, the level of students' intellectual development, newness and size of subjects, degree of threat felt by students and nature of assessment. One then begins to wonder how helping students to make meaning out of a learning situation can affect the engagement on task of surface and deep learners. In other words, when surface and deep learners are exposed to scaffolds that will help them along their learning, will surface learners be able to learn more.

Researchers in the field of science Education in Nigeria have found out that the problems of teaching science subjects stemmed from the first form of science a child comes across at the JSS (Junior Secondary School) level, that is Basic Science (Oludipe, 2011).Basic Science provides students with basis for further science Education study, a child that is not well grounded in Basic Science at the JSS level will not show interest in offering core subjects (Biology, Chemistry and Physics) at the SSS (Senior Secondary School) level which are the prerequisites for studying science-oriented courses at the nation's tertiary institution (Oludipe, 2011).In the light of this, the present study would want to investigate the effectiveness of Guided Discovery teaching strategy to ascertain whether it could prove effective in the teaching and learning of Basic Science at JSS compared with demonstration method.

2.7 Lecture Method of Teaching Basic Science

This is teacher-dominated or teacher-centred approach to teaching (Okoli, 2006). It involves the teacher telling the students what he knows about a concept. Most of the talking is carried out by the teacher while students remain as passive listeners taking

down notes. Hence, it is referred to as didactic approach or talk-chalk method (Nwagbo, 2006).

Most teachings carried out in our schools today are through the use of the lecture method (NOUN, 2004). This is because large amount of information can be presented to students in a limited time. Most teachers embrace the use of this method due to the fact that it leads to fast coverage of the syllabus.

In addition to that, the lecture method can be used to teach large and small class sizes. The teacher may ask few or no questions in the process. It does not require the use of instructional materials or resources (Okoli, 2006). To this effect, the students are denied the opportunity to develop manipulative skills. The lecture method is only concerned with the verbal presentation of concepts and ideas to the students (Uche & Umoren, 1998).

The lecture method is primary used to build upon the learners' existing base of knowledge (Ametefe, 2012). Thus while beginning a lecture it is essential to site the lecture at the learners' level. This can be done by asking some relevant questions and starting straight away. Thereafter, the trainer will have to make constant efforts to situate the new information in the content of the learner by continuously providing examples and illustrations to relate to the learners' content (Amefete, 2012). Other advantages of the lecture method are stated by NOUN 2004 includes: less time consuming in the part of the teacher in preparation for his lessons since no materials are needed in the process. It is cheap to operate; it is a good method for delivering large amount of knowledge in a short time. That is, it leads to a very high content coverage, others include large size classes which can be handled easily, it can be used to introduce new topics. It helps to channel the students' thinking towards a particular direction as

well as helps the teacher to develop confidence in his teaching as a facilitator of knowledge.

The following points as opined by Uche and Umoren (1998) may be effective for the utilization of the lecture method.

- Let the material to be taught fit into the time limit at your disposal
- Avoid making the lecture method a mere verbal presentation. Rather encourage active involvement of the students by giving them room to ask questions and make verbal contributions.
- Teachers are encouraged not only to write a brief outline on the chalk board during the lecture, but to summarize the important points at the end of the lecture.
- Provide enough attention getting cues in order to prevent the minds of the students from wandering during the lecture.
- No matter how exceptionally planned the content of a lecture and the outcome of teaching will be ineffectual if the teacher is not audible. To ascertain that students sitting at the back of the class are with you, ask from time to time for a sign that they do adequately hear you.
- An ideal lecture should start with a problem that is meaningful to the students. It should be presented in such a way that the students perceive a need for a solution to the problem. The teaching should present the evidence and the example leading to the solution.

Other general science teaching methods to be discussed are the experimental, discussion and project methods.

The experimental method is usually taken to be the most scientific of all teaching methods (Obeka, 2010). It is an activity that an individual or group is involved with the purpose of making a personal observation or cause-effect relationship. It is a student-

centered method that provides direct experience resulting from observation and manipulation of materials in science.

The Discussion method involves a class in oral exchange of ideas, facts and opinions about a topic of mutual concern and interest (Obeka, 2010). The teacher draws upon the experience and knowledge of the group instead of leaving them to rely entirely his. He acts as a leader and redirects ideas and information produced by them. Discussion makes for active participation of student, stimulate them to think individually and to learn to express themselves freely. It helps the teacher to evaluate students' interest and learning as well as encourages them to develop clear thinking, self-assurance and sometimes leadership.

Another science teaching method is the project method. The project method as opined by Obeka (2010) is a method in which pupils learn through independent activity, though under the guidance of a teacher. The pupils plan and execute every step from the beginning of a project to its completion in a logical sequence with the help of the teacher. The teacher refrains from doing the work for them, because all the experiences connected with a job and with obtaining and using the knowledge required to carry it out properly constitutes the project. Some projects involve certain information from books while others depend on practical investigation or making things, such as apparatus for a particular purpose. They may involve work both inside the classroom and outside the school. They may extend over widely varying periods of time but, usually, over several lesson period, at least a double period. The project method of learning helps to stimulate and hold interest and to motivate the study of the technical facts and related knowledge in spheres of learning.

2.8 Academic Achievement in Basic Science

The history of science teaching in Nigeria dated back to 1867 (Aworanti, 1991). It was introduced as nature study and hygiene. Later it metamorphosed into biology, chemistry and physics. As a step towards presenting science to the child, reflecting the cultures and traditions of Nigerians, the idea of the Nigerian science project was bone, which was an attempt to teach science as a unified whole. The Science Teachers Association of Nigeria (1970) states that Basic Science should enable students to be able to:

- observe carefully and thoroughly
- report completely and accurately
- organize information acquired
- generalize on the basis of acquired information
- predict a result in terms of generalization
- design experiments (including controls where necessary to check the predictions)
- use models to explain phenomena, where appropriate; and
- Continue the process of inquiring when new data do not conform to predictions.

To acquire these objectives, it is suggested that the teaching of Basic Science should involve the use of discovery teaching tactics, problem-solving activities, and open-ended field of laboratory exercises. It is worthy of note that Basic Science embraces all science subjects, namely biology, chemistry, physics and mathematics. Therefore, it is a subject that cuts across the school curriculum and needed in all branches of science, applied sciences and social sciences (Adodo & Gbore, 2012). This implies that no student should be denied of the proper grasp of Basic Science at the foundation classes

of primary and junior secondary classes in the Nigerian 9-year Basic Science and technology programme.

Results from previous researches on the teaching of Basic Sciences revealed that teachers lectured and give notes in Basic Science lesson (Aworanti, 1991). This has serious implications for cognitive achievement in Basic Science. Findings also indicated that a laboratory based method, where processes of science are used could be effective in improving the achievement of students in science. For example Adodo and Gbore (2012) observed that where students engage in the processes of science in their schools, the level of achievement in science was higher. The processes of science provide students with unique opportunities to study abstract concepts and generalization through the medium of "real" materials. As students interact with learning materials, teachers and classmates practice what scientists do, they gradually develop skill-needed for future study in sciences.

However, Basic Science emphasizes the learning of the processes of science rather than mere acquisition of scientific knowledge. Therefore, one will expect a substantial part of the lesson to be devoted to investigative activities. In a study of students' perception of Basic Science teaching in Nigeria, Aworanti (1991) concluded that:

- students do not carry out suggested science activities in Basic Science lessons,
- the teachers teach Basic Science without performing experiments,
- Project work is not done in Basic Science.
- Observing or measuring things, reporting activities, predicting the result of activities are not carried out in Basic Science lesson.
- There is a statistically significant difference between the opinions of rural and urban students on what happens and the activities taking place in Basic Science lesson.

The key concepts in the process of science are: observing things, reporting activities, measuring things were not adequately carried out. This may not help in laying a good foundation for scientific knowledge and achievement.

The term 'academic achievement' on the other hand has been described as the scholastic standing of student at a given moment. It refers to how an individual is able to demonstrate his or her intellectual abilities successfully, especially using their own efforts and skills (Edokpayi & Suleiman, 2011). This scholastic standing could be explained as the grades obtained in a course or group of courses taken. Thus, in predicting academic achievement Daniels and Schouten (1970) emphasize the use of grades in examinations and reported that grades could serve as prediction measures and criterion measures.

The state of Basic Science academic achievement is fast deteriorating in our secondary schools. This view is attested to by abysmally low rate of enrolment of students in the core science subjects like Physics, Chemistry and Biology (Oludipe, 2011). This is due to the fact that Basic Science teachers, many of whom are unqualified for the job they are doing (Odetoyinbo, 2004), instruct children in a language which is foreign and difficult for most of them to understand. It is, therefore, not surprising that children who have to suffer through this shameful process are disenchanted and apathetic and ipso facto develop a negative attitude towards Basic Science (Oludipe, 1997). Some measures must be taken to reverse the negative attitude of our students towards Basic Science.

It seems that we need to reappraise Basic Science curriculum objectives vis-à-vis the intellectual status of the average learner at the secondary school level. It is in the light of this that the Basic Science curriculum is child-centred and emphasis is laid more on learning science as a process than as a body of knowledge (Oludipe, 2011). Learning

science as a process is not a common practice in science teaching in Nigeria, and hence, it behoves the planners of the new curriculum to specify the methods of teaching to be adopted in handling the materials that could enhance academic achievement. Among the methods to be used, the following were specifically recommended:

- Use of guided discovery teaching strategy
- Use of laboratory exercise (STAN,1970) and
- Field trip

Guided discovery strategy is an innovative way of teaching science. It enables the students to find answers by themselves. A change usually occurs in students learning when they are actively involved in the learning process (Olarenwaju, 1994). The use of guided discovery in teaching Basic Science is not usually practiced since this strategy is time consuming and progress is comparatively slow. Apparatus has to be set up and result of the investigation awaited. The strategy is good for a small class where effective teacher's supervision is easy to achieve. This is not the case in most of our secondary schools where a teacher is assigned to teach more than forty students in a class. The teacher should be made to use other teaching strategies and allowed to use the appropriate ones. If the guided discovery strategy, however, becomes imperative for a large class, the class could be divided into groups to enhance an effective supervision. However, for the intellectual status of the learner to be assessed two main pedagogical problems must be considered, thus: reading for learning and English as a medium of instruction.

There are two schools of thought on the issue of readiness for learning (Oludipe, 2011). The other school opines that age and level of intelligence should be the determinants of the depth of knowledge that should be imparted to students at any and every stage. On the other hand, the new school believes in the concept that any topic can

be taught to any student at any level provided the subject matter is simplified enough to be easily digested by the students.Both concepts have their merits. It is imperative that we consider the cognitive level of the average students, especially in the junior school when planning the curriculum. In addition, the teacher who will teach the content must familiarize himself or herself with the level of development of the child and adopt the best means of conveying the ideas to be put across to the child (Ofoha, Uchegbu, Anyika & Nkemdirim, 2009). Another more serious issue is the perennial problem of English (a second language) as a vehicle of instruction in Nigeria schools. It is quite obvious that unless a student has good proficiency in the language of the class room, his ability to have a meaningful learning experience in the school setting will be hampered (Oludipe, 2011).

Through Basic Science, the curriculum planners presuppose it to be a child-centred and broad field which is supposed to provide a reasonable foundation for the study of Physics, Chemistry, Biology and other science subjects at the Senior Secondary School (SSS) level (Edokpayi & Suleiman, 2011). This is due to the fact that through Basic Science the students are exposed to various concepts and principles of science so as to make them effectively in the technological age, but unfortunately this purpose has not yet been achieved as Basic Science cannot be used as a predictor for later student performance in Physics, Chemistry and Biology which are the core science subjects at the senior class, as students show low rate of enrolment and poor academic achievement in those subjects (Edokpayi *et al*., 2011). One of the problems could be that Basic Science is not taught by specialists. It has been established that predominantly, the junior and less qualified teachers handle the teaching of Basic Science and majority of the teachers either have no university degree or teaching qualifications (Usman, 1992; Edokpayi *et al.*, 2011).

In an attempt to identify the problems facing Basic Science teachers Adejoh (2006) noted that most of the teachers are single subject specialists in Physics, Chemistry, Biology or Agricultural Science who often feel more secure to teach in their own subject area at the detriment of other areas in the Basic Science lesson. Many teachers in Nigerian secondary schools are, therefore, handicapped by inadequate background for the teaching of Basic Science or may have little philosophy behind it or the method of teaching it. However, Basic Science teachers in Nigeria remain the only hope for improving science in primary and secondary schools. Certain measures must be taken to improve the quality of Basic Science teachers for better academic achievements. Such measures as stated by Oludipe (2011) include:

- Better recruitment and possibility of better selection
- Better substantive education in teacher training institutions
- On-the-job-training of younger teachers by more experienced ones; and

  In-service and long-vacation courses to continue the education of teacher

2.9 Gender and Academic Achievement in Science Education

Gender is seen as a socially ascribed attribute which differentiate feminine from masculine. The achievement and the result of learning efficiency of male and female may be different. This is because some schools out of omission or commission provide a plat form for channeling children into prescribed gender activities. For instance, the grouping of subject in our schools encourages stereotypical choice of subject. Example include: food and nutrition/technical drawing, Physics/home management. Such grouping will enable females to choose food and nutrition whereas males will choose technical drawing and physics (Nwagbo & Obiekwe, 2010).

Influence of gender in teaching and learning is a paramount issue. In mathematics, Helpern (1986) accepted that female are more verbal than male in mathematics, however, the result of Ahmed, Abimbola, Omosewo and Akanbi (2012) showed no significant difference in the ratings of difficult levels in nutrition between the male and female secondary school teachers, in Ilorin. But, in another research conducted by Ahmed (2009), male lecturers rated genetic concepts more difficult than their female counterparts in Nigeria Colleges of Education. Also in another study, conducted by Onasanya and Ahmed (2011), a significance difference existed between the cognitive achievement of male and female students in Biology.

In a study of comparisons of academic performance of undergraduate Biology students admitted into University with different entry qualification, Mari and Tongding (2010) found out that male and female students with the same entry qualification do not differ significantly in performances. In a similar vein, Omirin (1999) in his research work on sex and course of study as predictors of academic achievement reported that there is no significant difference in performance between male and female candidates with the same entry qualification. Expressing a divergent view in a similar study, Araoye (1991), reported superior performances of male students over female students, generally, gender relate differences have either been attributed to teaching methods or gender stereotyping due to cultural differences in assigning roles of male and female children. However, there is a general global change in attitude which seems to encourage equal treatment to individuals irrespective of gender. This may be responsible for the gradual bridging of gap in performances and choice of careers among female and male students in science and technology. It was on this note that in 1996, United Nation Education, Scientific and Cultural Organization (UNESCO) was requested by each Member State to plan and undertake a six-year special project on

Scientific, Technological and Vocational Education of girls in Africa. Among other factors the project was aimed at encouraging women to participate in local initiatives and to enhance girls' performance in such a way that science Education at the Primary and Secondary level will give them access to careers in science and technology (Opara & Elekalechi, 2007).

The influence of beliefs systems be it class, race, creed, traditionally, or institutionally-based, although at times covert, appears to be the driving force for many socially unproductive gender-based inequalities that tend to generally put limitations on the disadvantaged sex, often experienced in the contemporary human community especially in sub-Saharan Africa, including Nigeria (Anyanwu, 2007). A number of this gender disparities tending to affect the female sex are aptly shown in Science Education which are some of the dominance social developmental indicators. The United Nation Millennium Development Goals (MDGs) initiatives demonstrate a wise understanding that Education is indispensable to achieving gender equality and empowerment of women. A number of authors, Kirk and Garrow (2004); Bellamy (2004)
indicated that Education enables girls and women to take care of their own reproductive health, better protected themselves against HIV/AIDS and rare healthier children who will also go to school.

There are however, arguments for and against the role of teaching experience in improving achievement in Basic Science (Bajah, 1982; Ogunniyi, 1983; Balogun 1992; Odetoyinbo, 2004). Gender issues both on the part of the teachers and students have also been documented to affect achievement generally (Odunusi, 1988; Ogunkola, 1999). The stereotype idea is that anything "rigorous" should be left for boys while girls should settle for less rigorous work especially with the creation story which states that the woman was created out of the man's rib. Of course, this is a myth because various

studies have shown that females given equal opportunities as their male counterparts are able (Yoloye, 2002; 2004).

Education aims at preparing an individual morally, socially, intellectually, physically and vocationally to enable him or her being useful to the society. Differences to accessibility to western Education represent an important source of inequality between male and female in African continent. In Nigeria attitude towards western Education in the 19th century was not different from the Romans, Americans, Sudanese and others (Kajuru & Kauru, 2010). Women were regarded as economic commodity and housekeepers where Education was not necessary and valued. Despite the facts that Western education started in south, some parents did not see the value of women Education until recent time (Ugwu, 1998).The low achievement of pupil in mathematics has become a concern in science education. According to Sikes (1973), the problem of different in gender performance started from gender-stereotyped choice. According to him, a study conducted in summer period in England discovered that girls' performance was high in English, History, Language, Domestic and Commercial subjects. The only science subject in which girls achieved majority of passes was Biology. This implies that boys performed better than girls in all subjects except in Biology. In 1986, study conducted in England by the department of education revealed that at high level of attainment, boys still achieve proportionally far better than girls in mathematics and science subjects (Kajuru & Kauru, 2010).

The parity and disparity in the performance of male and female students in science has form an important focus of research in science education. Liberal feminism believed that education allows the individual to attend self-fulfilment and developed their potential to the fullest. While socialist feminist have drawn attention to the role that gender plays, arguing that schools reproduce both gender inequality and class

inequality (Kajuru & Kauru, 2010). The radical feminists concentrated to power relationship between boys and girls. They suggested that boys dominate schools and classrooms and that this has a very negative effect on girls' chance of performance and success at school. Some teachers' assumption and actions about gender on the basis of class and ethnic background affect their performance and achievement. Some teachers' expectation on girls and inequality in time that boys receive more attention, participate more in classroom discussions, receive higher cognitive questions and greater response time than girls (Lynda & Patricia, 1993).

Study conducted by Ezeugo and Agwagah (2000) revealed that male performed significantly better than their female counterparts in word problems of algebra. Sex differences are factors that affect performance in achievement test. It is widely believed that there are some inherent capabilities specifically for boys or girls, and that boys excel in areas that involve mental reasoning. In Nigeria, as in many developing economics there is a gap in science related courses in our institutions of learning with female at disadvantage. Achieving parity in science education is one of the aims of MDGs and it is also primary objective of the 1990 world declaration on Education For All (EFA) as well as the Dakar Frame work of action (2000). But till date gender inequality still remains elusive (Adepoju, 2009). This could be attributed to the facts that many parents do not want to spend as much on the female education as that of the male child because of their social and cultural environment. This affects gender stereotype in schools (Adeboye, 1998).

In another development, the issue of gender difference in secondary school was conducted by Alio and Harbor- peter (2000). During the study with Polya's problem solving techniques, they found that despite the improvement in mathematics

achievement test recorded by the adoption of Polya's techniques; there existed a significance disparity in the achievement of male and female students in favours of males. Some of the problems that researchers have identified as important for gender differences were the attitude and expectation of teachers. Research evidences cited above have shown that those teachers' assumptions and actions about gender on the basis of class and ethnic background affect their performance and achievement. Teachers themselves have different expectations of girls and boys behaviour and achievement and this are highly influential (Osafehinti, 1998).

The major goal for EFA (2000) was that education should be accessible to all irrespective of gender. However, researcher like Isa (2005) showed that in Nigeria there is a gap in the ratio of male to female that gains admission into tertiary institutions in favour of male. Some reasons for this imbalance being that of financial constraint and traditional prejudices. Isa also cited by Umar and Ghana (2004) that in "over 90% of Africans countries including Nigeria, females enrolments are lower than those of males in all levels of education," indicating a poor trend in the utilization of the potentials in the female folk which can lead to lower productivity by them. When academic achievement of boys and girls in science subjects were compared however, some showed significance difference (Olatoye & Afuwaye, 2004) while other showed no significant difference in the academic achievement of boys and girls in science education (Agommoh & Nzewi, 2003). To ensure girls proper involvement in sciences, Eniayeju (2008), Nzeribe (2008) and Nnaka (2008) advocated for gender sensitive classrooms in Nigeria. It is therefore, necessary for studies to be conducted from time to time to see how girls fare in science classes in order to maintain the tempo.

Traditionally, “the sciences” have been perceived as a masculine domain while conversely “the arts” have been seen as feminine at all school levels (Okigbo & Okeke, 2011). Research findings showed that gender imbalance in science education is not a recent trend but stretches back to pre-historic culture (Obasi 2007; Oshun 2007; Ochu & Ataghar 2010). Other reasons identified by Offor (2007) for gender disparity in science education include; opportunity cost of education, early marriage among girls, lack of female role models, poor self-concept, inherent sex differences as well as gender stereotyping among students and teachers. Hence, there is a need to try out demonstration and guided discovery teaching methods as well as societal enlightenment against gender disparity in science education.

2.10 Interest as a Factor in Academic Achievement in Science Education

Many variables had been identified by Imoko and Agwagah (2006), Iyekekpolor (2007) and Anyagh and Ok’wu (2011) as responsible for students low interest and poor performance in science education. Such variables include curriculum, examination bodies, teachers, students, environment, and text-book. Also, Obioma (2005) and Okereke (2000) identify poor primary school background, lack of interest on the part of the students, incompetent teachers in primary schools, female students not being interested in science subjects, perception that science courses are difficult, large class syndrome, psychological fear of science subject, poor methods of teaching and lack of qualified science teachers are causes of poor achievement in science education.

Interest is an important variable in learning because when one becomes interested in an activity, one is likely to be more deeply involved in that activity (Okigbo & Okeke, 2011). Interest is a subjective feeling of concentration or persisting tendency to pay attention and enjoys some activity or content (Imoko & Agwagah,

2006). Though some children may be intellectually and physically capable of learning, they may never learn until their interest is stimulated. Once the students are stimulated, they will continue to learn as long as the teacher is capable of sustaining there interest in the subject matter. This is because interest is a mother of attention, once there is direct interest, attention is guaranteed and learning is assured (Okigbo & Okeke, 2011). Also, interest can be expressed to simple statements made by individuals of their likes and dislike and one is likely to do well in a discipline of interest.

The low interest in science education emanate from anxiety and fear. Phobia has been observed by Aprebo, (as cited by Okigbo, 2010) to be an academic sickness whose virus has not yet been fully diagnosed for an effective treatment in the class and the symptoms of these phobia are usually expressed in the faces of science students especially when there is examination. The WAEC Chief Examiner's Report (2009) suggested that teacher should help students to improve their achievement and develop interest in science subject by reducing the abstractness of science concepts, and remove the apathy and fear of those subjects. It is in the light of this that Abonyi (1999) also note that current instructional approaches in science education which did not take into consideration prior cultural beliefs seemed to have contributed to poor concept formation and poor students' interest in science. For example, Fafunwa, Macaulay and Sokoya (1989) recommend the mother tongue approach based on the success of a programme in the western part of Nigeria in which students were taught science using the local language. The programme was found to boost students' interest and academic achievement in science education.

When a learner is not psychologically ready for a task he loses interest or benefit nothing from a learning process (Okene, 2002). Also a learner attention span determines

the extent of learning and this is highly connected to the age of the learner. This implies that the teacher must organize learning activities in such quantities that those he teaches are able to cope with and have interest in the course (Attamah, 2012). Now, researchers around the country are calling for changing the method of teaching introductory science classes which is the foundation of all science related subjects. The current techniques of teaching Basic Science classes are out dated and no longer keep students interested. Thus, new techniques of teaching and learning of science involves hands-on and minds-on exercise that will arouse and sustain students' interest and involvement are needed (Agoro & Oyediran, 2009). When science is taught with materials and demonstration, the learners tends to learn better and sustain their interest. This is because it keeps the learners actively involved as this will help science students develop hypotheses, design and conduct experiments, collect and interpret data and writes about the result (Dougianmas' 1998; Yezhao 2003). As students actively construct and direct their own learning through collaboration, they also develop the ability to construct their own meaning from the learning experiences. They no longer memorize formulae or definitions but are able to in co-operate new information into cognitive structure in a more substantive way (Opara, 2009). To achieve this, the role of the teacher is that of a facilitator which should give students room for personal discovery and wonder. It is the teacher's role to relate methods or strategies that enhance understanding of science concepts and allay the difficulties students encounter in physical science concept, (Ogunneye & Lasisi, 2008). Students must be given sufficient time to truly explore and ponder (Tai, Satllar & Loehr, 2005). The teacher can promote understanding by helping students develop systematic approach to monitor their learning. They can analyse or evaluate given problems using their thoughts while the teacher assist them on how to monitor and evaluate their learning.

Teaching that will arouse the interest of the learners involve the use of laboratory facilities. Okoli (2006) define laboratory as any environment outside the class room that provide practical work to give first hand experiences to the learners. Laboratory activities avail students the opportunity to think logically, ask reasonable questions, and seek appropriate answers to solve problems. The rationale for using the laboratory facilities in science teaching lies in the fact that if children are fully involved in activities and challenge to come out with result, they are more likely to learn than if they were simply taught or presented with outcome of the experiments (Nnorom, 2012).

Basic Science curriculum for Upper Basic Level is filled with a lot of activities and experiments which are meant to captivate the interest and help the students understand the theory more clearly and also provide continuous experience in process skill development (NERDC, 2007). An example of such topic is nutrition; the teacher is to provide materials for simple food test. The students are to carry out simple food tests. Their activities and experiments are better performed in the laboratory using the appropriate facilities. Also Obioma (2010) made the following suggestions:

- The establishment of laboratory or reverse room for learning Basic Science and Technology in Lower and Middle Basic Education levels
- The reactivation and restructuring of the existing Integrated Science laboratory to suite the purpose of teaching and learning of Basic Science in the Upper Basic level
- The establishment of Basic Science and Technology laboratory where they do not currently exist.

The National Agency for Science and Engineering infrastructure (NASEI), 2011, organized a workshop for training its workers across the country on how to use the content kits in teaching topics in Basic Science. All these efforts were geared towards

promoting the use of laboratory facilities to arouse interest in the teaching and learning of Basic Science.

The importance of clubs and societies in arousing and reawakening the interest of students in the study of basic core subjects such as Mathematics, practical-oriented science and other science related subjects cannot be over emphasized. Clubs and societies when functional, as data from a Nigerian State Ministry of Education (Lagos State MOE, Report, 2008) shows, can motivate more students to become more interested in schooling and also ensure an all-round development of students. This should be so, because clubs and societies in general provide opportunities for members to interact, as well as encourage healthy competitions among students and schools. In school settings, through opportunities for interactions which science clubs engender, students are provided the opportunity to share knowledge and experiences.

Through science clubs, students are provided the opportunities to interact with their colleagues even from other schools, share experiences, discuss problems, go on excursions, take part in exhibitions and quiz competitions (Adegoke, 2009). Students benefit from opportunities to discuss their ideas with their peers and through this, they will be able to see the value of different perspectives and refine their ideas. These activities enhance collaboration in learning as well as stimulate students' interest in science education. Reactivating science clubs will aid the teaching and learning of science subjects as well as remove the phobia most students attach to science courses as difficult subjects (Awotwi, 2008). He went on further to say that the establishment of science clubs was the secret of many basic and second cycle institutions in Ghana. A similar view was held by Tyagi (2003) while commenting on the need for a comprehensive networking of science clubs in India. These are likely to be some of the

factors that prompted the Federal Government of Nigeria through her Federal Ministry of Education (FME, 1989) to institute a science club known as Junior Engineers, Technicians and Scientists (JETS) in all secondary schools in Nigeria. Yearly reports (FME, JETS Report, 2003-2007) on JETS activities, however, show that in most schools, this club only exists in name. Nevertheless yearly reports further indicate that in schools where JETS are functional and students are encouraged to participate actively in all the club's activities the enrolment figures of students in science classes as well as students' performances in external examinations conducted by WAEC and NECO are higher than in schools where JETS are not functional.

Students' interest in studying science is so important to future involvement in science and technology education, it is useful to know how availability of functional science clubs such as JETS can inter relate with interests to encourage students in learning science subjects at the junior secondary level. These include relevance to further studies/careers, level of perceived difficulty of Basic Science, previous level of achievement in the course, students' biological sex, pedagogical skills of the teacher (the extent to which Basic Science concepts are clearly explained to the students by the teacher-clarity); interest in the context in which certain science concepts are met; as well as opportunities for performing experiments in the laboratory (Adegoke, 2009).

The benefits of science and its products can be seen in every facet of human life; at home, office, transport and clothing, just to mention a few. Theories and principles are fundamental to many scientific discoveries and technological inventions. However, the methods of teaching science in Nigeria cannot develop in the students' the scientific knowledge necessary to make them scientists needed for the development of the nation (Longjohn, 2009). Studies have shown that most science teachers do not possess the pre-requisite knowledge needed for activity-based learning (Nwosu, 2004 and Johnson,

2004) hence the most prevalent method of teaching has been talk and chalk (lecture) method. Ezeliora (2004) pointed out that most of the time science is talked to the pupils using descriptive or lecture method instead of hands-on approach. Most science teachers rarely use adequate teaching aids or connect ideas and concepts with physical realities. This makes students to see science as abstracts and easy to forget. This has resulted in poor enrolment and poor performance in science among secondary school students. The need to use activity-oriented and learner-centred methods of teaching science that will arouse the interest of learners become necessary as emphasized in the National Policy on Education (FME, 2004) as it spells out that:

- educational activities shall be centred on the learner for maximum self-development and self-fulfilment
- the education system shall be structured to develop the practice of self-learning. Government shall in this regard continue to encourage the establishment of young readers clubs in schools.

As a way of motivating students towards learning of science subjects, it will be suggested in the light of this study that science clubs and societies, as earlier outlined, should be made compulsory rather than an option in schools and as well, innovative teaching methods such as demonstration and guided discovery methods, the use of analogy, cooperative learning and constructivism should be further encouraged to boost the students' academic performance in science subjects.

2.11 Overview of Similar Studies

At this point, attempt is being made from this research work to show from empirical evidence that the use of activity-oriented methods of teaching such as the demonstration and guided discovery method of instructions are often used to maximize

conceptual understanding, arose students' interest as well as enhances better academic achievement in the science teaching and learning (Shaibu, 2013).

Consequently, there is a direct positive link between practical activity methods of instructions such as the demonstration and guided discovery method of instructions and students' academic achievements in Basic Science. Shaibu (1998) investigated the relationship between the laboratory practical competence of senior secondary school students in Kaduna state and there academic achievement in chemistry. He found that there is a significant and positive relationship($r=0.52$) between the two variables. He concluded that activity-based instruction involving practical activities should receive higher premium to improve academic achievement.

In a related study, Alawade(2010) investigated the relationship between science resource availability for teaching practical activity-based methods like the guided discovery and demonstration methods and secondary school students' chemistry achievement in Kaduna state. She found a significant relationship($r=0.50$ at $p\leq0.05$) between availability of human resources and students' academic achievement.

In a similar vein, Musa (2000) investigated the efficacy of laboratory teaching method vis-a-vis the conventional chalk-talk method. She found that the laboratory method of instruction was more robust in enhancing and promoting academic achievement and interest in comparison to the conventional lecture method when the result of her data analyses showed a t-value of 2.13 which was found to be statistically significant at $p\leq0.05$.

In addition to that; Igboegwu (2012) studied the effect of guided discovery and demonstration teaching methods on academic achievements of Chemistry students of different levels of scientific literacy in Anambara state. He found that the guided

discovery method produced the highest mean achievement scores in chemistry for the high scientific literacy level group with the pretest and posttest mean achievements scores of 24.23 and 57.64 with S.D of 12.91and 14.03 respectively for the high level group followed by the medium level group with mean achievements scores of 23.00 and 44.51 with S.D of 17.81 and 21.02 respectively the low level group had mean achievements scores of 15,13 and 32.21 with S.D of 7.09 and 15.45 respectively.

Similarly the findings also indicate that the guided discovery method is superior to the demonstration method in promoting cognitive achievement in chemistry amongst students of all levels of scientific literacy. The results confirm that the differences in the mean achievements scores in chemistry amongst students in the three levels of scientific literacy were significant. An observed f-value of 6.581 at $p \leq 0.05$ (2,138df) =3.96 indicate that the higher the scientific literacy level, the better the performance in chemistry for the two teaching methods (fcal>fcrit).

In a study conducted by Shuaibu and Usman (2001) on the relationship between students' performance in practical activity and their academic achievement in Integrated Science using the NISTEP mode of teaching found a positive correlation coefficient, r=0.75 between the subjects' performance in practical activity and the academic achievement in Integrated Science. This was found to be higher than the critical value of 0.27. Showing that there was a statistically significant correlation between students' performance in practical activity and their academic achievements in Integrated Science. They concluded that students performed higher in practical activity when expose to NISTEP mode of instructions in Integrated Science.

Other studies that showed empirically that students' achieve significantly higher when taught science using laboratory or practically based activities included those of Akale and Usman (1993) and Archibong(1999).

There is no agreement on the best way to measure interest, apart from the use of a broader measure of academic interest for young children and the use of domain-specific measures for older children (Goulart & Bedi, 2011). However, the use of different measures involves trade-offs. The more complex measures-domain-specific and multidimensional indices allow a more nuanced analysis of interest but are time-intensive and this makes them less attractive in a large scale surveys.

There are a range of studies which have examined the relationship between interest and persistent attention (Shirley & Reynolds, 1988; Hidi, 1990), academic choice (Holland, 1985), the acquisition of domain-specific knowledge (Alexander, Murphy, Woods, Duhon & Parkar, 1997) and most pertinently for this study, academic achievement. The main conclusion from the interest-academic strand of work is that there is a positive relationship between achievement and interest with correlations ranging from 0.25 – 0.35 (Eccles, Wigfield, Midgley, Reuman, Iver & Feldlaufer, 1993; Wigfield, 1997; Reave & Hakel, 2000; Marsh *et al.*, 2005). On the basis of a meta-analysis, Schiefele, Krapp, Winteler, (1992) conclude that the correlation between interest and academic achievement is about 0.30. The link between interest and achievement is unlikely to be static and it has been argued that while interest and achievement may be quite distinct at an early age, owing to the interaction between the two constructs they are likely to become increasingly intertwined as children mature (Denga & Ali, 1998; Wigfield & Eccles, 2002). For example, Denissen, Zarret, Eccles, (2007) use longitudinal data from Michigan to examine the link between interest and

academic achievement for children between grade 1 and 12. Their analyses support the strengthening of the link between these two constructs from a correlation of 0.13 in grade 1 to about 0.29 by grade 12.

A recent theme in the educational psychology literature has been a concern about the "causal ordering" between interest and achievement. That is, does interest precede an achievement or does achievement precede an interest. Marsh, Trautwein, Ludtke,Koller& Baumet (2005) study this link based on two data bases of 7^{th} graders from Germany from where data was collected at two points in the same academic year. Their analysis shows that while interest in Mathematics in period 1 is statistically significantly correlated with Mathematics test scores in period 2 (Correlation is 0.09 – 0.10) which shows that there is a limited support for the effects of test scores in period 1 on interest in period 2. Koller, Baumert, Schnabel (2001) also work with a sample of German students and find that Mathematics interest in grade 7 has no effect on achievement in grade 10, while interest in grade 10 does influence the achievement in grade 12. Thus, both these findings provide a support for the idea that interest precedes achievement.

While the educational psychology literature pays a considerable attention to the role of a child's motivation in determining educational achievement, there are two issues about this body of work that need to be highlighted. First, there is little attempt to control for the role of a child's unobserved ability in influencing interest and achievement and second, almost none of the work controls for the role that may be played by individual, household and community characteristics in influencing achievement (Goulart & Bedi, 2011). Usually, the focus is squarely on the bivariate link between educational achievement and interest. Despite raising this concern, there seems

to be a little attempt even in the most recent empirical work in this genre to control for differences in socio-economic background or to control for unobserved ability (Marsh *et al.,* 2005; Denissen, *Zarret &Eccles,* 2007).This review aims at assessing the impact achieved through earlier methods of teaching science subjects on students' interest and academic achievements in the learning of science subjects.

2.12 Implication of the Literature Reviewed on the Present Study

The relevance of science to national goals, aspirations and economy dictates to a large extent, the huge commitment and support which most nations make and give to science and technological development (Olagunju, Adesoji, Iroegbu & Ige, 2003). This is because one of the indices of national development (world leadership) is a nation's capacity to make use of newer technologies. There are consistent reports in literature of students' poor performance in science in Nigeria (Mordi, 1983; Keeves, 1992; Olatoye & Afuwape, 2004). The deplorable level of science achievements by students in later years of the 21st century has necessitated the call by the government and several researchers for more positive actions to be initiated to put science achievement back on track (Monk & Osborn, 2000). The hand writing is there on the wall for individuals, communities and nations to see. It is that those who by acts of commission or omission, fail to get prepared physically, psychologically and cognitively to relate with, handle and dealing with issues of our day via the application of scientific and technological knowledge, orientation and expertise will have themselves to blame as they are likely to find themselves emasculated in an on-going global struggle in which only the fittest survived (Shaibu, 2005).

It is in recognition of this reality of our time that science education in the last few decades had resolved to use the integrated approach to teach science. The integrated

approach to science teaching seems to remain wide spread and most influential (Resnick, 1989). “Integration” in science implies teaching science in a way to present specific ideas as a unified whole (Bajah, 1983). Using this approach, the Basic Science teacher presents science subjects without demarcating to which subject a concept belongs. Students, therefore, learn general rules and functions of science in everyday life and the world in which they live. This implies that Basic Science teachers must be versatile in the topic to be covered to cut across many specialized disciplines like Biology, Chemistry, Physics and Geography (Olatoye & Afuwape, 2004).

Current studies on how students learn science have started revealing new ideas and innovative instructional approaches that have proved effective. Examples include: the use of analog, inquiry, guided discovery, cooperative learning, problem solving and constructivism (Nwosu & Nzewi, 1998). The implication of these instructional strategies is that the child should become very autonomous refusing to be governed by reward and punishment (Kato & Kamoi, 2001). Nwafo (2007) explain that the new wave of changes in demonstration and guided discovery approaches is changing the educational goals to not just equipping the learners with basic knowledge, skills and values but with the higher cognitive skills such as problem solving and thinking, that will enable the learner to adapt freely in a rapidly changing world. The present study demands that students must take some responsibilities for their learning. This is because they have to be actively involved in the teaching and learning process and to build up their knowledge (Von Glaserfeld, 1995b).

A study by Ajeyalemi (2002) observed that the prevalent use of lecture method in instruction may be another factor that impedes meaningful learning of Basic Science concepts. Thus, if students are to acquire the basic concepts and principles use in the teaching and learning of Basic Science, the need for teachers to employ the

students' activity mode of teaching must be taken seriously to ensure effective teaching and learning of Basic Science in our JSS. Owolabi (2006) acknowledge the fact that Basic Science is better taught by "doing" in order to promote the development of scientific skills, interest and attitude, and the development of functional knowledge and manipulative skills. Therefore, Basic Science should be activity driven by actively engaging students throughout the lesson (Owolabi, 2006). This would increase students' self-confidence in relation to science, generate a more active participation in science activity and lead to greater interest in Basic Science.

The guided discovery method is a process that allows students to solve problems in a logical and systematic manner (Olagunju, 2002). It is also described as one that offers learners the opportunity to discover facts, concepts and principles for themselves. The presentstudy seeks to tie down lesson objectives to specific activity or series of activities. The strategy adopted in this study breaks down the lesson into small manageable components of engaging, exploring, explaining, elaborating and evaluating which are progressively webbed together to cover the entire context of the topic. It is an ideal teacher-learner interactive strategy that would adequately and easily permits the testing of lesson objectives stated in behavioural terms. This approach enhances teacher-learner interactions such that it attracts and sustains the interest of learners, promote experimental learning and lead to a full understanding of the subject matter (concepts).

Furthermore meaningfulness is achieve using this strategy since Basic Science is taught as a process (characterize by skills) culminating in the product (knowledge).

The Basic Science curriculum is student centered and emphasis is more on learning science as process than as a body of knowledge. For this purpose, the following methods were specifically recommended for the subject: Guided discovery techniques,

Problem solving activities and involvement of students in open-ended field work and Laboratory exercises (Olarenwaju, 1994).

The present study therefore, demands a highly level of competence in teaching strategies on the part of the teachers. Available evidence (Adejoh, 2006) shows that the teaching strategies employed for the subject by teachers are not different from the conventional methods. These studies show that there were virtually no teacher/pupil interactions which could result in the acquisition of practically skills and scientific attitudes. Rather, teachers emphasized more on the information aspect of the subject (Adejoh & Sambo, 2011). Besides that, researchers such as Obiekwe (2008) and Oludipe (2011) have shown that most teachers of Basic Science are unqualified for teaching the subject. To support this fact, Ukeje (1991) and Bello (2004) all agreed that science teachers have crucial roles to play in achieving vibrant science education as the quality of science education hinges on the quality of science teachers.

In spite of the strategic position of science teachers, evidences exist to show that many secondary schools in Nigeria lack qualified science teachers (Okeke, 1999). Science teachers are poorly trained in either content or pedagogy and therefore lack adequate knowledge of content and pedagogy. If today's youth are taught science in this manner, they will grow up only to discover that haphazard knowledge of science is not sufficient to understand the sophisticated operation of the present information age in science and technology (Uche & Umoren, 1998;Usman,2012).

Teaching is the most vital and strategic profession for national development. Without good teachers there cannot be good engineers, medical doctors, or good lawyers. As Ukeje (1996, as cited in Adejoh & Sambo, 2011) also observed, if a doctor makes a mistake, a patient may die. If an engineer makes a mistake a bridge may

collapse, if a lawyer makes a mistake an individual may loss his liberty. But, if a teacher makes a mistake generation yet unborn may suffer. It therefore follows that the quality of education of any nation is a direct reflection of qualities of teachers as no system of education can rise above the quality of its teachers (FME, 2004). In view of the strategic roles of the teachers and the centrality of teachers in the entire educational system, the need for teachers to display healthy attitudes by showing commitment and dedication to work cannot be over emphasized.

Since practical activities in Basic Science provide opportunity for students to actually do science as opposed to learning about science. Nzewi (2008) asserts that practical activities can be regarded as a strategy that could be adopted to make the task of a teacher (teaching) more real to the students, as oppose to abstract or theoretical presentation of facts, principles and concepts of subject matter. Nzewi (2008) maintained that Practical activities should engage the students in hands-on, minds-on activities using varieties of instructional materials/equipment to drive the lesson home.

The present study would want to suggest that the use of practical activities (Approach) to the teaching of Basic Science concepts should therefore be a rule than an option to Basic Science teachers, this is because science teaching and learning should be activity driven by actively engaging the students throughout the lesson if we hope to produce students that would be able to acquire the necessary knowledge, skills and competence needed to meet the scientific and technological demands of the nation (Nwagbo, 2008).

In the light of that, Obiekwe (2008) reported that all is not well with science instruction in Nigerian secondary schools, and noted that the science teaching lays extreme emphasis on content and use of “chalk and talk” method neglecting the

practical activity method which enhances teaching and learning. This negligence and "shy-away" attitude from activity oriented-method of teaching has led to abstraction which makes the students less active, more prone to rote memorization. It is on this note that the Federal Government of Nigeria is emphasizing "the teaching and learning of science process and principles which will lead to fundamental and applied research in the sciences at all levels of education" (FME, 2004). A lot has to be done to improve science teaching in secondary schools in Nigeria. In spite of that, students continue to perform poorly in science subjects, of which Basic Science is one. This situation has created the need for more effective teaching methods. It then becomes necessary to explore the efficacy of demonstration and guided discovery teaching methods of redressing this situation in which this research work is out to address.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This work investigated the effectiveness of demonstration and guided discovery method of instructions on academic achievement on academic achievement and interest in upper Basic Science.

In this chapter, the methodological aspect of the study is presented under the following sub-headings;

- Research Design
- Population of the study
- Sampling and Sampling Procedure
- Selection of Basic Science Topics for the Study
- Instrumentation
- Validity of the instruments (Basic Science Concepts Achievement Test (BSCAT) and Students' Interest Scale of Basic Science (SISBS)
- Pilot Study
- Reliability of the instrument BSCAT and SISBS
- Treatment Administration
- Data Collection Procedure
- Procedure for Data Analysis

3.2 Research Design

The research design adopted for this study was a quasi-experimental- control group design, involving pre and posttest as suggested by Kerlinger (1973)were used. The study will involve a control and experimental groups consisting of both male and

participants. The participants were assigned to intact classes for the two experimental and control groups. A pretest was administered to the groups, before the treatment, to determine the group comparability of experimental and control groups' ability level. Experimental Group1 (EG_1) was taught Nutrition concepts using demonstration method while EG_2 was taught the same concepts using Guided discovery method. The control group was also taught the same concepts using the lecture method. At the end of the treatment period, a posttest was administered to all the three groups of students in order to determine the effectiveness of the treatment. The treatment was done within five weeks. Also interest questionnaire on Basic Science (SISBS) was administered at the beginning before the treatment to both the experimental groups and the control group. This was done to ascertain the level of interest in Basic Science, both for the experimental and the control groups before treatment. The same interest questionnaire on Basic Science (SISBS) was also administered after the treatment to see if there should be any significant effect of the treatment on the participants' interest level. The research design is illustrated in Figure 3.1.

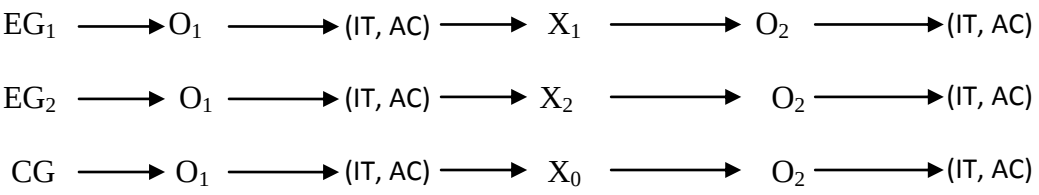


Figure 3.1 Research Design Illustration

Where,

EG_1 = Experimental group 1

EG_2 = Experimental group 2

CG = Control group

X_1 = Experimental treatment (Demonstration Method)

X_2 = Experimental treatment (Guided Discovery Method)

X_0 = Control (Exposed to Lecture Method)

O_1 = Pretest Administration

O_2 = Posttest Administration

IT = Interest

AC = Academic Achievement

3.3 Population of the Study

The population of the study comprised all the public Junior Secondary II students in Wukari Educational Zone. The total population is five thousand, one hundred and nine (5 109) Basic Science students, out of which three thousand one hundred and sixty-six (3 166) were males and one thousand nine hundred and forty-three (1 943) were females that were drawn from ten Government Junior Secondary Schools (GJSS) in the zone.

These JSS II students were suitable for the study, because the newly admitted JSS I students were yet to settle for serious academic work and some of them reported late. Also, JSS III students were busy preparing for the Junior Secondary Certificate Examination (JSCE).

For the purpose of this study, only Taraba State Government-owned Junior Secondary Schools in Wukari zone were used. The reason behind using JSS owned by Taraba State government is because they relatively enjoy the same funding, the same types of teaching staff, the same instructional materials, laboratory equipment, class room structure/environment as well as the same criteria for admitting students and the same JSCE syllabus. All these were geared towards common goals and aspirations.

Of the ten government-owned Junior Secondary Schools in Wukari Educational Zone, majority of these JSS were co-educational. The detail of the population is presented in Table 3.1.

Table 3.1: Population of the Study

S/No.	Name of School	Location	Gender		Total
			Male	Female	
1	GDJSS Bantaje	Bantaje	107	88	195
2	GDJSS Gindin Dorowa	G/ Dorowa	174	154	328
3	GDJSS Jibu	Jibu	336	220	556
4	GDJSS Gidan Idi	Gidan Idi	220	180	400
5	GDJSS Wukari	Wukari township	562	385	947
6	GDJSS Yakasai	Wukari township	427	265	692
7	GSS Wukari (Junior)	Wukari township	492	265	757
8	GDJSS Rafin Kada	R/Kada	405	185	590
9	GDJSS Ladan	Wukari township	71	49	120
10	GDJSS Wukari Central	Wukari township	372	152	524
Total			**3166**	**1943**	**5 109**

Source :(Wukari Zonal Education Office,2012).

3.4 Sample and Sampling Technique

Simple random sampling technique involving 'balloting method' was used to select three Junior Secondary Schools out of the ten Junior Secondary Schools in the population. This was done by taking the corresponding serial numbers of the Junior Secondary Schools written on pieces of paper, shuffled while three participants were asked to pick out of the ten available pieces of paper in an unbiased manner (randomly). At the end of the exercise three junior secondary schools were picked. This was necessary because the experiment require three intact classes: two experimental and a control group, where the sampled school had more than one streams of JSS2, one

wasdrawn by simple random sampling. The three sampled schools were randomly assigned to two experimentaland control group. Hence, demonstration, guided discovery and lecture method of instruction were used respectively in the sampled schools. In each of the classes there were approximately fifty Basic Science Students

This sample is accordance with Tuckman (1975) stated that minimum of thirty sample size is viable experimental research of this nature. Students' Interest Scale of Basic Science (SISBS) was administered to the participants. The next day Basic Science Concept Achievement Test (BSCAT) was administered before the commencement of the treatment. This was done in the two experimental and control school.The detail of the sample is represented in Table 3.3

Table 3.2: Sampling Frame for the Study

S/N	School	GroupGender		Total
		Male	Female	
1	GDJSS, Bantaje	$EG_1$32	23	55
2	GDJSS, Wukari	$EG_2$30	20	50
3	GDJSS, Gidan Idi	CG 31	23	54
Total		**93**	**66**	**159**

3.5 Selection of Basic Science Topics for the Study

The topics that were taught during the study were: types of nutrition and test for starch in leaf and yam tissues, conditions necessary for starch formation, introduction to proteins and test for proteins, introduction to fats and oil and test for fats and oil and types of vitamins and mineral salt. These topics were selected for the following reasons:

- To maintain continuity and sequence in the normal scheme of work for the Junior Secondary School II Basic Science students.

- The topics selected consist of various abstract term involving experiments that seem to give JSS students problems (Edopkayi & Suleiman, 2011).
- The topics lend themselves to problem-solving instruction ideal for the present study

3.6 Instrumentation

Two (2) instruments were developed by the researcher for the research work. These instruments were:

- Basic Science Concept Achievement Test (BSCAT)
- Students' Interest Scale of Basic Science (SISBS)

The instruments were used at both pre- and posttest treatments

3.6.1 Basic Science Concept Achievement Test (BSCAT)

Basic Science Concept Achievement Test (BSCAT) was developed by the researcher to investigate the Effectiveness of Demonstration and Guided Discovery Teaching Methods on Academic Achievement in Basic Science Students. BSCAT consisted of fifty (50) objectives (multiple choices) test items which was drawn from the concepts of Nutrition. Each of the fifty multiple choice items had four options, one correct answer and three plausible distractors. Two marks were awarded to each correct answer that was being shaded, with the total score of hundred (100) marks. The items were developed based on Bloom's taxonomy of cognitive educational objectives.

The table of specification is also called test blue print. This is a two-dimensional table that relates levels of instructional objectives to the course content (Obeka, 2011). The levels of instructional objectives (cognitive domain) are arranged at the top (in columns) and the topics or units in the course content are arranged vertically to the left (in rows). It contains number of items to be set from each section of the concept per each cognitive level. It is a plan that provides a guide to item construction and takes into account the relative emphasis or importance shown to each area of the content as well as the

cognitive level during teaching (Joshua, 2005). The test blue print will be used by the researcher as a means of ensuring content validity in setting questions for the test instrument. The table of specification is presented in Table 3.3

Table 3.3: Specifications (Test Blue Print)

S/No	Concepts	Knowledge 20%	Comprehension 20%	Application 20%	Analysis 15%	Synthesis 15%	Evaluation 10%	Total 100%
1.	Types of Nutrition and Test for starch in a leaf and a yam tissues 22%	2	2	2	2	2	1	11
2.	Conditions necessary for starch formation 18%	2	2	2	1	1	1	9
3.	Introduction to proteins and test for proteins 22%	2	2	2	2	2	1	11
4.	Introduction to fats and oil and test for fats and oil 18%	2	2	2	1	1	1	9
5.	Types of vitamins and mineral salt 20%	2	2	2	2	1	1	10
	Total 100%	10	10	10	8	7	5	50

Source: (Adapted from Obeka, 2011).

Table 3.4 Topics and Questions Distribution of Items According to the Selected Cognitive Levels

S/No	Topics	Knowledge	Comprehension	Application	Analysis	Synthesis	Evaluation	Total
1.	Types of Nutrition and Test for starch in a leaf and a yam tissues	6,48	12,49	14,40	20,30	4,5	2	11
2.	Conditions necessary for starch formation	28,39	43,47	31,50	42	41	37	9
3.	Introduction to proteins and test for proteins	7,18	11,36	13,33	29,35	23,27	1	11
4.	Introduction to fats and oil and test for fats and oil	32,26	45,46	17,38	44	34	3	9
5.	Types of vitamins and mineral salt	15,25	19,24	10,16	21,22	9	8	10

3.6.2 Students' Interest Scale of Basic Science (SISBS)

Students' Interest Scale of Basic Science (SISBS) consisted of twenty two (22) items questionnaire which was used to determine the students' interest in Basic Science. SISBS was developed based on Likert's five-point scale interest which was made up of Strongly Agreed (SA), Agreed (A), Undecided (U), Disagreed (D) and Strongly Disagreed (SD).

3.6.3 Validation of BSCAT and SISBS

Validity of a test instrument refers to the extent to which a test measures what it is designed to measure- that is, the extent to which the test serves the purpose for which it was designed, or the degree to which a test actually measures the variable it claims or purports to measure (Joshua, 2005). For content validation and reduction of errors, the instrument BSCAT was subjected to face and content validation by three experts, two from Science Education Department and one from Biological Sciences Department, all from Ahmadu Bello University, Zaria. All the experts have minimum rank of senior lecturers and minimum of PhD qualification.

To assess the content validity of SISBS, three experts, two from Science Education Department and one from Psychology Department, all in Faculty of Education, Ahmadu Bello University, Zaria. All the experts have a minimum rank of senior lecturer and a minimum of PhD qualification. The experts were asked to go through the instrument and make suggestions where necessary.

3.7Pilot Study

Government Day Junior Secondary School (GDJSS), G/Dorowa JSS II students were used for pilot testing of the instruments. These JSSII is part of the population, but not one of those identified to be used for the main study. The study participants were all students in the class since Basic Science is a compulsory subject to every child. The aim

of this pilot study was to determine the characteristics of the test items which include their clarity and reliability coefficient.

With the trial test, the researcher was able to determine the appropriate timing (duration) for each test as well as identify any problem which may affect the effective administration of the instruments during the actual experiment. Basic Science Concept Achievement Test (BSCAT) took forty-five minutes. This was the average time it took the first and the last participant to finished the paper (test) during the pilot testing. Students' Interest Scale of Basic Science (SISBS) took the students' between 10-15 minutes to complete because, while some students were able to finish their work within 10 minutes, all of them finished within 15 minutes. The data obtained from the trial testing were used to estimate the reliability (internal consistency) of the instrument.

One intact class of forty students made up of 25 boys and 15 girls formed the participants for the pilot study. The instruments Basic Science Concept Achievement Test (BSCAT) and Students' Interest Scale in Basic Science (SISBS) was administered to the participants. An intensive teaching session which lasted for one week was under gone. The result obtained from administration of BSCAT and SISBS was used to calculate their reliability coefficient of the instruments. The instrument BSCAT was found to have a reliability coefficient of r=0.75 using Kuder-Richardson K-R20 method. SISBS on the other hand was found to have a reliability coefficient of r=0.78 using Kuder-Richardson K-R21 method.

The pilot study also helped the researcher to assess the clarity of the instruments BSCAT and SISBS as well as to determine the appropriate number of weeks that was suitable for conducting the actual field work. It also help to pre-aimed the difficulties the researcher was coming to encounter in the application demonstration and guided

discovery teaching methods in the teaching and learning of nutrition concept of Basic Science.

3.8Reliability of the Instruments BSCAT and SISBS

Reliability of a test refers to the extent to which a test measures, whatever it is measuring consistently (Joshua, 2005). It refers to the consistency of scores obtained by the same persons when re-examined with the same test on different occasions or with different set of equivalent items on the same content. It shows the level of internal consistency of the instrument (test) or its stability over time. The result obtained from pilot testing of BSCAT showed that the instrument had a reliability coefficient of 0.75 using Kuder-Richardson K-R 20 Method. Since the test was a multiple choice objective item test that was scored dichotomously, the formula was suitable in determining the internal consistency of BSCAT.

From pilot testing of the instrument SISBS it was found to have a reliability coefficient of 0.78 using Kuder-Richardson K-R 21. This is because K-R 21 is applicable with instruments such as questionnaires where individuals have scores other than one and zeros (Joshua, 2005).

3.9 Treatment Administration

In teaching Effectiveness of Demonstration and Guided Discovery Teaching Methods on Academic Achievement and Interest in Upper Basic Science, the researcher sub-divided the topics in the concepts of nutrition into five sub-topics which are:

- Types of nutrition and test for starch in a leaf and a yam tissue.
- Conditions necessary for starch formation.
- Introduction to proteins and test for proteins
- Introduction to fats and oils and test for fats and oils
- Types of vitamins and mineral salt

3.9.1Treatment Procedure for Experimental Group One(Demonstration Method)

In teaching the sub-topic types of nutrition and testing for starch in a yam tissue and green leaf for experimental group one that is, demonstration teaching method the researcher quickly started as follows:

Step1: Introduction to the participants the apparatus and reagents used for the lesson such as beaker, test tube, iodine solution, ethanol and Bunsen burner and also food items such as yam tuber, bread and green leaf were provided. Activities include identify the usage of the teaching materials and the students listening attentively to the researcher's explanation.

Step II: The researcher mentioned and briefly explained the three types of nutrition such as the holophytic, holozoic and saprophytic types of nutrition.

Step III: The researcher appointed one participant to move to the front table of the class and demonstrate to the class how to test for starch in a yam tissue under the instruction of the researcher as follows:

First peel off a yam tuber, then, slice the yam into pieces, add 2 – 3 drops of iodine solution on the sliced yam. The iodine turns the sliced yam blue black. This is an indication that starch is present in yam tissues.

Step IV: The researcher appointed another participant to move to the front table and demonstrate how to test for starch in a green leaf. The researcher gave instructions as follows: Pluck a sunlight-exposed leaf, dip it into a beaker containing boiling water for thirty seconds and transfer it into a test tube containing ethanol. Remove the leaf and dips into cold clean water, remove and cover it with iodine solution, after 3-5 minutes, washed off the leaf with clean water. The researcher asked the participants what they

observe. The participants answered the presence of blue-black colour was seen on the leaf which was an indication that starch was present in the green leaf.

Step V: The researcher divided the class into groups of six. The apparatus and the reagents were provided to each group to carry out the activities as had been demonstrated. The participants went into smaller groups to test for starch in a green leaf.

Step VI: The researcher moved round to supervise the groups and compare their results and gave assistance to any group that was having difficulty in carrying out the activities. The above procedures or steps were applied to other sub-topics that were taught under experimental group one (DemonstrationMethod). The details of the lesson plan for treatment procedures of experimental group one are provided in appendix iv.

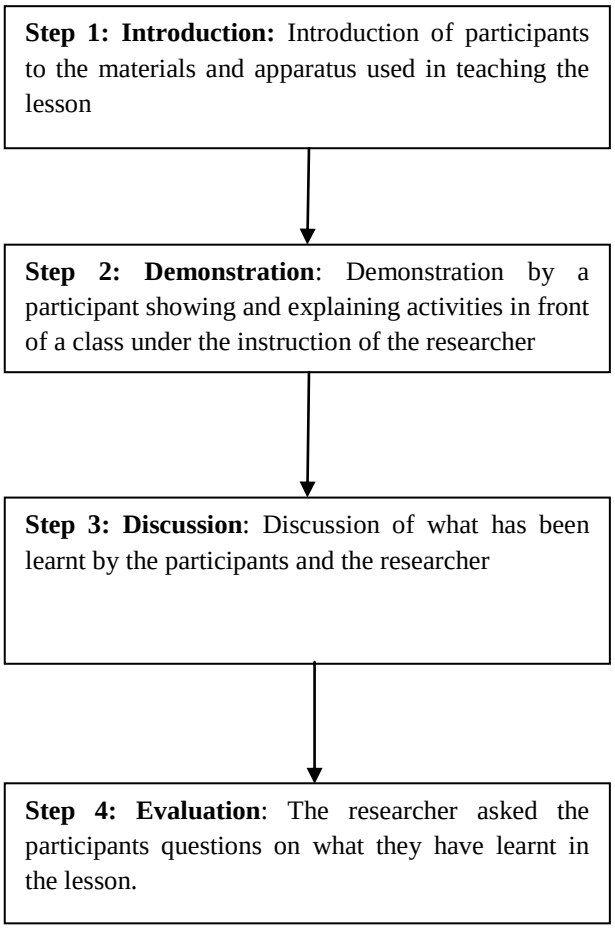


Figure 3.2: Flow Chart for Treatment of Experimental Group 1 (Demonstration Method)

Source: (Adapted from Ametefe, 2012).

3.9.2 Treatment procedure for Experimental Group 2(Guided Discovery Method)

In teaching the concept nutrition using guided discovery teaching method, the researcher reviewed the previous knowledge of student on growth and development (for example what is growth?What is development?)

The researcher quickly introduced his students/participants to the following instructional materials.

Step 1: Beaker, Test Tube, Iodine Solution, Ethanol, and Bunsen burner

Beaker:- A beaker is a round cylindrical container made up of glass or plastic mostly used in the laboratory for keeping solution during practical sessions.

Test tube:-A test tube is a round cylindrical glass tube used for mixing chemicals/reagents during practical. It is heat resistance therefore; sometimes reagent could be heated on the Bunsen burner using the test tube.

Iodine solution: -Iodine solution is a reagent mostly used in the test for starch in food items.

Ethanol:- Ethanol is a reagent employed in food test commonly used to soften and extract the tissues of plants e.g. boiled leaves.

Bunsen burner:- This is the source of heat used in the laboratory for boiling water or warming of solutions.

Step II: When the JSS II Basic Science students were familiar with the explanation and usage of the instructional materials, next, the researcher asked the students what is nutrition? The students answer the researcher question that, nutrition is the act of feeding which is capable of bringing nourishment to the organism.

Step III: The researcher asked the students do plants eat food in the same manner as human beings eat food. The students answer the researcher's question by saying "no" plants do not feed as humans. They suspect that some chemical activities do take place within the body of the plants that makes them to grow.

Step IV: The researcher pointed out that there are three types of nutrition generally, which are: holophytic, holozoic and saprophytic types of nutrition. The researcher explained that

Holophytic nutrition:- is used mainly by green plants whereby through the process of photosynthesis, carbohydrates are build up from simple chemical substances such as carbon (iv) oxide and soil water as raw materials. Sunlight is trapped by chlorophyll of the green leaves as source of energy in manufacturing food.

Holozoic nutrition:- This is a characteristic feeding habit of almost all animals that depends directly or indirectly on autotrophic living things for food. Organisms with this mode of feeding include:(i) Herbivores: These are animals that feed on plants only. Carnivores: These are animals that feed on flesh mainly. (iii) Omnivores: These are animals that feed on both plants and animals

Saprophytic nutrition: - These are characteristics of non-green plants like fungi, and most bacteria that obtain their food mainly from dead organic remains of matter.

Step V: The researcher asked his students. How can we test for starch in a yam tissue? He gave instruction to the students. Peel off the yam and slice it into pieces. Add 2-3 drops of iodine solution on the slice pieces of yam. What do they observe? The students were divided into groups of six (6) each, provided with the material needed to perform the activity under the instructions from the researcher. At the end of the activity the

iodine solution turns the slice pieces of yam blue-black, an indication that starch was present in yam tissues.

Step VI: The researcher outlined and performed the activity with the students as follows: first remove a leaf from a young plant that has been exposed to sunlight for some hours. Next dip the leaf for 30 seconds into a beaker containing boiling water. Then transfer the leaf into a test tube containing ethanol. After the chlorophyll has been dissolved and extracted out by the ethanol. The researcher removed the leaf and dippedit into cold clean water. Later the leaf was covered with the iodine solution for a period of 3-5 minutes. The iodine solution wasthen washed off the leaf. The presence of blue-black colour was evidence that starch is present in green leaves.

Step VII: The researcher divided the class into small groups of six. The apparatus and the reagents were provided to each group to test for the presence of starch in a yam tissue and a green leaf according to the instructions provided in the previous steps while the researcher guided the students.

The students went into smaller groups and begin to test for the presence of starch in a yam tissue and a green leaf.

Step VIII: The researcher moved round the class and supervised the groups and gave assistance to any group that was having difficulty. The students were busy engaged in testing for the presence of starch in yam tissue and a green leaf.

The above procedures/steps was applied to other sub-topics under the concepts of nutrition that were taught under experimental group 2 (Guided Discovery Method), for example, conditions necessary for starch formation, introduction to proteins and test for proteins, introduction to fats and oil and test for fats and oil.

The researcher taught the experimental group 2(Guided Discovery Method) for 5 weeks. The time agreed by the researcher, students and the school authority was during prep time in Government Day Junior Secondary School (GDJSS) that is, JSS Wukari (experimental group 2). The researcher spends 45 minutes per period (90 minutes double period) per week. The detail of the lesson plan isprovided in appendix (v).

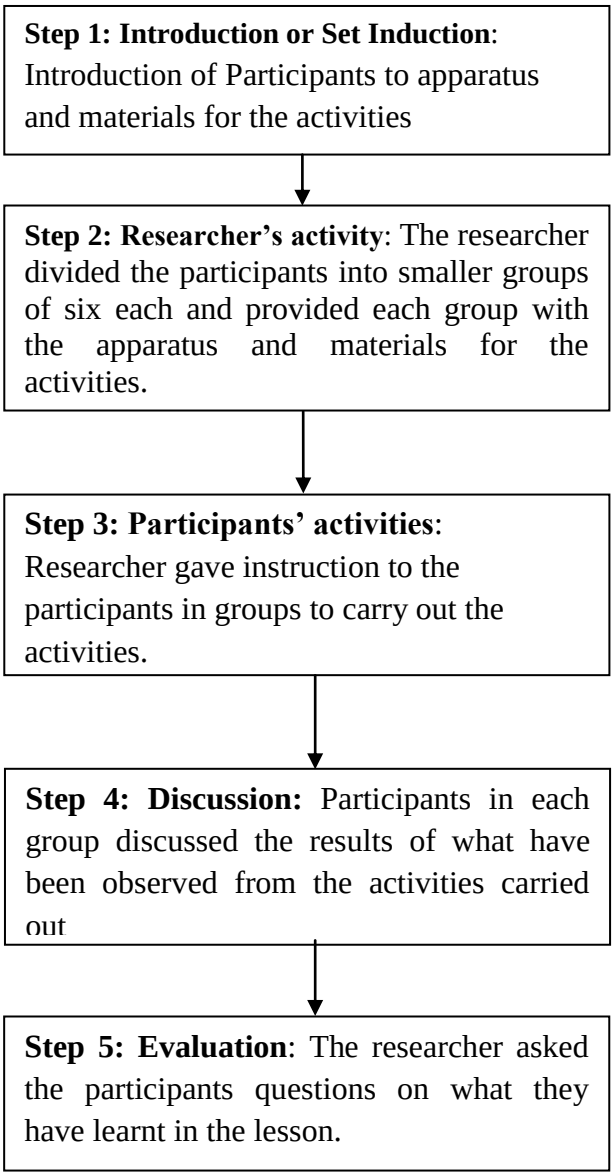


Figure 3.3: Flow Chart for Treatment of Experimental Group 2 (Guided Discovery Method)

Source: (Adapted from Mkpa, 2009)

3.9.3 Teaching theControl Group(Lecture Method)

In teaching the sub-topic types of nutrition and testing for starch in a yam and green leaf using lecture method which is a sub-topic under the concepts of nutrition. The researcher stated by reviewing previous knowledge of the participants on the topic Growth and Development. The researcher asked the participants what is Growth? What is Development? Why do living things feed? And so on. The researcher proceeded by explaining that all living things feed in order to get energy to carry out their daily activities as well as for growth and development. The researcher wrote on the chalkboard the types of nutrition carried out by living organisms to include: Holophytic, Holozoic and Saprophytic nutrition and gave explanation on each type of the nutrition to the participants. The researcher proceeded by discussing the steps involved in testing for the presence of starch in a yam tissue as well as in a green leaf. The details of the lesson plans for teaching the control group is presented in appendix vi

3.9.4 Data Collection Procedure

The instrument Basic Science Concept Achievement Test (BSCAT) and Students' Interest Scale of Basic Science (SISBS) which was developed by the researcher was administered at the beginning (pretest) and after the treatment (posttest) to the two experimental and control groups and the participants responded to the items in the presence of the researcher.

After the administration of the two instruments (BSCAT & SISBS) as pretest, the experimental group 1 were taught nutrition concepts by the researcher using Demonstration Method while experimental group 2 were taught the same concepts using Guided Discovery Method by the researcher. The researcher used the Lecture Method in teaching the control group on the same concepts (nutrition). The time that was agreed by the researcher, participants and the school authority was in the evening

during the prep time in all the Junior Secondary Schools (JSS) that were selected for the study. The researcher spent a total of ninety minutes per week (45 minutes for a particular period) for the two experimental and the control groups.

At the end of five weeks of instruction, BSCAT was administered to the entire participants both the two experimental and the control groups. This was done to compare the performance of participants in experimental group 1 and experimental group 2 and also the control group. Two days after the administration of the posttest, a 30 minutes SISBS questionnaire was administered after the treatment to the two experimental and control groups. Researchers like Beidel (1998) encourages the application of interest test at least two or three days after taking the achievement test. This will enable the respondents to state in his/her opinion how Basic Science is interesting to them, because he/she has gone out of the test/examination tension. This was done to compare the interest level of Basic Science students in the two experimental and the control groups before and after the treatment period.

3.9.5 Procedure for Data Analysis

The data collected for this study were used to analyze research questions and hypotheses as follows:

3.9.6Answering Research Questions

- What are the mean academic achievement scores of students who are taught nutrition concepts of Basic Science using Demonstration, Guided Discovery and those taught with Lecture Methods of Basic Science? The mean and standard deviation of the students' pre and post test scores was used to answer this research question.

- How do demonstration, guided discovery and lecture methods influence students' interest in nutrition concepts of Basic Science? The mean and standard deviation of the students' pre and post test scores was used to answer this research question.
- What is the difference in the academic achievement of boys and girls who are taught nutrition concepts using lecture, demonstration and guided discovery methods in Basic Science? The mean and standard deviation of the students' pre and post test scores was used to answer this research question.

To test for the significant difference in the mean academic achievement scores null hypotheses were stated and tested as follows:

3.9.7 Hypotheses Testing

H_{01}: There is no significant difference ($P>0.05$) in the mean academic achievement scores of students taught nutrition concepts using Demonstration Method, Guided Discovery Method and those taught with Lecture Method in Basic Science.

The appropriate statistical tool that will be used to test this hypothesis is Analysis of Variance (ANOVA). This is because there are three (3) groups which are designated to determine the effectiveness of the three teaching methods on academic achievement of Basic Science students. The scores that were obtained from the administration of BSCAT was an interval scale of measurement. Also, ANOVA can tell us significant differences of the mean scores in each of the group (EG_1, EG_2 & CG).

H_{02}: There is no significant difference ($P>0.05$) in Basic Science students' interest before and after exposure to demonstration method, guided discovery method and those taught with lecture method in Basic Science.

The appropriate statistical tools that wereused to test this hypothesis were Kruskal-Wallis and Scheffe's Post Tests were used to test this hypothesis. This was because there were three variables that were tested before and after instructions in which interest

being the dependent variable was tested on three teaching methods (demonstration, guided discovery & lecture methods) which were the independent variables.

H_{03}: There is no significant difference (P>0.05) between the mean achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with demonstration method, guided discovery method and those taught with lecture methods in Basic Science. The appropriate statistical tool that was used in testing this hypothesis was Scheffe's Post Hoc Tests. The reasons are the same as stated in hypothesis one above. To determine the groups that showed significant difference Scheffe's Post Hoc Tests was carried out.

CHAPTER FOUR

ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the data analysis of the study. The participants include 159students sampled for the study. The study focuses on the effectiveness of demonstration and guided discovery teaching methods on academic achievement and interest in Upper Basic Science in Wukari Educational Zone, Taraba State. The data obtained was analyzed using the Statistical Package for Social Sciences (SPSS) 20th Edition. The chapter is presented under the following sub-headings:

- Data Analysis and Result Presentation.
- Summary of Findings.
- Discussion of the Results.

4.2 Data Analysis and Result Presentation.

Mean and standard deviations of the analysis were used for answering the research questions while hypotheses were tested using Analysis of Variance (ANOVA). Scheffe's Post Hoc Tests as well as Two- way ANOVAwas used. Kruskal-Wallis and Scheffe's Post Hoc Tests werealso used to test differences in level of students' interest. Each of the hypotheses is stated below alongside with the distribution of the statistical tools used for testing each at $P \leq 0.05$ probability level.

1. **Research Question One:**What are the differences in the mean academic achievement scoreswhen students are taught nutrition concepts using demonstration, guided discovery and those taught with Lecture Method?

Table 4.1:Means and Standard Deviations of Academic Achievement of Pretest and Posttest Scores of Students taught with Demonstration, Guided Discovery and those Taught with Lecture Method

Treatment groups	N	Mean of Pretest	S.D	Mean of Posttest	S.D	Mean Gain
Demonstration Method(EG_1)	55	25.76	7.92	45.00	8.65	19.24
Guided Discovery Method (EG_2)	50	29.90	7.92	58.92	13.32	29.02
Lecture Method (CG)	54	28.11	9.23	32.60	13.18	4.49

The Table 4.1 above showed the descriptive mean academic achievement scores of those taught with lecture methods in Basic Science. It was found that their mean gain academic achievement scores were 19.24, 29.02 and 4.49 by participants taught using demonstration, guided discovery and those taught with lecture methods respectively. This showed that participants taught using guided discovery method have the highest mean gain academic achievement of 29.02 followed by participants taught with demonstration method with mean gain achievement scores of 19.24, participants taught with lecture method had the least mean gain achievement scores of 4.49. This implies that those taught with guided discovery method have the highest mean gain academic achievement scores than participants in the other treatment groups.

Hypothesis One: There is no significant difference in the mean academic achievement scores of students taught Basic Science with Demonstration method, Guided Discovery method and those taught with Lecture method.

Table 4.2: Results of Posttest Analysis of Variance (ANOVA)on Achievement Scores of Students in the Experimental and Control Groups.

	Sum of Squares	Df	Mean Square	F calculated	Sig.	R
Between Groups	17364.653	2	8682.327	61.152		
Within Groups	20870.820	147	141.978		0.00	*S
Total	38235.473	149				

*Significant at $P \leq 0.05$, $F_{crit} = 2.60$

Based on the outcome of the Analysis of Variance (ANOVA) statistics in Table 4.2 significant differences exist in the mean academic achievement scores of students taught Basic Science with Demonstration method (EG_1), Guided Discovery method (EG_2) and those taught with Lecture method (CG) in Basic Science.

Reason being that the calculated P-value of 0.000 is lower than the 0.05 alpha level of significance at the calculated F value of 61.15 at (df 2, 147). Therefore, the null hypothesis which states that there is no significant difference in the mean academic achievement scores of students taught Basic Science with Demonstration method (EG_1), Guided Discovery method (EG_2) and those taught with Lecture method (CG), is hereby rejected. This implies that guided discovery methods of instruction have produced significant difference in achievement between experimental group 1 and the control group. This is evident from the achievement of posttest mean scores of the groups. EG_2 having the highest mean value of 58.94, follow by EG_1 with 45.00 and the least value of 32.60 recorded by the Control Group (CG). In order to determine the direction of

significant difference in achievement among the three groups multiple comparison (Post Hoc Test) analysis was carried out using Scheffe's test to determine the group that showed the significant difference and the result is presented in Table 4.3

Table 4.3: Results of Scheffe's Post Hoc Tests Showing Multiple Comparisons of Dependent Variables

Dependent Variable: Achievement

	(I) treatment groups	(J) treatment groups	Mean Difference (I-J)	Std. Error	Sig.	Remark
Scheffe	EG1	EG2	-14.55443*	2.50610	.001	S
		CG	12.57765*	2.50610	.001	S
	EG2	EG1	14.55443*	2.50610	.001	S
		CG	27.13208*	2.49414	.001	S
	CG	EG1	-12.57765*	2.50610	.001	S
		EG2	-27.13208*	2.49414	.001	S

*. The mean difference is significant at the 0.05 level.

Based on Table 4.3 of the Post Hoc Test using Scheffe's test, there is significant difference in the academic achievement of students taught pair wise comparison. Comparison between demonstration method and guided discovery method revealed that significant difference exist showing participants taught nutrition concepts using guided discovery method performed significantly better than their counterparts taught the same concepts using demonstration method. In the comparison between demonstration method and lecture method, there was significant differences showing that participants taught with demonstration method have significantly higher mean academic achievement. In each pair wise comparison, there was significant difference observed, as the computed p- value in each case was 0.001 which was less than the 0.05alpha level of significance. It can be concluded therefore; that students taught with guided

discovery method has significantly higher mean gain academic achievement than those taught with demonstration and lecture method. Those taught with demonstration method had significantly higher mean gain academic achievement than those taught with lecture method.

Research Question Two: how do Demonstration, Guided Discovery and Lecture Methods influence students' interest in nutrition concept of Upper Basic Science?

Table 4.4: Means and Standard Deviations of Students' Pretest and Posttest Interest Level

Groups	N	Mean of pretest	SD	Mean of posttest	S.D	Mean Interest change
Demonstration Method (EG_1)	22	37.91	7.92	80.00	16.14	42.09
Guided Discovery Method (EG_2)	22	39.27	10.82	72.00	20.71	32.73
Lecture Method (CG)	22	32.36	11.09	62.00	30.27	29.64

Table 4.4 above showed that the mean interest change of students taught nutrition concepts of Upper Basic Science with Demonstration Method (EG_1), Guided Discovery Method (EG_2) and those taught with Lecture Method (CG) were 42.09, 32.73 and 292.64 respectively with their standard deviations of 16.14, 20.71, and 30.27 respectively for Demonstration, Guided Discovery and Lecture Method of instructions. This implies that demonstration method of instruction appears to have the greatest influence on students' interest on the concepts of nutrition than the Guided Discovery and Lecture Method of instructions. The lecture method had the least influence interest with a mean gain of 29.64.

Hypothesis Two: There is no significant difference in Basic Science students' interest before and after exposure to demonstration method, guided discovery method and those taught with lecture method.

Table 4.5 Kruskal-Wallis Test Analysis of Interest Levels in Participants TaughtwithDemonstration, Guided Discovery and Lecture method

Interest groups	N	Mean Rank	Df	K-cal	P-value	Remark
Demonstration	22	29.73	2	7.79	0.02	S
Guided Discovery	22	42.75				
Lecture method	22	28.02				
Total	66					

Result of Table 4.5 Showed Kruskal-Wallis test analysis of interest level ranking of participants in the three groups.(Demonstration Guided discovery and lecture method of instructions. The result shows that significant difference exists in the Mean level interest ranking of participants in the three groups. This is because the calculated p-value of 0.02 is lower than the 0.05 alpha level of significance. Their mean ranking interest was 29.73, 42.75 and 28.02 of participants in demonstration, guided discovery and lecture method of instructions respectively. The null hypothesis which states that there is no significant difference in Basic Science Students' interest before and after exposure to demonstration method, guided discovery method and those taught with Lecture method is hereby rejected.

Table 4.6: Results of Scheffe's Post Hoc Analysis of Interest Scores Before and After Exposure to Demonstration, Guided Discovery and Lecture Method

Interest Groups	Mean Rank		N	P-value	Remark
EG_1	Interest Before	29.73	55	0.02	S
	Interest After	34.55	55		
EG_2	Interest Before	39.46	50	0.43	NS
	Interest After	42.75	50		
CG	Interest Before	28.02	54	0.55	NS
	Interest After	29.27	54		

- Significant at $P \leq 0.05$

Table 4.6 above showed that the P-value calculated is 0.02 which is less than the alpha level of significance ($P \leq 0.05$). This means that there is a significant difference in the mean rank of students' interest exposed to the demonstration method of instruction before and after the treatment. The null hypothesis which states that there is no significant difference in Basic Science students' interest before and after exposure to demonstration method is therefore rejected.

Table 4.6 showed the P-value calculated is 0.43 which is higher than the alpha level of significance ($P \leq 0.05$), meaning that there is no significant difference in the mean rank of students' interest before and after exposure to the Guided Discovery method of instruction. Therefore, the null hypothesis which states that there is no significant difference in Basic Science students' interest before and after exposure to the Guided Discovery method of instruction is retained.

Table 4.6 showed that the P-value calculated is 0.55 which is greater than the alpha level of significance ($P \leq 0.05$). This means that there is no significant difference in the

mean rank of Basic Science students' interest before and after exposure to the Lecture method. The null hypothesis which states that there is no significant difference in Basic Science students' interest before and after exposure to the lecture method of instruction is hereby retained.

Research Question Three: What are the difference in academic achievements scores of boys and girls who are taught nutrition concepts using demonstration, guided discovery and those taught with lecture method?

Table 4.7: Means and Standard Deviations ofPretest and Posttest Scores of Boys and Girls Taught with Demonstration Method

Variable	N	Mean of Pretest	S.D	Mean of Posttest	S.D	Mean Gain
MALE	32	26.52	9.13	47.10	8.49	20.58
FEMALE	23	24.64	5.64	41.85	8.09	17.21

Results of the Descriptive statistics in Table 4.7 above showed the mean gain of academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with demonstration method. Their computed mean gain academic achievement scores were 20.58 and 17.21 for male and female students respectively.This implies that male students had better academic achievement scores than their female counterparts when taught nutrition concepts of Upper Basic Science with demonstration method.

Table 4.8: Means and Standard Deviations ofPretest and Posttest Scores of Boys and Girls Taught with Guided Discovery Method.

Variable	N	Mean of Pretest	S.D	Mean of Posttest	S.D	Mean Gain
MALE	30	31.16	7.61	59.60	14.03	28.44
FEMALE	20	28.00	8.19	57.95	12.47	29.95

Results of the Descriptive statistics in Table 4.8 above showed the mean gain academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science taught with Guided Discovery method. Their computed mean gain academic achievement scores were 28.44 and 29.95 for male and female students respectively. This implies that female participants had marginal better academic achievement scores than theirmale counterparts when taught nutrition concepts of Upper Basic Science with Guided Discovery Method.

Table 4.9: Means and Standard Deviations ofPretest and Posttest Scores of Boys and GirlsTaught with Lecture Method.

Variable	N	Mean of Pretest	S.D	Mean of Posttest	S.D	Mean Gain
MALE	30	31.17	7.61	32.35	13.98	1.18
FEMALE	24	29.67	8.87	33.00	12.12	3.33

Results of the Descriptive statistics on Table 4.9 above showed the mean gain academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with Lecture method. Their computed mean gain academic achievement scores were 1.18 and 3.33 for male and female students respectively. This implies that female students had marginal better academic achievement scores than their male counterparts when taught nutrition concepts of Upper Basic Science with Lecture method.

Hypothesis Three:

There is no significant difference between the mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with demonstration method, guided discovery method and those taught with lecture method in Basic Science.

Table 4.10:Two-way Analysis of Variance (ANOVA) of Boys and Girls Taught withDemonstration Method, Guided Discovery Method and those Taught with Lecture Method in Basic Science.

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	R
Corrected Model	17732.977[a]	5	3546.595	24.910	.001	S
Intercept	293791.292	1	293791.292	2063.453	.001	S
GROUPS	16254.830	2	8127.415	57.083	.001	S
GENDER	155.524	1	155.524	1.092	.298	NS
GROUPS * GENDER	210.273	2	105.136	.738	.480	NS
Error	20502.497	144	142.378			
Total	348955.000	150				
Corrected Total	38235.473	149				

a. R Squared = .464 (Adjusted R Squared = .445)

Result of the Two-way Analysis of variance statistics on Table 4.10 showed that there issignificant difference between the mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with Demonstration Method, Guided Discovery Method and Lecture Method in Basic Science. This is because the calculated level of intercept significant (p) value of 0.001 is less than the 0.05 alpha level of tolerance while the calculated F ratio intercept value of 2063.45 is greater than the 2.60 F critical value. The Table 4.10 above further showed that the calculated p value of 0.001 value of treatment is lower than 0.05 alpha level of tolerance while the calculated p-value of0.29 genders is higher than the 0.05 alpha. It means that there is significant effect of gender on their academic achievement. Therefore, the null hypothesis which states that there is no significant difference between the mean

academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with Demonstration Method, Guided Discovery Method and Lecture Method in Basic Science, is hereby rejected.

To test this hypothesis the computed mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with demonstration method, guided discovery method and those taught with lecture method were compared.

Table 4.11: Scheffe's Post Hoc Tests Comparison of Mean Academic Achievement ofBoys and Girls Taught with Demonstration, Guided Discovery and Lecture Method.

Dependent Variable: Academic Achievement

Treatment Groups	Sex	Mean	Std. Deviation	N	P-value	Remark
	Male	46.8125	8.31026	33		
EG1	0.03	S				
	Female	40.5238	8.55347	22		
Total	**44.3208**	**8.88554**	**55**			
	Male	60.0645	14.03789	30		
EG2					0.67	NS
	Female	57.9500	12.47091	20		
Total	**59.2353**	**13.35753**	**50**			
	Male	32.3590	14.03981	30		
CG				0.86	NS	
	Female	33.01581	11.94950	24		
Total	**32.1731**	**13.11296**	**54**			

Results of the Scheffe's Post Hoc Test on Table 4.11 showed that there are significant differences existing inthe mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with Demonstration Method. Reason being that the calculated p value of 0.03 is lower than the 0.05 alpha level of significance while their mean academic achievement scores were 46.81 and 40.52 respectively for boys and girls. This implies that male participants had better

academicachievement scores than their female counterparts when taught nutrition concepts of Upper Basic Science with Demonstration Method. Consequently, the null hypothesis which state that there is no significant difference between the mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with Demonstration Method is hereby rejected. Demonstration method as far as this study is concerned is not gender friendly because it favours male students as observed in their mean scores.

The outcome of Scheffe's Post Hoc Test on Table 4.11 above revealed that there is no significant differences inthe mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with Guided Discovery Method. Reason being that the calculated p value of 0.67 is higher than the 0.05 alpha level of significance .Their computed mean academic achievement scores were 60.06 and 57.95 for male and female students respectively when taught nutrition concepts with Guided Discovery Method. This implies that both male and female had no significant difference in their academic achievement scores when both of them were taught nutrition concepts of Upper Basic Science with Guided Discovery Method. Therefore, the null hypothesis which state that there is no significant difference in the mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with Guided Discovery Method is hereby accepted and retained. this shows that the Guided Discovery method of instruction is gender friendly as both male and female participants performed very well as observed in their mean scores.

The outcome of the Scheffe's Post Hoc Test in Table 4.11revealed that there is no significant difference inthe mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with Lecture Method. Reason being that the calculated p value of 0.86 is higher than the0.05 alpha level of

significance. Their computed mean academic achievement scores were 32.35 and 33.00 for male and female students respectively when taught nutrition concepts with Lecture Method. This implies that both male and female had no significant differences in their academic achievement scores when both of them were taught nutrition concepts of Upper Basic Science with Lecture Method. Therefore, the null hypothesis which state that there is no significant difference between the mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with Lecture Method is hereby retained. This implies that the lecture method is also gender friendly as observed in their mean scores.

4.3 Summary of Findings

1. There is difference in the mean academic achievement scores of students taught nutrition concepts of Basic Science with Demonstration Method (EG_1), Guided Discovery Methods (EG_2) and those taught with the Lecture Method (CG). The significant differences are in favour of Experimental Group 2 (EG_2); that is, participants taught nutrition concepts using Guided Discovery Method of instruction. This was found to be significant with an F value of 61.15 at $P \leq 0.05$ levels of significance.

2. There is difference in the level of students' interest taught nutrition concepts of Basic Science with Demonstration Method (EG_1), Guided Discovery Method (EG_2) and those taughtwith Lecture Method (CG). The difference is in favour of participants taught nutrition concepts with Demonstration method of instruction, that is,ExperimentalGroup 1 (EG_1).

3. There are nodifferences between the mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with guided discovery method and those taught with lecture method in Basic Science.

4. There is no difference between the mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science using Guided Discovery method.

4.4 Discussion of the Results

The major objective of this study was to investigate the Effectiveness of Demonstrationand Guided Discovery Teaching Methods on Academic Achievement and interest on Upper BasicScience three null hypotheses were stated. Analysesof the data obtained were present in the Table 4.1 to 4.11 in accordance with the stated hypotheses. The findings from the analysis were discussed.

The result on Table 4.1 showed that significant differences exist in the mean academic achievement scores of participants taught nutrition concepts of Basic Science with Demonstration Method (EG_1), Guided Discovery Demonstrating (EG_2) and those taught with Lecture method in Basic Science. The Experimental Group2(EG_2) achieved significantly higher than the Control Group (CG) and Experimental Group1 (EG_1).The significant difference in favour of EG_2suggests a greater effectiveness in Guided Discovery teaching method which was used to teach the participants over the Lecture and Demonstration method of instructions which was used to teach participants in the control group and experimental group1 respectively during the treatment session. The superior success of the EG_2 participants over their counterparts in the CG and EG_1 could be explained by the fact that the participants in the EG_2 enjoyed creativity in their treatment and their participation was in a well-equipped laboratory in which the researcher provided the setting, structures, materials and guided the participants progress through problem solving to discover answers to instructional topics at hand. This finding is in line with the earlier works of Bruner(1966); Musa(2000); Shaibu and

Usman(2001); Adamu(2001); Olagunju(2002); Owolabi (2006); Abdullahi(2007); Mkpa(2009); Nzewi and Ibeneme(2011); Alawode(2010); Oludipe(2011); Adodo and Gbore (2012), Igboegwu(2012); who opined that any concept can be taught to the learner at any level but the responsibility of ensuring learning mastery falls on the teacher who must structure thesubject matter and learning experiences in a manner that is consistent with the maturity and growth level of the learner.

The result on Table 4.9 was stated to find out if there is any significant difference in Basic Science Students' interest level before and after exposure to demonstration method. Findings from the study indicates that the Experimental Group1 taught with demonstration method showed significant difference in their mean ranking interest level in Basic Science before and after exposure to nutrition concepts in Basic Science. This is due to the fact that recent theme in the educational psychology literature has been showing concern about the 'causal ordering' between interest and academic achievement. That is, does interest precede an achievement or does achievement precede an interest. This finding is in line with the result of Marsh et al. (2005) whom in their research, study the link between interest and academic achievement based on two data bases of 7^{th}graders from Germany where data was collected at two points in the same academic year. Their analysis showed that while interest in mathematics in period1 shows significant difference with mathematics test scores in period 2. This shows that there is a limited support for the effects of test scores in period 1 on interest in period 2.

Result on Table 4.9was also stated to find out if there is any significant difference in Basic science students' interest before and after exposure to guided discovery. The result of the findings showed no significant difference in Basic Science student interest before and after exposure to the treatment by guided discovery method

of instruction. This is could be explained from the fact that the link between interest and academic achievement is unlikely to be static and it has been argued that while interest and academic achievement may be quite distinct at an early age, owing to the interaction between the two constructs. They are likely to become increasingly intertwined as the children matured. This finding agrees with the result of Denga and Ali (1998); Wigfield and Eccles (2002);Ahmed, Abimbola, Omosewo and Akanbi (2012) which in their research works showed no significant difference in the rating of interest levels in nutrition concepts between male and female secondary school teachers, in Ilorin.

Analysis of result on Table 4.9 was stated to find out if there is significant difference in Basic Science students' interest before and after exposure to treatment by the Lecture method of instruction. The result of the finding showed no significant difference in Basic Science students' interest before and after exposure to the treatment by the lecture method. This could be explained from the fact that the lecture method is teacher-dominated or teacher-centred approach to teaching. It does not require the use of instructional materials or resources. To this effect, the students are denied the opportunity to develop manipulative skills. There has been a growing concern of educational literature to pay a considerable attention to the role of child's motivation by the use of instructional materials in classroom teaching to determine the students' interest and academic achievement especially through making attempt to control the variables that will mask the child's unobserved ability in influencing interest and academic achievement. This agrees with the earlier works of Koller, Baumert and Schnable (2001) who worked with a sample of German students and find out that Mathematics interest in grade 7 has no significant difference on achievement in grade10, while interest in grade 10 does not influence achievement in grade 12.

Table 4.11 was stated to find out if there was no significant difference between the mean academic achievement scores of boys and girls taught nutrition concept of Upper Basic Science with demonstration method. The result of testing this hypothesis showed that significant difference exists in the mean academic achievement scores of boys and girls. The significant difference is in favour of boys. This implies that the male participants had better academic achievement scores than their female counterparts when taught nutrition concepts of Upper Basic Sciences with demonstration method. Consequently, the null hypothesis which states that there is no significant difference between the mean academic achievement scores of boys and girls taught nutrition concept of Upper Basic Science with demonstration methods is hereby rejected. This could be explained from the fact that boys are more aggressive and exposed to teaching and learning that involves activity-oriented strategy like the demonstration method. Hence, the significant difference in their mean achievement scores than their female counterparts. The findings of this study is in agreement with that of Linda and Patricia (1993); Alio and Habo-Peter (2000); Ezeugo and Agwagah (2000); Kajuru and Kauru (2010) who observed that boys dominate schools and classrooms and this has very negative effects on girls chance of performance and success at schools making the male to perform significantly better than their female counterpart. They advocated for a gender sensitive classroom in order to curb down this problem.

Result on Table 4.11 was stated to find out whether there was no significant difference inthe mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with Guided Discovery Method. This null hypothesis was consequently accepted and retained. This implies that both male and female had no significant differences in their mean academic achievement scores when both of them were taught nutrition concepts of Upper Basic Science with Guided Discovery teaching

Method. This implies that this teaching method is gender friendly as both male and female participants benefitted from it. This is because their academic performances were not significantly different on the basis of their sex status. Therefore, it is highly recommended that both male and female students should be taught nutrition concepts of Upper Basic Science with Guided Discovery Method. This agrees with the findings of Omirin (1999); Mari and Tongding (2010); Ahmad, Abimbola, Omosewo and Akanbi (2012), who in their study of comparism of academic performances of male and female undergraduate biology students admitted with the same entry qualifications found no significant difference in their performances.

Result on Table 4.11 was meant to test if there was no significant difference inthe mean academic achievement scores of boys and girls taught nutrition concepts of Upper Basic Science with Lecture Method. However their computed mean academic achievement scores were very low when compared with their counterparts taught the same concepts with Demonstration or Guided Discovery Methods. The Lecture Method should therefore be supported with activity-oriented methods of teaching like Demonstration and Guided Discovery teaching Methods to remove the burden associated with a monotonous pattern of a particular teaching strategy in classroom instruction. This is in line with earlier works of Abonyi (1999); Okereke (2000); Usman (2000); Okene (2002); Ajeyalemi (2002); Obioma (2005); Imoko and Agwagah (2006); Iyekepolar (2007); Usman(2007&2010); Anyah and Ok'wu (2011); Oludipe (2011); Shaibu (2013) who identified variables such as constant use of lecture method, lack of resources for science laboratory and science teaching, non-sequential arrangement of some Basic Science concepts in the curriculum, students environment, lack of test books on Basic Science, incompetent teachers at primary school level,

perception of science courses as difficult, large class syndrome are responsible for students low interest and poor academic achievement in science education.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The purpose of this study is to investigate the effectiveness of two teaching methods on academic achievement and interest in Upper Basic Science (J.S.S.2). In the last chapter data collected using the instruments Basic Science Concept Achievement Test (BSCAT) and Students Interest Scale in Basic Scale in Basic Science (SISBS) were analysed in relation to three null hypotheses outlined to guide the investigation. The results were subsequently discussed. This chapter summarizes the whole study and is presented under the following sub-headings:

- Summary
- Summary of Major Findings
- Conclusion
- Contribution to Knowledge
- Recommendations
- Limitations of the Study
- Suggestions for Further Study

5.2 Summary

This study was carried out to find the effectiveness of Demonstration and Guided Discovery Teaching Methods on Academic Achievement and Interest in Upper Basic Science. The three Junior Secondary School were randomly selected for the Study. The study participants were also randomly selected using odd and even number method. This was done by collecting the registration number of all the JSS2

students in each of the selected Schools. Odd and even numbers were used in selecting the study participants. In the selection of the study participants the first 50 even numbers were accepted and rejected all the odd numbers within the registration numbers collected. The secondary schools were Government Day Junior Secondary School Bantaje as Experimental Group 1 and Government Day Junior Secondary School Wukari was Experimental Group 2. The Control Group was Junior Secondary School Gidan Idi. The Experimental Group 1 (EG_1) was taught nutrition concept using Demonstration Method of Instruction while Experimental Group2 (EG_2) were taught the same concept using Guided Discovery Method. The control group (CG) wasexposed to Lecture method on the same concept. Three null hypotheses were formulated and tested using Analyses of Variance (ANOVA), Kruskal-Wallis and Scheffe's Post Hoc Testsstatistics at $P \leq 0.05$

A quasi-experimental-control group design, involving pre and posttest was used for the purpose of data collection.A pretest made up BSCAT and SISBS was first administered before the treatment was given to the participants.After that, an intensive teaching session of five weeks was done by the researcher, after which a posttest consisting of the two instruments (BSCAT & SISBS) were administered. Data collected from the pre and posttest scores of the participants in the three groups were analysed using ANOVA, Kruskal-Wallis and Scheffe's Post Hoc Tests at 0.05 levels significance.

5.3 Summary of Major Findings

Result of the data analysed revealed that:

Guided Discovery Method of teaching is more effective than the Demonstration and Lecture Methods of instruction in enhancing Upper Basic Science students' academic achievement in nutrition concepts of Basic Science.

1. Teaching nutrition concepts in Upper Basic Science using demonstration methods tends to increase students interest level than teaching using the and lecture methods of instruction.
2. There is no significant difference between the mean academic achievement scores of boys and girls when taught nutrition concepts of Upper Basic Science using Guided Discovery Methods.
3. Significant difference exist in favour of the male participants over their female counterparts when taught nutrition concepts of Upper Basic Science using Demonstration Methods.

5.4 Conclusions

From these findings, the following conclusions are drawn:

1. Teaching methods teachers employ in the teaching and learning of Basic Science have significant impact on students' academic achievement.
2. Guided discovery teaching methods has helped in improving academic achievement of Upper Basic Science students as well as their interest level. Therefore, guided discovery teaching method is a viable method of instruction and has the potential of enhancing the academic achievement and interest of Basic Science Students on nutrition concepts at the JSS level.
3. Teaching of nutrition concepts using guided discovery teaching method was found to be gender-friendly. This means that when Basic Science male and

female participants were taught using this instructional method had higher mean achievement scores. The results obtained indicate no significant difference in the academic achievement between male and female participants.

4. Male study participants taught nutrition concepts of Upper Basic Science using demonstration method achieved higher than their female counterparts.
5. Participants taught nutrition concepts of Basic Science using guided discovery method achieved better than those taught the same concepts using demonstration and the lecture methods.

5.5 Contribution to Knowledge

The main thrust of the activity-oriented method of teaching nutrition concepts tested in this study by demonstration method was student–student centered interaction in the teaching and learning process. Unlike most demonstration strategies that are teacher-centred the researcher has device a demonstration method in which it should be the student that will be demonstrating the event or process and explaining it in the front of the class as he or she proceeds. This will help exert more influence or interest on students' mode of studying and learning through constant self-evaluation of difficult areas on the concept being demonstrated. I believe that I have made some modest contribution to the knowledge bank as follows:

1. By developing the instruments Basic Science Concept Achievement Test (BSCAT) and Students' Interest Scale of Basic Science (SISBS) used for data collection.
2. Coming up with a demonstration method that is student – student centred whereby it involves a student showing activities in front of a class and

explaining as he or she proceeds. And also a flow chart showing the steps involve in a demonstration method of instruction

3. provision of empirical evidence that guided discovery teaching method is more effective in the teaching and learning of Basic Science at the JSS level
4. That interest of students is enhanced significantly to stay on task till they accomplish it when an activity-oriented method of teaching such as the Guided Discovery or Demonstration teaching methods are used.
5. The provision of empirical evidence that there is a positive relationship between academic achievement and activity-oriented method of teaching like the Demonstration and Guided Discovery teaching methods.
6. The provision of empirical evidence that male participants had better academic achievement scores than their female counterparts when taught with demonstration method of instruction.

5.6 Recommendations

On the basis of the findings emanating from this study, the following recommendations are made:

- The federal ministry of education at the locallevels, state levels and federal should encourage the use of Guided Discovery teaching methods by sponsoring teachers to attend in-service training, seminars or workshops so as to be acquainted with this activity-oriented teaching strategy in the teaching and learning of Basic Science in our secondary schools.
- Students' interest should be sustained in the teaching and learning of Basic Science by instructors at the Junior Secondary School (JSS) levelsthrough

carefully guiding and motivating the students when performing an activity such as using guided discovery method of instruction.

- Funding of science laboratories equipment for effective science teaching strategies like the guided discovery method should be enhanced at the junior secondary school levels. This assistance should be done by individual philanthropies, Non-Governmental Organizations (NGO's), the Science Teachers Association of Nigeria(STAN) or the participation of local communities through Parent Teachers Association (PTA).
- Motivational incentives should be provided by the education stakeholders to keep teachers especially science teachers on the job.
- Universal Basic Education Commision (UBEC) at the local, state and federal levels should provide both adequate instructional and infrastructural resources for the effective implementation of activity-based teaching strategies such as the Demonstration and Guided Discovery teaching methods in the teaching and learning of Basic Science.

5.7 Limitations of the Study

Limitations of this Study include:

- Retaining Junior Secondary School Students for research purpose was found to be difficult
- Administrative delay observed during the conduct of the study for example the researcher waited for one to two weeks in some sample schools due to fee drive to ensure that the participants were available for the research work
- Using only a class in the sampled schools most staff complain of period loss thereby dragging them behind to cover their syllabus

5.8 Suggestions for Further Studies

The following are suggestions for further studies. This study may be expanded in the following ways:

1. There is need to conduct similar research to investigate the effectiveness of other teaching strategies such as Constructivism, Concept Mapping or Problem Solving Methods.
2. Similar studies on the effectiveness of teaching methods should be carried out in other Educational Zones of some states in Nigeria.
3. This study can be extended to Senior Secondary Schools to find out if teaching strategies have any influence on the students' choice of career at the Senior Secondary School level.
4. There is a need to find out if gender has a role to play between teaching strategy and curriculum content taught at schools.

REFERENCES

Abdulahi, A. B. (2007). Improving the Teaching Methods of Chemistry Practical.*Science Teachers Association of Nigeria, Chemistry Panel, NationalWorkshopPreceedings*. (3), 120-123.

Abonyi, O.S. (1999). Effects of an Ethnoscience-Based Instructional Package on Students' Conception of Scientific Phenomena and Interest in Science.*Science Teachers Association of Nigeria 53rd Annual Conference (2012); Meeting the Challenges of UBE Through STM Education*

Adamu, A. (2001). *Computer Assisted Teaching Learning*, National Commission for Colleges of Education, Abuja Area Ltd, Kaduna.

Adegboye, A.O. (1998). Gender Preferential Treatment by Parent and Nigeria Family. In: Nwagbo, C & Obiekwe, C. (Eds). Effects of Constructivist Instructional Approach on Students' Achievement in Ecological Concepts in Biology. *Science Teachers Association of Nigeria, 45(1&2):26-33.*

Adegoke, B.A. (2009). Determining Factors in Secondary Students' choice of Physics. *Journal of Science Teachers Association of Nigeria, 44(1&2):75-91*

Adejoh, M.J. (2006). Evaluation of Integrated Science and Introductory technology Program in Secondary Schools in Benue State.An Unpublished Ph.D Thesis, University of Jos, Jos.In: Abonyi, O. S. (Eds). *Science Teachers Association of Nigeria 52nd Annual Conference (2011). Reform in STEM Education.*pp.182-188.

Adejoh, M.J. and Sambo, M.H. (2011). Improving the quality of Basic Science Technology and Learning Through Educational Reforms.*Science Teachers Association of Nigeria 52nd Annual Conference (2011).Reform in STEM Education.*

Adekunle, F.R. (2012). Improving Learners Attitude to Science under the Universal Basic Education Programme: The effect of Ethnoscience-Based Instruction.*Science Teachers Association of Nigeria 53rd Annual Conference (2012).Meeting the challenges of Universal Basic Education through STM Education.*pp.169-175.

Adepoju, T.I. (2009). Managing Strategies and Policy Initiatives for Bridging Gender Gap in Science and Technology Education in Nigeria Higher Institutions. Paper presented at the First International Conference of Girls and in Science and Technology in Africa, Bamako, Mali. *Journal of Studies in Science and Math Education*, Ahmadu Bello University, Zaria, 1(1) :82-87

Adeyegbe, S. O. (1998). The Senior Secondary School Science Curriculum and the Candidates' Performance: An Appraisal of the First Cycle Operation. *Journal of Science Teachers Association of Nigeria*, 28(1&2): 3-12.

Adodo, S. O. and Gbore, L. O. (2012).Prediction of attitude and interest of science students of different ability on their academic performance in Basic Science.*International Journal of Psychology and Counseling*, 4(6): 68-72. Retrieved on the 21st September, 2013, from http://www.academicjournals.org/IJPC.

Afe, J.O. (2002). Reflections on Becoming a Teacher and The Challenges of the Teacher Education. Inaugural Lecture Series No 64, University of Benin. In: Nwosu, A.A. and Ibe, E. (Eds). Assessment of Teachers Level of Implementation of the Basic Science Curriculum: Implication for Professional Development.*Science Teachers Association of Nigeria 53rd Annual Conference (2012) Meeting The Challenges of UBE Through STM Education,* pp.190-196

Agommuoh, P.C. and Nzewi, U.M. (2003).Effect of Video-Typed Instruction on Secondary School Student's Achievement in Physics.*Journal of Science Teachers Association of Nigeria,* 38(1 &2):65-72

Agoro, A.A and Oyediran, A.M. (2009). Integrated Science Teachers' involvement in the use of Hand-on Laboratory Methods of Integrated Science,*Journal of Science Teachers Association of Nigeria,44(1&2):71-74*

Ahmed, M.A. (2009). Lecturers Assessment of Difficulty Levels of Genetics Concepts in Nigerian Colleges of Education. *Journal of Curriculum and Instruction*,7(1&2):132-140.

Ahmed, M.A; Abimbola, I.O; Omosew, E.O. and Akanbi, A.O. (2012).Availability and Utilization of Instructional Resources for Teaching Basic Science and Technology in Secondary Schools in Ilorin, Nigeria. *Science Teachers Association of Nigeria 53rd Annual Conference (2012) Meeting the Challenges of UBE through STM Education,* pp. 203-213

Ajeyalemi, D. (2002). *Capacity Building in the Sciences.Imperative for Teacher Education in Nigeria*. University of Lagos press

Akale, M.A.G. and Usman I.A.(1993). Effect of Practical Activities in Integrated Science among Junior Secondary School Students in Kaduna State.*Journal of Science Teachers' Association of Nigeria,* 28(1&2):102-108

Akbani, R and Allvar, N.K (2010).Teachers Characteristics as Predictors of Students Academic Achievement.*Tarbiat Moderate University*, 13(4): 68-72.

Akinsete, A. M. (2006). Effective Method of Teaching Difficult Concepts in Chemistry. Chemistry Panel, *Science Teacher Association of Nigeria Workshop Series,* 2, 47-54.

Akpan, B.B. (1996). Towards a Reduction in The Contents of our Primary and Secondary Science Curricula. *Journal of the Science Teachers Association of Nigeria,* 31(1&2):1-5

Alawode, S. O. (2010). A study of the Relationship between Science Resources Availability and Secondary School Students' Chemistry Achievement in

Kaduna Metropolis.*An unpublished M.Ed thesis submitted to Faculty of Education Ahmadu Bello University, Zaria.*

Alexander, P. A., Murphy, P. K., Woods B. S., Duhon, K. E. and Parker, D. (1997). "College instruction and concomitant changes in students' knowledge, interest and strategy used: A study of domain learning". *Contemporary Educational Psychology*, 22(2): 125-46

Alio, R.C and Harbor-Peter, V.F. (2000). Effect of Polya's Problem Solving Technique on Secondary School Students Achievement in Mathematics, Abacus. *The Journal of Mathematics Association of Nigeria*, 9(2):56-60

Ametefe, G.T.D. (2012). *Curriculum and Teaching.An Introduction to Principles and Methods of Teaching*. Publishedby Qalam tech publications Company, Jalingo: Nigeria.

Anyagh, P. I. and Okwu, E. I. (2010).Effects of Formula Teaching Approach on Students' Achievement in Algebra.*Journal of Research in Curriculum and Teaching*, 5(1): 374-379

Anyanwu, I.N. (2007). Belief-Systems and Gender Disparity: Implication and Sustainable Development in the Wake of HIV/AIDS Epidemic.*Science Teachers Association of Nigeria Proceedings of the 50th Anniversary Conference.*pp.131-135

Appleton, K Beasley, W. (1994). Students' Learning in Science Lessons: Towards Understanding the Learning Process. Paper presented at the Annual Meeting of the Australasian Science Education Research Association In: Nzewi, U. and Ibeneme, A.N. (Eds). The Effect of Cueing Questions as Instructional Scaffolding on Students Achievement in Biology. *Journal of the Science Teachers Association of Nigeria,46(1):35-36*

Araoye, M.E. (1991). Relationship Between Critical Thinking Skills and Self Concept Assessment as a Thinker Among Some Selected Nigerian Science Teachers. Unpublished M.Ed Thesis, Department of Education, Ahmadu Bello University, Zaria.

Archibong, M. (1999).The Relative Effectiveness of Activity-Based Approach and Lecture Method on Cognitive Achievement on Integrated Science Students.*Journal of Science Teachers' Association of Nigeria,* 32(18&12): 37-42.

Arigbabu, A.A and Oludipe, D.I. (2004). Relationship Between Prior Mathematic Knowledge and Students' Academic Performance in Integrated Science. *Journal of Science Teachers Association of Nigeria,* 39(1&2):52-55.

Attamah C. G. (2012). Learning Environment: A Major factor in implementing UBE curriculum in Basic Science.*Science Teachers Association of Nigeria 53rd Annual Conference* (2012); *Meeting the Challenges of UBE through STM Education*, pp.178-181

Ausubel, D. (1968). Educational Psychology: A Cognitive View. New York. In: Uche & Umoren (Eds) *Integratd Science Teaching Perspective and approaches. pp. 66-68*

Aworanti, O. A. (1991). Studenti Perception of Integrated Science Teaching in Nigeria.*Retrieved on 27th September, 2013, from Unilorin* edu.ng/…/students%20PERCEPTION%200F% 20INT …

Awortwi, H.A. (2008). Establishing Science In Schools – Retired Director of Education. Retrieved the 15th of May, 2013, from http://www.modernghana.com

Babajide, V.F.T (2010) Generative and Predict-Observe-Explain Instructional Strategies as Determinants of Senior Secondary School Students' Achievement and Practical Skills in physics. Unpublished Ph.D. Thesis, University of Ibadan. In: Abonyi, O. (Eds). *Journal of Science Teachers Association of Nigeria,* 46(1): 125-133

Babalola, S.K. (2000). Blue print for the management of the UBE at the secondary school level. Paper presented at the National Workshop on Effective School Management and Challenge of Conducting School Examination in Nigeria, organized by All Nigerian Conference of Secondary School Principals (ANCOPSS), March.

Bajah S.T (1982) Two Decades of Primary Science in Nigeria: A Critical Evaluation.*23rd Annual Conference Proceedings of Science Teacher Association of Nigeria*, pp.19-25.

Bajah, S.T. (1983). *Teaching Integrated Science Creativity* Ibadan: University Press, Nigeria.

Balogun, T.A. (1992). Integrated Science Teaching Concept Problem and Progress: A Keynote Address Presented at the Regional Workshop on Integrated Science Teaching University of Ibadan, Ibadan. In: Nzewi, U. (Eds). *Journal of Science Teachers Association of Nigeria,* 39(1&2):17-21

Beidel, D. C. (1998).Psychological Assessment of Anxious Emotional Studies in Children.*Journal of Abnormal Psychology.* 97, 80-82

Bellany, C. (2004). Globalization and Infectious Diseases in Women.International Conference on Women on Infectious Diseases. Feb 27-29,2004, Atlanta Georgia in United State of America. In: Anyanwu I.N (Ed) Belief-Systems and Gender Disparity: Implication and Sustainable Development in the Wake of HIV/AIDS Epidemic.*Science Teachers Association of Nigeria Preceding of the 50th Anniversary Conference*, pp. 131-135

Bello, G.U. (2004). Sustainable development and indigenous vocational technical education the only way for Nigeria.*Kontagora Journal of Science and Technology,* 4(2):15-21

Biggs, J. (1989). Approaches to the Enhancement of Tertiary Teaching.*Higher Education Research and Development,* 8:1-25.

Biggs, J. and Moore, O. (1993).*The Process of Learning*.3rd Edition. New York: Prentice Hall.

Bruner, J.S (1966). *Towards a theory of instruction.* Cambridge, M.A Harvard University Press.

Carin, A. and Sund, R.B. (1964).*Teaching science through discovery*.Columbia, Charles Merrik Books.

Danjuma, I.M. (2005) An Investigation of Pre-service Teachers' Problem-Solving Behaviourin Solving Selected Numerical Problems in Chemistry. An Unpublished PhD Thesis, Science Education Programme, Abubakar Tafawa Balewa University, Bauchi

Daniels, M. and Schouten, J. (1970).*Education in Europe: the screening of student's problems of Assessment and Prediction of Academic Performance. Council for Cultural Cooperation of the Council of Europe*, London: George Harrap, Co Ltd, pp. 65

Danmole, B.T. (2011). Emerging Issues on the Universal Basic Education Curriculum in Nigeria.Implication for the Science and Technology Component.*Pakistan Journal of Social Science,* 8(1): 62-68.

Denga, D.I. (2000). Evolving a New Education Culture: The Universal Basic Education Focus.*International Journal of Research in Basic and Life Long Education,* 1(1&2): 1-6

Denga, I.D.and Ali (1998).*An Introduction to Research Methods and Statistics in Education and Social Sciences.*Rapid Educational Publishers Limited,Calabar,Nigeria.

Dennisen, J.J.A.; Zarrete, N.R. and Eccles, J.S. (2007)."I Like to Do It, I'm Able, and I know I Am. Longitudional Couplings between Domain-Specific Achievement, Self-Concept, and Interest" *Child Development,*78(2): 430-470.

Dike, V.W. (2000). School library facilities required for successful implementation of the Universal Basic Education in Nigeria. Paper presented at the 16 th Annual Conference of the Nigerian School Library Association, at the Children's Centre Library, UNN, 23-26 October. pp. 2-7.

Domin, D.J. (1999). A review of laboratory instructional styles. *Journal of Chemical Education*, 76: 1-5.

Dougiamas, M .(1998). A Journey into Constructivism. In: Agoro, A.A and A.M. Oyediran (Eds.) Integrated Science teachers' involvement in the use of Hands-on Laboratory Methods of teaching Integrated Science. *Journal of Science Teachers Association of Nigeria, 44(1&2):71-74*

Duada, D.M. and Udofia, N.A. (2010).Comparing the Objectives, Themes and Sub-themes of the Integrated and Basic Science Curriculum of Junior Secondary Schools. *Journal of Science Teachers Association of Nigeria,45(1&2):36-47*

Duru, V. N. (2007). Enhancing Interested Science teaching through the use of Concept mapping.*Alvana Journal of Science*, 3(1): 65-75

Eccles, J.S., Wigfield, A., Midgley, C., Reuman, D., Iver, D. M. and Felldlaufer, H., (1993)."Negative Effects of Traditional Middle Schools on Students' Motivation".*The Elementary School Journal*, 93(5): 553-74

Edho, O.G. (2009). The Challenges Affecting the Implementation of the Universal Basic Education (UBE) in Delta State, Nigeria.*Journal of Social Science*, 20(3): 183-187

Edmonson, K.M. and Novak, J.D. (1993). The Interplay of Scientific Epistemological views on Learning Strategies and Attitudes of College Students of Research. *Journal in Science Teaching*, 30: 547-559.

Edokpayi, J. N. and Suleiman, M. A. (2011). Students Integrated Science Achievement as Predictor of later Achievement in Chemistry: a case study among selected secondary schools in Zaria metropolis. Retrieved on the 21st September, 2013, from www.scholarsresearchlibrary.com

Educational Resource Centre (2008). JSS Integrated Science Report. Ministry of Education Kaduna, Kaduna State, Nigeria.

EFA. (2000). Education For All. Dakar Framework for Action

Eniayeju, P. (2008). Maintaining Learner Friendly and Gender Sensitive Science Classrooms for Enhanced Performance. Focus on Research, Reproductive Health Education and Gender Sensitive Classrooms. *Science Teachers Association of Nigeria, Gender and STM Education Series No.2*

Ezeliora, B. (2004). Motivating Secondary School Science Teachers to Face the Challenges of the Third Millennium.*Journal of Science Teachers Association of Nigeria*, 39(1&2): 83-87.

Eya, Patrick (2001). The extent of primary school teachers' awareness and involvement in Universal Basic Education in Enugu urban areas.Retrived on the 3rd July, 2015 from http://www2.ncsu.ed/ncsu/aern/teaware.html.

Ezirim, M.U. (2006). Scaling Up Girls in Science Education toward a Score Card on Quality Education. In: Ogunleye, B.O. and Babajide, V.F.T. (Eds). Commitment to Science and Gender as Determinant of Students Achievement and Practical Skills in Physics.*Journal of Science Teachers Association of Nigeria, 46(1):125-133.*

Fafunwa, A.B; Macauley, J.I. and Sokoya, J.A.F. (1989) .Education in Mother-tongue: The Ife Primary Research Project.1970-1978. Ibadan, Nigeria. In: Adekunle, F.R. (Ed) Improving Learners Attitude to Science Under the Universal Basic Education Programme: The Effect of Ethnoscience-Based Instruction.*Science Teachers Association of Nigeria, 53rd Annual Conference (2012) Meeting The Challenges of UBE Through STM Education*, pp. 169-175

Federal Government of Nigeria (FGN, 2004).National Policy on Education, Lagos, NERDC Press.

Federal Ministry of Education (2008). Teacher Handbook for the 9-year Basic Education Curriculum, Basic Science for Junior Secondary School Abuja, Nigerian Education Research and Development Council (NERDC) Abuja. In: Udofia and Salami (Eds). Appraisal of the UBE Curriculum Using Basic Science as an example.*Science Teachers Association of Nigeria 53rd Annual Conference (2012) meeting the challenges of the UBE through STM Education,* pp. 147-152

Federal Republic of Education (2006). National Action Plan (NAP) for implementation of Universal Basic Education Programme for All (EFA) and the Millennium Development Goals by 2015, Federal Ministry of Education, Abuja. In: Udofia and Salami (Eds). Appraisal of the UBE Curriculum Using Basic Science as an example. *Science Teachers Association of Nigeria 53rd Annual Conference (2012) meeting the challenges of the UBE through STM Education.*

Federal Republic of Education (2008).*Frequently Asked Question (FAQ)* .The New 9-year Basic Education Curriculum, Structure. Nigerian Educational Research and Development Council (NERDC), Abuja.

Federal Republic of Education (2008). Teacher Handbook for the 9-year Basic Education Curriculum, Basic Science for Junior Secondary School Abuja, Nigerian Education Research and Development Council (NERDC) Abuja. In: Udofia and Salami (Eds). Appraisal of the UBE Curriculum Using Basic Science as an example.*Science Teachers Association of Nigeria. 53rd Annual Conference (2012) meeting the challenges of the UBE through STM Education*, pp. 147-152

Federal Republic of Nigeria (FGN) (1984).Junior Secondary School Syllabus in Science, Introductory Technology Business Education EC Comparative Education Study and Adaption Centre (CESACE). Nigerian Secondary School Technology Project (NSSTP). Lagos Federal Government Publication. In: Duada, D.M. and Udofia, N.A. (Eds). Comparing the Objectives, Themes and Sub-themes of the Integrated and Basic Curriculum of Junior Secondary Schools.*Journal of Science Teachers' Association of Nigeria,*45(1&2): 36-46

Federal Republic of Nigeria (FGN) (2004). Education For All is the Responsibility of All. The Compulsory free Universal Basic Education Act, 2004 and other related matters Abuja. UBE Building IBB Close. In: Duada, D.M. and Udofia, N.A. (Eds). Comparing the Objectives, Themes and Sub-themes of the Integrated and Basic Curriculum of Junior Secondary Schools.*Journal Science Teachers Association of Nigeria*,45(1&2):36-46

Federal Republic of Nigeria (FGN) (2006).Universal Basic Education Commisssion.Universal Basic Education Programme. A flag tip programme of the Federal Government of Nigeria, Abuja. Federal Government Publication. In: Duada, D.M. and Udofia, N.A. (Eds).Comparing the Objectives, Themes and

Sub-themes of the Integrated and Basic Curriculum of Junior Secondary Schools. *Journal of Science Teachers Association of Nigeria,* 45(1&):36-46

Flick, L.B. (2000). Cognitive Scaffolding that Fosters Scientific Inquiry in Middle Level Science. *Journal of Science Teacher Education;* 11(2):109-129.

Gagne, R.M.(1977). *The Conditions of Learning* (3rd ed.).New York: Holt Rinehart & Winston, USA.

Gibbs, G. (1992). *Improving The Quality of State's Learning.* New York: Holt, Rinchant and Winston.

Goulart, P. and Bedi, A. S. (2011) .The Impact of Interest in Schools on Educational Success in Portugal .Retrieved on the 8th May,2013 from www.iza.org/en/webcontent/publications/papers/viewabstract?dp_id

Haggis, S.M. (1973).Integrated Science a Challenge to the Science Teachers. In: Richmond, P.E. (Ed). *New Trends in Integrated Science Teaching.*Paris : UNESCO.

Halpern, J.Y. (1986). Reasoning About Knowledge: An Overview. In: Ahmed M.A. Abimbola, I.O; Omosewo, E.O. and Akanbi, A.O. (Eds). Availability and Utilization of Instructional Resources for Teaching Basic Science and Technology in Secondary Schools in Ilorin, Nigeria.*Science Teachers Association of Nigeria 53RD Anniversary Conference (2012) Meeting the challenge of UBE Through STM Education*.

Hammond, J. (2001). *Scaffolding: Teaching and Learning in Language and Literacy Education.* Rozelle: PETA.

Hillsdale, N. J. and Erlbaum, N.J. (1992).The role of interest in learning and development. In: Krapp, A; Schiefele, U and Winteler, A. (Eds). Interest as a predictor of academic achievement:a meta-analysis of research. Retrieved on 15tt May, 2013. From http://opus.kobv.de/ubp/volltexte/2009/3352/

Hmelo-Silver, C.E., Duncan, R.G. and Chinn, C.A. (2007). Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller and Clark (2006). *Education Psychologist*, 42: 99-107.

Holland, J.L.(1985). *Making Vocational Choices: A Psychology of Carriers*.Englewood cliffs, N.J. Princeton Hall.

Ibe, E. (2004). Effect of Guided-inquiry and Demonstration on Science Process Skills Acquisition Among Biology Secondary School Students.Unpublished M. Ed Thesis, University of Nigeria Nsukka.

Ibe, E. (2008). Status of Science Teachers in JSS Science: Implication for Attainment of Millennium Development Goals. In: Nwosu, A.A. and Ibe, E. (Eds). Assessment of Teachers Level of Implementation of Basic Science Curriculum: Implications for Professional Development. *Science Teachers' Association of*

Nigeria, 53rd Annual Conference (2012).meeting the challenges of UBE through STM Education. pp.190-196

Igboegwu, E.N. (2012). Effect of Guided Discovery and Demonstration Teaching Methods on Achievement of Chemistry Students of Different Levels of Scientific Literacy.*Journal of Research in Curriculum and Teaching. Benue State University, Makurdi,* 6(1): 445- 458.

Imogie, A.I. (2010). A New Paradigm in Teacher Preparation in the 21st Century Nigeria. In: Nwosu, A.A. and Ibe E (Eds) Assessment of Teachers Level of Implementation of the Basic Science Curriculum: Implication for Professional Development. *Science Teachers Association of Nigeria, 53rd Annual Conference (2012) Meeting The Challenges of UBE Through STM Education*. pp. 190-196

Imoko, I. B. and Agwagah U. N. V. (2006). Improvising Students' Interest in Mathematics Through the Concept Mapping Technique: A focus on gender. *Journal of Research in Curriculum and Teaching 1(1): 30-38*

Inyang, N.E.U. and Mkpanang, J.T. (2004).Science Education Research Trends in Nigeria. *Journal of Science Teachers Association of Nigeria*, 39(1&2): 61 – 68

Isa, H. (2005). Gender Imbalance in Access to Science Education: Implication for Production of Female Science Teachers. *Journal of Science Teachers Association of Nigeria,* 40(1&2):36-42

Iyekekpolor, A. S. O. (2007). *Cooperative Strategies for Combatting Poor Performance in Mathematics*. Makurdi: Onavi

Jegede, O. J. (1997). Integrated Science Students' Association of their Teachers for Characteristics of Effective Teaching. *Journal of Research in Science and Mathematics,* 5(2):235-247.

Jekayinfa, A. A. (2007). Teaching as a Profession Characteristics of Professions.*West African Journal of Education*, 9(92): 239-246.

Johnson, K. (2004). The Role of Paleontology on Teachers' Attitude Towards Inquiry Science. In: Longjohn, I.T. (Eds). Effect of Game Method of Teaching on Students Academic Achievement in Chemistry.*Journal of Science Teachers Association of Nigeria*, 44(1&2):55-91

Joshua, M.T. (2005). *Fundamentals of Test and Measurement in Education.*Published by University of Calabar Press, Calabar, Nigeria.

Kajuru, Y.K. and Kauru, A.I. (2010) Effects of Constructivist Teaching Strategy on Gender in Learning of Addition and Subtraction Skills at Primary School Level.*Journal of Studies in Science and Mathematics Education.* Ahmadu Bello University, Zaria, 1(1):82-87.

Kato, Y; and Kamoi, C. (2001).*Piaget's Constructivism and Childhood Education in Japan*, XXXI, (2)161-173.

Keeves, J.P. (1992). *Learning Science in the Changing World: Cross-natural studies of science achievement 1977-1984 Australia: IEA Headquarters*.

Kerlinger, N. (1973).'*Foundations of Behavioural Research*' (2nded.) New York: Holt, Rinchart and Winston.

Kirk, J. and Garrow, S. (2004). Progress to Gender Equality in Education.Insight Education 3 (September, 2004) ID 21 Education Series, University of Sussex, Brighton, United Kingdom. In: Anyanwu I.N. (Ed). Belief-Systems and Gender Disparity: Implication and Sustainable Development in the Wake of HIV/AIDS Epidemic. *Science Teachers Association of Nigeria Preceding of the 50th Anniversary Conference,* pp. 131-135

Koller, O., Baumert, J., and Schnabel, K. (2001). "Does interest matter? The relationship between academic interest and achievement in Mathematics. *Journal for Research in Mathematics Education,* 32(5): 448-70

Krapp, A., Schiefele, U. and Winteler, A. (2009). Interest as a predictor of academic achievement: a meta-analysis of research. Retrieved on 15th May, 2013.Fromwww.iza.org/en/webcontent.publications/papers/viewabstract?dp_id

Longe, R.S and Adedeji, S.O. (2003).Increasing Girls Access to Technical and Vocational Education in Nigeria. In: Ogunleye, B. O., Babajide, V.F.T. (Eds). Commitment to Science and Gender as Determinant of Student's Achievement and Practical Skills in Physics.*Journal of Science Teachers Association of Nigeria,* 46(1):12 – 133

Longjohn, I.T. (2009). Effect of Game Method of Teaching on Students' Academic Achievement in Chemistry.*Journal of Science Teachers Association of Nigeria,* 44(1&2): 85-91

Madu, B.C. (2004). Effect of Constructivist-Based Instructional Model on Students' Conceptual Change and Retention in Physics.*Unpublished Ph.D Thesis.University of Nigeria Nsukka*.In: Igboegwu, E.N. (Ed). Effect of Guided Discovery and Demonstration Teaching Methods on Achievement of Chemistry Students of Different Levels of Scientific Literacy.*Journal of Research in Curriculum and Teaching. Benue State University, Makurdi,* 6(1): 445-458.

Mari, J.S. and Tongding, (2010). Comparisons of Academic Performance of Undergraduate Biology Students Admitted into University with Different Entry Qualification. *Journal of Studies in Science and Mathematics Education,* 1(1):19-24.

Marsh, H.W; Trautwein, U; Ludtke, O., Koller, O. and Baumert, J. (2005). "Academic Self-Concept, Interest, Grades and Standardized Test Scores: Reciprocal Effects Models of Causal Ordering", *Child Development,* 76(2): 397-416.

Metzler, M.W. (2000). *Instructional models for physical education*: Allyn and Bacon. *In:* Thomas, G. (2007). Skill instruction in outdoor leadership: A comparison of a direct instructional model and a discovery-learning model. Retrieved on the

16th June, 2013, from www.latrobe.edu.au/education/.../thomas_g_Thomas_v11n2_2007.pdf

Mkpa, N.D, (2009). Teaching Methods and Strategies. In: *Curriculum Theory and Practice*. Published by Curriculum Organization of Nigeria

Monk, M. and Osborn, J. (2000*).Good practice in Science Teaching,* Burkingham:Open University Press

Mordi, C.O. (1983).Social-Cultural Factors and Achievements in the Second Science Study.*An Unpublish Ph.D Thesis University of Ibadan, Ibadan*.

Musa, B. (2000). The Relative Efficacy of Laboratory Teaching Method For Enhancing Academic Performance in Chemistry Among Senior Secondary School Students in Kaduna State. An Unpublished M.Ed Thesis Submitted to Faculty of Education, Ahmadu Bello University, Zaria.

Mustapha, M.T. (2012). Appraisal of the Nigerian Junior Secondary Basic Science Education Curriculum for Attainment of Universal Basic Education Goals.Science Teachers Association of Nigeria, 53rd Annual Conference (2012). Meeting the Challenges of UBE through STM Education, pp.135-139

National Agency for Science and Engineering Infrastructure (NASEI), (2011). Junior Secondary School Science Kit User Mannual.

National Open University of Nigeria NOUN (2004).Biology Methods School of science and Technology.

National Teachers Institute, Kaduna (2009). Manual for Re-Training of Primary School Teachers on Primary Science. Kaduna, Nigeria.

Nigeria (2000). Implementation Guidelines for the Universal Basic Education (UBE) Programme. Abuja: Federal Ministry of Education, pp. 3-4.

Nigerian Education Research and Develop*ment Council (NERDC) (2007). Basic Science Curriculum for JSS 1-3, Abuja.*

Nnaobi, A.F. (2007). Teaching qualitative inorganic component analysis in College using multiple methods.*Journal of Science Teacher Association of Nigeria Chemistry Panel National Workshop,* 3: 87-91.

Nnorom N. R., (2012). Availability and usability of Basic Science Laboratory facilities for teaching Basic Science in Upper Basic secondary schools. *Science Teachers' Association of Nigeria, 53rd Annual Conference (2012); Meeting the Challenges of UBE Through STM Education,* pp. 183-188

Novak, J.D. (1990). Concept Maps and Vee Diagrams: Two Cognitive Tools for Science and Mathematics Education. In: Nzewi, U.and Ibeneme, A. (Eds). The Effect of Cueing Questions as Instructional Scaffolding on Students' Achievement in Biology.*Journal of Science Teachers Association of Nigeria,* 46(1):35-43.

Novak, J.D. and. Gowin, D.B. (1984).*Learning how to learn*. Cambridge University Press, Cambridge.

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

Nwagbo, C. and Obiekwe, C. (2010).Effects of Constructivist Instructional Approach on Students' Achievement in Ecological Concepts in Biology.*Journal of Science Teachers Association of Nigeria, 45(1&2):26-33.*

Nwagbo, C.R. (2006). Effects of two Teaching Methods on the Achievement in and attitude to Biology of Students of Different levels of scientific literacy. *International Journal of Educational Research of Nigeria,* 45(2006): 216-229

Nwosu, A.A. (2004). Teachers' Awareness of Creativity Related Behavior Science Classroom. *Journal of Science Teachers Association of Nigeria,* 39(1&2). 23-27

Nwosu, A.A. and Nzewi, U. (1998). Using Constructivist Model to Communicate Science. *39th Annual Conference Proceedings. Science Teacher's Association of Nigeria.*

Nzeribe, A. (2008). Gender Issues in Nigeria: Lessons To Be Learned for Learners Friendly Environment and Gender Sensitivity in Science Education. Focus on Research Reproduce Health Education, and Gender Sensitivity Classrooms.*Science Teachers Association of Nigeria Gender and STM Education Series,* Nos.2.

Nzewi, U. and Ibeneme, A.N. (2011). The Effect of Cueing Questions as Instructional Scaffolding on Students' Achievement in Biology.*Journal of Science Teachers Association of Nigeria*, 46(1): 35-43.

Nzewi, U.M. (2008). Practical Approach to the Effective Teaching of Ecological Concepts for Sustainable Development. *Science Teachers Association of Nigeria (STAN) Biology Panel Series 2008*.1-6.

O'Connor, J. (2006). Making sense of teaching skills, games and sports.*In:* Thomas, G. (2007). Skill instruction in outdoor leadership: A comparison of a direct instructional model and a discovery-learning model. Retrieved on the 16th June, 2013, from www.latrobe.edu.au/education/.../thomas_g_Thomas_v11n2_2007.pdf

Obasi, V.A. (2007). The Need for Feminist Intellectual Species in Nigeria Academy.*Journal of Women in Academics*, 4(1): 162-171.

Obeka, S. S. (2010). *Current Trends in Geographical and Environmental Education,* Ahmadu Bello University Press Ltd, Zaria, Kaduna State, Nigeria.

Obeka, S.S. (2010). Effect of Inquiry and Demonstration Methods on Students Achievement in some Environmental Education Concepts of Geography. *Journal of Studies in Science and Mathematics Education,* 1(1): 52-58.

Obeka, S.S. (2011). *Panacea of Science Education Research,* Ahmadu Bello University Press Limited, Zaria.

Obiekwe, C.K. (2008). Effects of Constructivist Instructional Approach on Students Achievements and Interest in Basic Ecological Concept in Biology.Unpublished M.Ed Thesis, Department of Science Education University of Nigeria, Nsukka.

Obioma, G. (2010). *9-year Basic Education Curriculum, Nigerian Educational Research and Development Council (NERDC), Abuja.*

Obioma, G. O. (2005). Emerging Issues in Mathematics Education in Nigeria with Emphasis on the Strategies for Effective Teaching and Learning of Word Problems and Algebraic Expressions. *Journals of Issues on Mathematics, 8(1): 1-8*

Obomanu, B.J. and Nbina, J.B. (2010). An Assessment of the Effects of Solving Instructional Strategies on Students' Achievement and Retention in Chemistry with Respect to Location in River State. *Academic Arena.*Retrieved on October 24, 2012 from (http://www.science-pub.net).

Ochu, A.A.O and Atagher, K.F. (2010). Gender Imbalance in Secondary School Physics in Vandekiya Local Government Area of Benue State: Implication for Sustainable Development. *Journal of Research in Curriculum and Teaching*, 5(1):387-396.

Odetoyinbo, B.B. (2004). Evaluation of the Nigerian Integration Science Programme in Junior Secondary Schools.An Unpublished Ph.D Thesis, University of Ibadan.

Odogwu, H.N. (2002). Female Students' Perception and Attitude to Mathematics: A Bane to their STM Education. *The Journal of the Mathematical Associations of Nigeria*, 27(1): 67-73

Odunusi, T.O. (1988). A Study of the Attitude of Some Nigerian Teachers Towards Science and Science Teaching. *Journal of Research in Curriculum*, 6(2):205-211.

Offor, E.I. (2007). Gender Stereotyping in Some Popular Primary Science Textbooks Used in Primary School in Imo State.*Journal of Women in Academy*, 4(1):232-240.

Ofoha, D; Uchegbu, C.N; Anyika, B, Nkemdirim M. (2009). A critical Appraisal of the Mode of Implementation of Nigeria Secondary School Curriculum: *Towards Socio-economic Empowerment of Youths*. ERNWACA Research grant programme.

Ogunkola, B.J. (1999). Interaction Pattern in Primary School Science Classroom in Ijebu-Ode, Ogun State.*African Journal of Educational Research*, 5(1):51-61

Ogunkola, B.J. (2002). Instructor Expressiveness, Student Locus of Control and Cognitive Entry Behavior as Measures of Student Achievement in and Attitude

Towards Biology. Thesis: University of Ibadan. In: Adekunle, F.R. (Ed). Improving Learners Attitude to Science Under the Universal Basic Education Programme The Effect of Ethnoscience-Based Instruction.*Science Teachers Association of Nigeria 53rd Annual Conference (2012) Meeting The Challenges of UBE Through STM Education*, pp. 169-175

Ogunleye, B.O. and Babajide, V.F.T. (2011). Commitment to Science and Gender as Determinants of Students Achievement and Practical Skills in Physics.*Journal of Science Teachers Association of Nigeria,* 46(1):125-133.

Ogunneye, W. and Lasisi, I. T .(2008). Increasing Women Enrolment in Physics Education: The way forward. *Journal of science Teachers Association of Nigeria;* 43(1&2):35-43.

Ogunniyi, M. B. (1983). The Logic and Practice of Integrated Science in Nigeria.*24th Annual Conference Proceedings of the Science Teachers Association of Nigeria*, pp. 43-50.

Okebukola, P.A. (1986). "The Problem of Large Classes in Science: An experiment in cooperative learning". *European Journal of Science Education, 8(1)73-77*. In: Obomanu, B.J. and Nbina, J.B. (2010). An Assessment of the Effects of Solving Instructional Strategies on Students' Achievement and Retention in Chemistry with Respect to Location in River State.*Academic Arena.*Retrieved on October 24, 2012 from (http://www.science-pub.net).

Okebukola, P.A.O. (2002). A Review of the State of Science in Developing Countries.*Science Education Journal*, 67(4):489-508.

Okebukola, P.A.O. (2002).*Beyond the Stereotype to New Trajectories in Science Teaching*.Published by the Science Teachers' Association of Nigeria. Printed by Taste and Styles RH13 Cultural Complex Abuja.

Okeke, D. C. (2012). Impact of Material Resources in Facilitating Students' Interest and Academic Achieve in Agricultural Science. *Science Teachers' Association of Nigeria 53rd Annual Conference (2012). Meeting the Challenges of UBE through STM Education*

Okeke, R. J. (1999). *Perception of Teachers Regarding the Strategic Learning Activities and Media for Primary Science Teaching Nsukka*.University of Nigeria, Nsuka.

Okene, I. (2002). Science Teaching Concept, Principles and Methods. In: Attamah C. G. (Ed). Learning environment: a Major Factor in Implementing UBE Curriculum in Basic Science.*Science Teachers Association of Nigeria 53rd Annual Conference (2012); Meeting the Challenges of UBE Through STM Education*.pp: 178-181

Okereke, S. C. (2006). Effects of Prior Knowledge of Implications of Mathematical Tasks/ Concepts to Career types and Gender on Students' Achievement, Interest and Retention.*The 47th Science Teachers Association of Nigeria, Annual Conference Proceedings*, pp. 253-259.

Okigbo, E. C. (2010). Comparative effectiveness of mathematical game instructional analogy as advance organizers on students' achievement and interest in mathematics.*Unpublished doctoral dissertation, Nnamdi Azikwe University, Awka, Nigeria.* In: Abonyi, O. (Ed). Effects of Games and Analogies on students' interest in mathematics.*Journals of Science Teachers Association of Nigeria,* 46(1):101-111.

Okigbo, E. C. and Okeke S. O. C. (2011).Effects of Games and Analogies on Students' Interest in Mathematics.*Journals of Science Teachers Association of Nigeria,* 46(1):101-111.

Okoli, J. N. (2006). Effects of Investigating Laboratory Approach and Expository Method on Acquisition of Science Process Skills by Biology of Different Levels of Scientific Literacy. *Journals of Science Teachers Association of Nigeria,* (1&2): 79-88

Olagunju, A.M. (2002). "Modern Trends in Science School Biology Teaching" in Samuel O Ayodele (Ed). Teaching Strategies For Nigeria Secondary Schools

Olagunju, A. M; Adesoji, F.A; Iroegbu, T.O. and Ige, T. A. (2003).Innovations in Science Teaching for the New Millennium.In: Olatoye, R.A and Afuwape, M. O (2004) Students Integrated Science Achievement as a Predictor of later achievement in Biology, Chemistry and Physics. *Journal of Science Teachers Association of Nigeria,* 39(1&2):11-15.

Olagunju, A.M. (1996). The Attitude to The Use of the Computer For Teaching and Learning. Implication for Sciences and Education. *Nigeria Journal of Computer Literacy,* 1(1): 28-33

Olanrewaju, A.O .(1994). *New Approaches to the Teaching of Integrated Science*. Ibadan: Alafas company.

Olatoye, R. A and Afuwape,M. O.(2004). Students Integrated Science Achievement as a Predictor of Later Achievement in Biology Chemistry and Physics .*Journal of Science Teachers Association of Nigeria,39(1&2):11-15.*

Olayiwola, M.A. (2002). "Achieving Effective Sciences: Technology and Mathematics Delivery in the 21st Century.Some Areas for Consideration". *Journal of Science Teachers Association of Nigeria,* 34(1&2): 16-19.

Oludipe, D. I. (1997). Causes and Solution of the Negative Attitudes of Students Towards Integrated Science. *Journal of Science Education*, 2(1): 75-81

Oludipe, D. I. (2011). Developing Nigerian Integrated Science Curriculum.*Journal of Soil and Environmental Management 2(8): 134-145. Retrieved on the 21st September, 2013, from http://www.academicjournal.org/JSSEM*

Omirin, M.S. (1999). Construction and Validity of a Science-Oriented Attitude Scale for Nigerian School; Unpublished Thesis, Department of Education, University of Ado-Ekiti. In: Mari, J.S. and Tongding, C.N. (Eds). Comparisons of Academic Performance of Undergraduate Biology Students Admitted into

University with Different Entry Qualification. *Journal of Studies in Science and Mathematics Education,* 1(1):19-24.

Onasanya, S.A. and Ahmed, M.A. (2011).Computer-Based Learning and Students Cognitive Achievement in Biology in Selected Secondary Schools in Ilorin, Kwara State.*53rd Anniversary Conference (2012) Meeting the challenge of UBE Through STM Education,* pp. 203-213

Onwukwe, E.O and Chinwe, O. (2009). Achievement in J.S.S Integrated Science and S.S.S Science Subject as Correlates; an Index of Harmonious STM Education. *Journal Science Teachers Association of Nigeria,* 44(1&2):50-54.

Opara, M. F. and Eze-Odurukwe, I. P. (2011). Teachers' Self-Regulatory Skills as Correlate of Students' Achievement in Integrated Science.*Journal of the Science Teachers Association of Nigeria,* 46(1): 113-124.

Opara, M.F. and Elekalachi, C.I. (2007). Breaking The Gender Gap in Science Education Through The Application of Indigenous Technology: Implication for Sustainable Development.*Science Teachers Association of Nigeria, Proceedings of the 50th Anniversary Conference (2007) Science, Technology and Mathematics (STM) Education for Sustainable Development,* pp. 81-84

Opara,M.F.(2009). Enhancing the understanding of Stoichiometry Through Self-regulatory:Implication For Students Performance. *Journal of Science Teachers Association Nigeria,* 44(1&2):11-15

Osafehinti, I.O. (1998). Sex Related Differences in Mathematics at Secondary School. Abacus.The Journal of Mathematics Association of Nigeria. In: Kajuru, Y. K. and Kauru, A. I. (2010). Effects of Constructivist Teaching Strategy on Gender in Learning of Addition and Subtraction Skills at Primary School Level.*Journal of Studies in Science and Mathematics Education. Ahmadu Bello University, Zaria,*1(1): 82 – 87.

Osborn, J.F. (2001) .Science Education for Contemporary Society.Problems, Issues and Dilemmas. In: Adekunle, F.R. (Ed). Improving Learners Attitude to Science Under the Universal Basic Education Programme The Effect of Ethnoscience-Based Instruction. *Science Teachers Association of Nigeria, 53rd Annual Conference (2012) Meeting The Challenges of UBE Through STM Education,* pp. 169-175

Oshun, C.O. (2007). Gender Differences in Level of Discipline Amongst Lagos State Senior Secondary School Students'. *Journal of Women in Academic,* 4(1): 76-79.

Osuala, R.C. and Ogomaka, P.M.C.(2005). Effects of Teaching Methods on Students' Performance in Senior Secondary School Chemistry.*Alvana Journal of Science,* 1(5): 67-82

Oyedokun, C.A. (1998). Effects of a Conceptual Change Model on Student Achievement, Retention and Attitude to Biology Concepts.Unpublished Ph.D Dissertation, Ahmadu Bello University, Zaria.

Owolabi, T. (2006).An Evaluation of the Science Secondary School Physics Curriculum in Nigeria.Unpublished PhD Thesis Ahmadu Bello University Zaria.

Pajares, F. and Schunk, D. H. (2002).“ Self and Self-Belief in Psychology and Education an Historical perspective. In: Goulart, P. and. Bedi A.S the impact of interest in school on Educational Success in Portugal. Retrieve on the 8th May, 2013, from: www.iza.org/en/webcontent/publications/papers/viewabstract?dp_id

Reeve, C. L. and Hakel, M. D. (2000). “Towards an Understanding of Adult Intellectual Development: Investigating within Individual Convergence of Interest and Knowledge Profiles”. *Journal of applied psychology,* 85(6): 897-908

Renninger, K.A. and Hidi, S. (2002). “Student Interest and Achievement: Developmental Issues Raised by a Case study”. In: Goulart, P. and Bedi A.S. (ed). The Impact of Interest in Schools on Educational Success in Portugal. Retrieved on the 8th May, 2013 from www.iza.org/en/webcontent/publications/papers/viewabstract?dp_id

Resnick, L. (1989) .Knowing, Learning and Instruction. Essay in Honor of Robert Glaser: In: Olatoye, R.A and Afuwape, M.O .(2004) Students Integrated Science Achievement as a Prediction of Later Achievement in Biology, Chemistry and Physics. *Journal of Science Teachers Association Nigeria,* 39(1&2):11-15.

Schiefele, U, Krapp, A. and Winteler, A. (1992). “Interest as predictor of academic achievement: A meta-analysis of research”. In Goulart, P. and Bedi A.S. (Eds) The Impact of Interest in Schools on Educational Success in Portugal. Retrieved on the 8th May, 2013 from www.iza.org/en/webcontent/publications/papers/viewabstract?dp_id

Schmidst, H.G., Loyens, S.M.M., van Gog, T. and Paas, F. (2007). Problem-based learning is compatible with human cognitive architecture: Commentary on Kirschner, Sweller and Clark (2006). *Education Psychologist,* 42: 91-97. Retrieved on the 16th June, 2013 from sweller-cogtech.usc.edu/publications/sweller_kirschner_clark_reply_ep07.pdf

Shaibu, A.A.M. (1992).An evaluation of the aims and objectives of the Integrated Science Teachers’ Education Programme of the Ahmadu Bello University, Zaria, Nigeria. An Unpublished Research Report submitted to Faculty of Education, University of London, London.

Shaibu, A.A.M. (1998). Relationship between Laboratory Practical Competence of Senior Secondary School Students in Kaduna State. *Journal of Science Teachers Association of Nigeria,* 33(1&2): 21-27

Shaibu, A.A.M. (2005). Science Education as Bedrock .An Invited Lead Paper Presented at a Seminar Week organized by the school of sciences, Kaduna State College of Education, Gidan Waya, Kaduna State. Unpublished

Shirley, L.L. and Reynolds, R.E. (1988). “Effect of Interest on Attention and Learning” *Journal of Educational* and *Psychology*, 80:159-66

Shaibu, A.A.M. and Mari, J.S. (1997) .Gender Related Difference in Understanding of Science Process Skills Amongst Junior Secondary Schools. *Journal of Science Teachers Association of Nigeria,* 32(1 & 2): 21-27.

Shaibu, A.A.M.and Usman,I.A. (2001). The Relationship between Students in Practical Activities and Their Academic Achievement in Integrated Science Using NISTEP mode of Teaching. *The Jos Journal of Education,* 6(10):17-20

Shaibu, A.A.M, (2013). Resources for Science Laboratories and Science Teaching in Schools.*Proceedings of multicultural Africa Conference (2013). Resource Mobilization, Management for Access and Quality Education in Africa.*

Sikes, P. (1973). Intellectual Strength in Culturally Different Groups. An Eskimo Lustration Review of Educational Research In: Kajuru, Y.K. and Kauru, A.I. (2010). Effects of Constructivist Teaching Strategy on Gender in Learning of Addition and Subtraction Skills at Primary School Level.*Journal of Studies in Science and Mathematics Education* Ahmadu Bello University Zaria, 1(1):82-87.

STAN (1970). Curriculum Development Newsletter, p.1

Tai, R. H., Sadler, P.M. and Loehr, J .F .(2005) .Factors Influencing Success in Introductory College Chemistry. *Journal of Research in science Teaching,* 42(9):984-1012.

Tanner, L.N. (1972). *The Swing Away from Science Education Forum,* 39: 229-238.

Teachers Registration Council of Nigeria- T.R.C.N, (2002) Roles of Teachers in Schools.TRCN (2).

Tobin, K. (1990). Local Constructivist Perspective on the Reform of Science Education.*Australians' Science Teachers Journal,* 36(34): 29-35.

Tuckman, B.W. (1975). *Measurement Educational Fundamental of Testing*. NewYork: Harcourt Brace Jovanovich, Inc.

Tyage,S.B.K .(2003).Network of Vigyan Prasar Science Clubs. Called on the 28th June, 2013 fromhttp://www.vigyanprasar.gov.in/vipnet.htm.

Uche,S.G. and Umoren, G.U.(1998). *Integrated Science Teaching: Perspectives and Approaches.*Published by AAU Vitalis Book Company, Aba-Nigeria

Udofia ,N.A and Salami , O.S. (2012). Appraisal of the UBE Curriculum Using the Basic Science as an Example.*Science Teachers Association of Nigeria 53rdAnnual Conference (2012)*: *Meeting the Challenges of UBE through STM Education.*

Udofia, N.A. (2001). One year of Universal Basic Education Practice in Nigeria. In: Udofia and Salami (2012). Appraisal of the UBE Curriculum Using Basic Science as an example.*Science Teachers Association of Nigeria 53rd Annual*

`Conference (2012):Meeting the challenges of the UBE through STM Education. pp. 10-23

Ugwu, A.N. Ofuebe, J.I .and Etiubon, R.U. (2011). Status of Science and Technology Curricular towards National Education Reforms.*Proceedings of Science Teachers Association of Nigeria. pp.* 48-53.

Ugwu, P.N.(1998). Women in Mathematics, Science and Technology; Challenges for Nigerian Women. *Journal of Women in Colleges of Education*,1, 1-8.

UNDP (1998).*Nigerian Human Development Report.* Lagos: UNDP.

Universal Basic Education (UBE) (2000).Programmes Planning and Implementation Document. Abuja: Federal Government Press

Usman, I. A. (1992).Effects of Practical Activities on Achievement in Integrated Science among Secondary School Students in Zaria.Unpublished M. Ed. Thesis, Ahmadu Bello University, Zaria.

Usman, I.A .(2012). Restructuring Science,Technology and Mathematics Education for Skills Acquisition. A Seminar Paper Presented For EDSE 702 (Science and Society). Department of Science Education, Faculty of Education Ahmadu Bello University, Zaria.

Usman, I.A. (2000). The Relation between Students Performance in Practical Activities and their Academic Achievements in Integrated Science NISTEP Mode of Teaching.Unpublished Ph.D Thesis, Ahmadu Bello University, Zaria.In:*Journal of Studies in Science and Mathematics Education. Ahmadu Bello University, Zaria*,1(1):66-72

Usman, I.A. (2007). Relationship between students performances in practical Activities and their Academic Achievements in Senior Secondary School Biology using NISTEP mode of Teaching. *Journal of Educational Research and Development*. Faculty of Education, Ahmadu Bello University, Zaria, 2(3): 240-244.

Usman, I.A. (2010). The Effects of Indoor and Outdoor Laboratory Instructional Methods on Academic Achievement of Junior Secondary School Integrated Science Students' in Zaria Local Government Area of Kaduna State. *Journal of Studies in Science and Mathematics Education.Ahmadu Bello University Zaria, 1(1):66-72*

Von Glaserfeld, E. (1995b). Sensory Experience: Abstraction and Teaching In: Nwagbo, C .and Obiekwe, C. (Eds). Effects of Constructivists Instructional Approach on Students' Achievements in Basic Ecological Concepts in Biology.*Journal of Science Teachers Association of Nigeria*, 45(1&2):26-33.

Weller,M.(2005). General Principles of Motivation.Retrieved on May 24, 2013. From www.honolulu.hawai.edu

West African Examinations Council (2005-2009) Chief Examiner's Reports (Nigeria) SSCE, May/June Examination.

Wigfield, A. (1997). "Reading motives: A domain-specific approach to motivation". *Educational psychologist,* 32(2):59-68

Wigfield, A. and Eccles, J. S. (2002). "The Development of Competence Beliefs, Expectancies for Success, and Achievement Values from Childhood Through Adolescence". In: Goulart, P. and Bedi, A.S. (Eds). The Impact of Interest in Schools on Educational Success in Portugal.Retrieved on the 8th May, 2013 from www.iza.org/en/webcontent/publications/papers/viewabstract?dp_id

Ye Zhao, (2003).The Use of Constructivist Teaching Model in Environment Science in China Papers (78). In: Agoro, A.A.and Oyediran,A.M.(Eds). Integrated Science Teachers' Involvement in the use of hands-on,Laboratory Methods in Teaching Integrated Science. *Journal of Science Teachers Association of Nigeria,*44(1&2):71-74

Yoloye, T.W. (2002). Increasing Female Students Participation in Science: *Technical Report on African Forum for Children Literacy in Science & Technology.*

Yoloye, T.W. (2004). That we may Learn Better. An Inaugural Lecture delivered at the University of Ibadan. In: Odetoyinbo, B.B. (Ed). Teachersand Student Factors as Correlates of Achievement in Integrated Science. *Journal of Science Teachers Association of Nigeria,* 39(1&2):17-21.

Yoloye, T.W. (2004*). Increasing female Participation in Science Mimeograph*, University of Ibadan Press, Nigeria.

APPENDIX I

BASIC SCIENCE CONCEPTS ACHIEVEMENT TEST (BSCAT)

INSTRUCTIONS

Please read the following instructions carefully before you answer the following questions.

1. Use HB pencil provided for the examination.
2. Write your school name, class and identification No provided for the examination in the space provided in the answer sheet.
3. Read each question carefully before answering it. If you find a question difficult, go on to the other questions and finish them first.
4. After you have selected what you have taken to be correct answer, go to your answer sheet and shade the appropriate alphabet in the space that correspond with your choice.
5. Shade only one letter for each answer in the objective questions.
6. If you change your mind on any answer completely erase the first shading.

1. To an egg albumenadds
2. few drops of Million's reagent. A white precipitate is formed which when heated turns red. This is the test for

(a) Carbohydrate (b) Proteins (c) Fats and oil (d) Water

02. One of the following is not a source of carbohydrate

(a) Yam (b) Sugar cane (c) Beans (d) Banana

3. Sudan III test is a test used for testing the presence of:

(a) Starch (b) Fats and oil (c) Water (d) Proteins

Read the following information and answer questions 4 and 5.

Add one or two drops of iodine solution on a piece of bread

4. The colour of the bread turns _____

(a) Blue black (b) Brick red (c) White (d) Red

5. This indicate the presence of_____

(a) Proteins (b) Fats and oil (c) Starch (d) Vitamins

6. Carbohydrates are mainly produced by plants with the help of sunlight using the green pigment called _____ in plants.

(a) Chlorophyll (b) Carbon (iv)oxide (c) Water (d) Iodine solution

7. The class of food that is responsible for replacing worn out tissues and forms new cells which promotes growth is called_____

(a) Proteins (b) Fats and oil (c) Carbohydrates (d) Water.

8. Deficiencies in _____ vitamin will cause night blindness.

(a) Vitamin B complex (b) Vitamin C (c) Vitamin A (d) Vitamin K

9. The type of mineral salt present in green vegetables is _____

(a) Calcium (b) Iodine (c) Iron compound (d) Copper

10. A meal that contains about 55% carbohydrate, 15% fats and oils, 20% Proteins, 10% water, mineral salt and vitamins is called _____

(a) Meal (b) Balanced diet (c) starchy (d) Vitamins

11. A child who is deficient in Proteins will develop swollen limbs, protruding abdomen and weak liver, the condition is known as _____

(a) Obesity (b) Scurvy (c) Kwashiorkor (d) Rickets

12. What is the colour obtained when iodine is added into starch?

(a) Yellow (b) Red (c) Purple (d) Blue-black

13. Which of the following foods contain Proteins?

(a) Carrot (b) Millet (c) Cowpea (d) Maize

14. Which group of food items can be classified as carbohydrate?

(a) yam, egg, beans (b) cassava, egg, yam (c) yam, beans, banana (d) cassava, yam, rice

15. What is the name of the deficiency disease caused by lack of vitamin A?

(a) beri-beri (b) Scurvy (c) rickets (d) night blindness

16. All the following are leafy vegetables except _____

(a) Water melon (b) Spinach (c) Cabbage (d) Water leaf

17. Which of the following food substances contain fats and oils?

(a) Cake (b) Rice (c) Margarine (d) Yam

18. What is the name the food nutrient obtained in beans?

(a) Carbohydrate (b) Fat (c) Proteins (d) Vitamins

19. Lack of vitamin D causes _____ and is commonly derived from the _____

Read the following instruction carefully and answer questions 20- 25.

For each statement in the left column (A), match the term from the right column (B) that is most appropriate. Each response alternative may be used only once.

	A. Statement	B. Terms
	(Options)	
20.	Too much of carbohydrate in the body causes_____	A. Scurvy
21.	Inability of blood to clot is as a result of lack of _____	B. Kwashiorkor
22.	Lack of vitamin C causes_____	C.Vitamin K
23.	Lack of Proteins causes_____ in children	D.Beri-beri
24.	Any mixture of food which an animal chooses to eat	
	is called _____	E.Obesity
25.	_____ is a disease that occurs among rice eating people	G.Diet

26. Beans and cocoa are the type of food items that provide the mineral salt called_____

(a) calcium (b) iodine (c) iron compound (d) phosphorus

27. The most important gland for growth in human is _____ gland

(a) Adrenal (b) Endocrine (c) Pituitary (d) Salivary.

28. The leaf that has different shades of colours on its surface is called _____

(a) Flamboyant leaf (b) Variegated leaf (c) Spinach (d) Water leaf

29. Cretinism is another abnormality that reduces growth and development. It is caused by lack of secretion of _____

(a) Pituitary gland (b) Adrenal gland (c) Thyroxin (d) Endocrine gland

30. In the test for starch in a leaf the function of ethanol on the leaf is to _____

(a) Make it blue-black (b) Dissolve and extract the chlorophyll (c) Harden the leaf

(d) Exposed it to carbon (iv) oxide

31. The presence of one of the following gas is a condition necessary for photosynthesis

(a) Carbon (iv) oxide (b) Nitrogen (c) Sulphur (d) Neon

32. The translucent white paper test is commonly associated with _____

(a) Fats and oils (b) Proteins (c) Carbohydrates (d) Vitamins

33. One of the functions of Proteins is that it_____

(a) Gives energy to the body (b) Provide warmth to the body (c) Aids body repair (d) Serve as heat insulator in mammals

34. One of the following elements is not a chemical composition of fats and oil

(a) Carbon (b) Nitrogen (c) Hydrogen (d) Oxygen

Read the following procedure carefully and answer questions 35-36

Take egg albumen. Add 1cm^3 of dilute solution of sodium hydroxide and 2 drops of copper sulphate solution. Shake the mixture thoroughly after each drop.

35. The colour observed will be _____

(a) Red (b) Brick-red (c) Purple (d) White

36. The name of this test is called _____

(a) Million's test (b) Biuret's test (c) Fehling's test (d) Benedict's test

37. Why is leaf that has been exposed to sunlight for 3-4hours used in an experiment to show the conditions necessary for the formation of starch?

(a) Gather starch (b) soften the leaf (c) generate patches on the leaf (d) gather protein

38. One of the following food mineral is not an example of fats and oil_____

(a) Melon (b) Coconut (c) Palm oil (d) Maize

39. Which of the following is not a condition necessary for starch formation_____?

(a) Light (b) Carbon (iv) oxide (c) Nitrogen (d) Chlorophyll

40. Animals that consumes food which is largely of animal origin are called_____

(a) Symbiotic nutrition (b) Carnivorous nutrition (c) Omnivorous nutrition

(d) Herbivorous nutrition

41. The leaf of a plant placed in a cupboard could not turn blue-black colour with iodine solution after all the necessary steps for testing the presence of starch has been carried out. This is because:

(a) It lacks CO_2 (b) It lacks chlorophyll (c) It lacks sunlight (d) It lacks patches on its surface

42. In the demonstration of CO_2 necessary as a condition for photosynthesis. Why is the potted plant placed in a bell-jar containing caustic soda?

(a) to increase CO_2 (b) to remove CO_2 (c) to increase light intensity (d) to provide chlorophyll

43. In demonstrating for the presence of starch using variegated leaf, the pattern of starch corresponds with the green part after iodine has been applied. This shows the presence of_____

(a) CO_2 (b) light (c) nitrogen oxide (d) chlorophyll

44. Oxidation of fats produces _____ which is use for work in the body

(a) Obesity (b) Energy (c) Beri-beri (d) Scurvy

45. Which one of the following functions of food nutrients is associated with fats and oils?

(a) formation of enzymes and hormones (b) required for proper growth (c) serves as insulators in mammals (d) replacement of worn-out tissues.

46. _____ is good for bones growth and the nervous system

(a) Fats and oil (b) mineral salt (c) carbohydrates (d) proteins

47. Why do the leaves of a potted plant grow yellowish when placed in a cupboard?

(a) it lacks light (b) it lacks CO_2 (c) it lacks chlorophyll (d) it lacks O_2

48. An organism that obtains its food mainly from dead organic remains of matter is called_____

(a) Parasitic nutrition (b) symbiotic nutrition (c) Saprophytic nutrition (d) Holophytic nutrition

49. Which of the following is an example of herbivore?

(a) Hawk (b) Man (c) Sheep (d) Tiger

50. Which of the following is an example of variegated leaf?

(a) spinach (b) cabbage (c) croton (d) water melon

APPENDIX II

MARKING SCHEME FOR BASIC SCIENCE CONCEPTS ACHIEVEMENT TEST (BSCAT)

1. b
2. c
3. b
4. a
5. c
6. a
7. a
8. c
9. d
10. b
11. c
12. d
13. c
14. d
15. d
16. a
17. c
18. c
19. (i) ricket (ii) sun
20. E
21. C
22. A
23. B
24. G
25. D
26. C
27. c
28. b
29. c
30. b
31. a
32. a
33. c
34. b
35. c
36. b
37. c
38. d
39. c
40. b
41. c
42. b
43. a
44. b
45. c
46. b
47. b
48. c
49. c
50. d

Each correct response carries 2 marks.
(50 x 2 = 100%)

APPENDIX III

STUDENTS INTEREST SCALE OF BASIC SCIENCE (SISBS)

QUESTIONNAIRE

Dear Respondent,

Below is a list of items designated by a master student of the above named department, to examine the degree of students' interest in Upper Basic Science of Junior Secondary School (J.SS II). You are requested to freely rate yourself to indicate the extent to which the questionnaire items are interesting to you or not. In this regard, the researcher seeks your cooperation to honestly answer the questions by ticking the alternative that best describes your opinion or feelings in each statement.

Your responses represent your opinion or feelings. All information provided will be used mainly for the purpose of the study and will be treated with outmost confidentiality

Please indicate your responses by ticking (√) the appropriate column.

SECTION A: BIODATA

Name of School

Class

Gender male [ ] female [ ]

Serial number

SECTION B: ITEMS

SISBS has a five (5) points, Likert's type of scale rating for each item.

Please take note of the following keys to guide your responses

SA = Strongly Agree

A = Agree

U = Undecided or Neutral

D = Disagree

SD = Strongly Disagree

Mark (✓) in the appropriate column of your choice on the abbreviated response level in the continuum that best approximate your interest towards Basic Science as a JSS subject:

S/N	DESCRIPTION	SA	A	U	D	SD
1	My low interest in Basic Science comes from anxiety and fear that Basic Science topics are difficult for me to understand					
2	I learn Basic Science well if the teacher teaches and guides me using instructional materials like charts, pictures, models, specimens or diagrams.					
3	I may never learn Basis Science until my interests are stimulated by the use of modern methods in teaching Basic Science.					
		SA	**A**	**U**	**D**	**SD**
4	My best wish is to attend university level through the learning of Basic Science.					
5	I like Basic Science because it studies the things that are in the environment and help me to know more about myself.					
6	I am interested in Basic Science because the learning materials used in teaching the topics are available in the local environment.					
7	In Basic Science class, I would like to have more classwork and homework which will help me to understand more.					
8	In Basic Science class, I would like to have textbooks and workbook so that they will help to me learn more.					
9	My interest in Basic Science topics depends on the methods of					

	teaching the teacher adopts.					
10	I am interested in Basic Science because the knowledge I obtain from the subject can be applied in other subject areas.					
		SA	**A**	**U**	**D**	**SD**
11	Teaching that will arouse my interest in Basic Science should involve the use of laboratory facilities					
12	I hope to work harder so that I can get higher marks in Basic Science than any other classmate.					
13	If science clubs and societies are introduced in my school, they will arouse my interest in the study of Basic Science.					
14	I like all the topics and contents in Basic Science class.					
15	My interest in studying Basic Science is so important to my future involvement in science and technology education.					
16.	Teacher's explanation on Basic Science topics increases my interest in the subject.					
17.	Most science teachers lack adequate teaching aids to explain the Basic Science concepts, in order to increase my interest in the subject.					

		SA	A	U	D	SD
18.	If am being motivated by the teacher, I will develop interest in Basic Science.					
19.	My strong interest in Basic Science topics and zeal to stay on tasks till I finish them will depend on how interesting the lesson is.					
20.	I will be more interested in activity-oriented method of teaching Basic Science if only the teacher can monitor and guide me when performing a task.					
21.	I can explain Basic Science concepts most when the teacher leads me to demonstrate an activity.					
22.	Use of teaching aids by Basic Science teachers will motivate me in studying the subject.					

APPENDIX IV

LESSON PLAN FOR

EXPERIMENTAL GROUP 1 (DEMONSTRATION METHOD)

WEEK ONE

Date: 19-05-2014

Name of Teacher: Aaron N. Datom

Name of school: GDJSS Bantaje

Subject: Basic Science

Topic: Nutrition

Class: JSS IIa

Duration: 90 minutes (double period)

Sub-Topic: - Types of Nutrition and Testing for Starch in a Yam Tissue and a Green Leaf

Behavioural Objectives: - At the end of the lesson the students should be able to:

(i) state and explain the three types of nutrition

(ii) demonstrate an activity that could test for the presence of starch in a leaf and in a yam tissue

Teaching Material: - Beaker, Test tube, a very thick piece of yam, Green leaf, Iodine solution, Ethanol, Burner or Kerosene stove, Water

Previous Knowledge: students have been seeing plants growing but could not fully understand the process of nutrition in plants.

TEACHING PROCEDURE

Step	Content Development	Teacher's Activity	Students' Activity	Instructional Strategy
I	Introduction/ or set induction	The teacher asks his students what is nutrition?	The students answer the teacher's question by saying that nutrition is the act of feeding which is capable of bringing nourishment to the organism.	Questioning
II	Types of nutrition	The teacher points out that there are 3 types of nutrition generally which are: Holophytic, Holozoic and saprophytic types of nutrition. He explains that holophytic nutrition is used mainly by green plants, whereby through the process of photosynthesis, carbohydrate can build up from simple chemical substances. Fats and proteins are also formed through chemical activities of further reactions within the cells. Holozoic nutrition on the other hand is a characteristic feeding habit of almost all animals that depend directly or indirectly on autotrophic living things for their food. Organisms with this method of feeding include: i. herbivores: animals that feed on plants only. ii. Carnivores; animals that feed on flesh mainly iii. Omnivores: animals that feed on both plants and animals. While the third category is the saprophytic nutrition which is the characteristic of non-green plants	Students listen attentively to the teacher's explanation.	Lecturing

		like fungi and most bacteria that obtain their food mainly from dead organic remains of matter.		
III	Testing for starch in a yam tissue.	The teacher demonstrates how starch can be tested in a piece of white yam tuber by putting a drop of iodine solution on slice yam. The iodine turns starch blue-black. He observes the treated yam with a hand lens.	Students watch the demonstration.	Demonstration
IV	Testing for starch in green leaf	The teacher demonstrates to the students that, to test for starch in a leaf, first remove a leaf from a young plant that has been exposed to light for some hours. Dip the leaf for 30 seconds into a beaker containing boiling water. Next transfer the leaf into a test-tube containing ethanol after the chlorophyll has been dissolved and extracted. He removes the leaf and dips into cold clean water. The leaf is then covered with iodine solution. After 3 to 5 minutes the iodine solution is washed off the leaf. The presence of blue-black colour is an evidence that starch is present in green leaves.	Students listen carefully and watch the teacher's demonstration.	Demonstration
V	Testing for starch in yam tissue and a green leaf by groups	The teacher divides the class into groups of five or six. The apparatus and the reagents will be provided to each group to test for starch as the teacher has demonstrated.	The students go into small groups and begin to test for starch in the yam tissue and the green leaf.	Discovery or Group work
		The teacher moves round to	Students are busy engaged	

VI	Supervision	supervise the groups and compare their results.	in testing for starch in the yam tissue and the green leaf.	Group work
VII	Recapitulation	The teacher reviews the lesson by briefly stating and explaining the 3 types of nutrition, demonstrating how to test for the presence of starch in a yam tissue and a green leaf.	Students listen to the explanation of the teacher and follow the demonstration.	
	Evaluation	The teacher asks the individual students to answer in their note books the following questions: i. State 3 types of nutrition. ii. Outline the major steps of how to test for starch in a yam tissue and a green leaf.	Each student is busy involved in answering the questions in his/her note book.	
VII	Summary	The teacher summarizes the lesson and gives his students assignment to read on the conditions necessary for starch formation.		Closure

LESSON PLAN FOR

EXPERIMENTAL GROUP 1 (DEMONSTRATION METHOD)

WEEK TWO

Date: 21-05-2014

Class: J.S.S IIA

Name of Teacher: Aaron, N. Datom

Name of school: GDJSS Bantaje

Time/Duration: 90minutes

Subject: Basic Science

Topic: Conditions Necessary for Starch Formation

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

(i) mention at least three(3) conditions necessary for the formation of starch

(ii) demonstrate an activity to show that chlorophyll is necessary for starch formation

Teaching Materials: Variegated leaf, beaker, test-tube, iodine solution, ethanol, water, burner or kerosene stove

Previous Knowledge: Students have been taught types of nutrition and test for starch

TEACHING PROCEDURE

Step	Content Development	Teacher's activity	Students' activity	Instructional Strategy
I	Introduction/or set induction	The teacher asks the students what is starch	The students' answer the teacher's question that starch is mainly produced by the plants with the help of sunlight using the green pigment called chlorophyll in plants.	Questioning
II	Conditions necessary for the formation of starch	The teacher points out that for a starch to be formed in the green leaf of a plant, certain conditions must be available these are: - The presence of chlorophyll - The presence of light and - The presence of carbon(iv) dioxide	The students listen attentively and later jot down the points in their notebooks	Lecturing
III	Showing that chlorophyll is necessary for starch formation	The teacher uses the variegated leaves of ice plant (croton) that has different patches or shade of colours and shows to the Students. He explains that the leaf has been exposed to sunlight for 3-4 hours. He demonstrates the activity for testing of starch in a leaf as done in the previous lesson. At the end, it will be noticed that the pattern of starch corresponds with the green part of the leaf because it will turns blue – black. This is an indication that chlorophyll is necessary for starch formation.	Students watch carefully, and after the teacher have finish the demonstration, one of the students is call out to demonstrate the activity in front of the class as is done by the teacher.	Demonstration

IV	Demonstrating that chlorophyll is necessary for starch formation by groups.	The teacher divides the class into six groups and provides each group with the apparatus, reagent and materials necessary for demonstration of the activity.	Students go into their various groups and begin to carry out the activity, demonstrating that chlorophyll is necessary for starch formation	Group work or Discovery
V	Recapitulation Evaluation:	The teacher asks the students to go back to their various seats. He reviews the lesson by mentioning and explaining the conditions necessary for the formation of starch; he demonstrates briefly how chlorophyll is necessary for starch formation. The teacher evaluates his lesson by asking his students the following written questions: (i). List three(3) conditions necessary for starch formation (ii). Demonstrate(outline) the step to show that chlorophyll is necessary for starch formation	Students listen and follow the demonstration. Each student is busy involved in answering the questions in his/her notebook.	
VI	Summary	The teacher summarizes the lesson and gives his students assignment to read on proteins.		closure

LESSON PLAN FOR

EXPERIMENTAL GROUP 1 (DEMONSTATION METHOD)

WEEK THREE

DATE:	26-05-2014
CLASS:	JSS IIA
Name of Teacher:	Aaron, N. Datom
Name of school:	GDJSS Bantaje
Time / Duration:	90 Minutes (Double period)
Subject:	Basic Science
Topic:	Introduction to Proteins and Test for Proteins

Behavioural Objectives: At the end of the lesson the students should be able**:**

(i) State two functions of proteins to the body

(ii) List at least four(4) examples of foods that contains proteins

(iii) Perform an experiment to test for protein in a food

Teaching Materials: Eggs, million's reagent, kerosene stove, test tube, dry fish, groundnut, beans, milk, etc.

Previous Knowledge:- students are used to taking food daily but could not realized that, the different classes of food taken have different nutrients necessary for the activities, growth and well – being of the body.

TEACHING PROCEDURE

Step	Content Developments	Teacher's Activity	Students Activity	Instructional strategy
I	Introduction / or set induction	The teacher asks the students what are proteins	The students answer the teacher's question by mentioning various examples of classes of food such as yam, groundnut, sugar cane, beans maize etc.	Questioning
	Chemical composition of proteins	The teacher explains that proteins are food substances that contain carbon, hydrogen, oxygen, nitrogen, sulphur and phosphorus.	Students listen attentively	Lecturing
I	Functions of proteins to the body	The teacher points out that proteins is essential to the body because (i) it replaces worn out tissues of the body and form new cells. (ii). It promotes growth. These are the reasons children are given more foods that are rich in proteins than adults.	Students listen carefully and later jot down the points in the note books.	Lecturing
III	Examples of foods rich in proteins	The teacher mentions that example of foods rich in proteins are fish , meat,	The students handle the food items, observe and study them.	Discussion

		groundnut, beans, eggs, milk etc., he later present some of the sample of the food items rich in proteins for the students to observe		
IV	Test for proteins	The teacher demonstrates how to test for proteins as follows: Add Million's reagent to an egg albumen, mix well and heat gently. A white precipitate is form while on heating turns brick-red	The students watch the demonstration carefully and later ask the teacher question	Demonstration
V	Test for proteins by various groups	The teacher divides the class into small groups of six. He provides each group with the materials, reagent and a burner to test for proteins.	The students go into small groups and begin to test for protein.	Discovery Or Group work

VI	Recapitulation Evaluation	The teacher reviews the lesson by explaining the chemical composition of proteins states its functions to the body as well as list some examples of food items that are rich in proteins. The teacher evaluates his lesson by asking his students the following questions orally: (i)State at least two functions of proteins to the body (ii) Mention four (4) examples of food items that are rich in proteins (iii) Outline the major steps to test for proteins in an egg .	Students listen attentively and jot down the main points in their note books Students are expected to be busy putting up their hands to answer the teacher's question.	
VII	Summary	The teacher summarizes the major points of the lesson.		Closure

LESSON PLAN FOR

EXPERIMENTAL GROUP1 (DEMONSTRATION METHOD)

WEEK FOUR

Date 28-05-2014

Class: JSSIIa

Name of Teacher- Aaron, N. Datom

Name of School- GDJSS, Bantaje

Time/ Duration- 90 minutes (Double period)

Subject- Basic Science

Topic- Introduction to Fats and Oils and Test for Fats and Oils

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

(i). list at least three (3) chemical composition of fats and oils.

(ii). state three functions of fats and oils to the body.

(iii). demonstrate an activity to detect the presence of fats and oils on a piece of paper.

Teaching Materials:- White pieces of paper, sample of dry animal fats, palm oil, groundnut oil.

Previous Knowledge:- Students have been taught carbohydrates and test for starch.

TEACHING PROCEDURE

Step	Content Development	Teacher's Activity	Students' Activity	Instructional Strategy
I	Introduction/or set Induction Chemical composition of fats and oil	The teacher asks his students whether they have seen fats and oil before. The teacher presents samples of dry animal fats and some samples of groundnut oil and palm oil to the students and discusses their chemical compositions as made up of carbon, hydrogen and oxygen.	The students answer the teacher's questions by saying yes, that it is used in cooking. The students' watch and later handle the samples of the fats and oils.	Questioning Discussion
II	Functions of fats and oil to the body.	The teacher states the functions of fats and oil to the body to include: (i). Fats and oil give warmth Against extreme cold. (ii). They serve as protection for "delicate organs" of ourbody e.g.liver, kidneys or the heart. (iii). Stored fats in the body are also used as source of energy in times of need.	Students listen attentively and later jot down the main points in their notebook.	Lecturing
III	Test for Fats and Oil	The teacher demonstrates how to test for fats and oil as follows: Put a drop of groundnut oil on a white piece of	Students watch carefully and ask the teacher questions.	Demon-Stration

		paper and rub with the thumb. It is observed that the paper becomes translucent indicating the presence of fats and oil.		
IV	Test for fats and oil in groups	The teacher divides the class into small groups of six. He presents to each group the specimens, samples or materials needed for demonstration of the activity.	The students go into small groups and begin to carry out the activity to test for the presence of fats and oil on a material such as white paper.	Group Work.
V	Supervision by the teacher	The teacher moves round the class to supervise how the activity will be carried out by each group.	Students busy testing for fats or oil on a piece of white paper.	Group Work.
VI	Recapitulation Evaluation	The teacher reviews the lesson by listing the chemical compositions of fats and oils, states their functions to the body as well as how to test for the presence of fats and oils on a piece of paper. The teacher evaluates his lesson by asking his students the following questions orally: (i).List three chemical compositions of fats and oil. (ii).State three functions of Fats and oil to the body. (iii). Demonstrate an activity to test for the presence of fats or oil	Students listen, and follow the teacher's demonstration.	
VII	Summary	The teacher summarizes		Closure

		the lesson and gives his students assignment to read on vitamins.		

LESSON PLAN FOR

EXPERIMENTAL GROUP 1 (DEMONSTRATION METHOD)

WEEK FIVE

Date	30-05-2014
Class-	JSS IIa
Name of Teacher-	Aaron, N. Datom
Name of School-	GDJSS, Bantaje
Time / Duration-	90 minutes (Double Period)
Subject-	Basic Science
Topic-	Introduction to Vitamins and MineralSalts

Behavioural Objectives- Bythe end of the lesson the students should be able to:

(i) state what vitamins are.

(ii) mention at least five (5) types of vitamins.

(iii) classify food sources according to the vitamins they provide to the body.

Teaching Materials: Eggs, milk, liver, fresh vegetables, palm oil, palm wine, groundnut, cabbage, citrus fruits, fish, oranges, tomatoes, rice, beans e.t.c.

Previous Knowledge: Students are used to eating different sources of food but could not identify the type of vitamins they provide to the body.

TEACHING PROCEDURE

Step	Content Development	Teacher Activity	Students' Activity	Instruction Strategy
I	Introduction/ or set induction What Vitamins are	The teacher asks the students whether they have eaten fruits like mangoes, oranges, or greenvegetables.What do they provide to the body? The teacher explains that vitamins are nutrients found in our foods. He points out those vitamins are not only essential for growth, but they also make us very healthy. He presents to the students the various samples of foodsourcessuchasmangoes,oranges,tomatoes, green vegetables, eggs, fish, and beans to the students to observe and study them.	The students answer the teacher's question, yes they have eaten, and the food sources give the body nutrients. The students listen attentively to the teacher's explanation and later handle the various samples of food sources and observe.	Questioning Discussion
II	Types of Vitamins	The teacher points out that the type of vitamins include: Vitamin A, vitamin B complex, vitamin C, vitamin D, vitamin E, and vitamin K.	The students listen attentively to the teacher's explanation and jot down the main points in their notebooks.	Lecturing
III	Classification of food sources according to the vitamins they give to the body.	The teacher uses the various food samples and explains that food sources belonging to vitamin A are: eggs, milk, liver, fresh vegetables and red palm oil. Those belonging to vitamin B complex are: groundnut, beans, tomatoes, milk, fish, and palm wine and to the rest of the types of vitamins.	Students watch the classification of the food sources into the different types of vitamins and ask the teacher questions.	Demonstration.

IV	Classification of food sources by groups	The teacher divides the class into small groups of six. He provides them with the various samples of food sources and asks each group to classify them according to the vitamins they belong, such as vitamin A, vitamin B complex, etc.	Students go into small groups and begin to classify the samples of the food items into their respective types of vitamins	Demonstration or group work
V	Recapitulation Evaluation	The teacher asks the students to go back to their various seats. He reviews the lesson by explaining what vitamins are, he mention the different types of vitamins as well as classification of food items into their respective types of vitamins. The teacher evaluates his lesson orally by asking his students the following questions: (i). What are vitamins? (ii). Mention at least five (5) types of vitamins. (iii). List the food items that belongs to vitamin C	The students listen and follow the teacher's explanation. Students are expected to be busy putting up their hands to answer the teacher's Questions.	
VI	Summary	The teacher summarizes the lesson and gives his students assignment to read on Growth and Development.		Closure

APPENDIX V

LESSON PLAN FOR

EXPERIMENTAL GROUP 2 (GUIDED DISCOVERY METHOD)

WEEK ONE

DATE-	02-06-2014
NAME OF TEACHER-	AARON N. DATOM
NAME OF SCHOOL-	GDJSS Wukari
CLASS	J.S.S.II
AVERAGE AGE-	13 years
DURATION-	90 min (Double Period)
SUBJECT-	Basic Science
REFERENCE-	Nigerian Basic Science Project Pupils Testbook.2

TEACHING MATERIALS- Beaker, test-tube, pieces of yam, green leaf, iodine solution, ethanol, burner and water.

TOPIC- Types of Nutrition and Testing for Starch in a yam tissue and green leaf.

BEHAVIOURAL OBJECTIVES:- By the end of the lesson, the students should be able to:

i. state and explain the three (3) types of Nutrition.

ii. demonstrate an activity that could test for the presence of Starch in a green leaf and a yam tissue.

PREVIOUS KNOWLEDGE:- Students are used to seeing plants growing as well as human beings but did not realize that it is as a result of the food we eat.

TEACHING PROCEDURE

Step	Content Development	Teacher's Activity	Students' Activity	Instructional Strategy
I	Introduction/set induction	The teacher asks his students what is Nutrition?	The students answer the teacher by saying: that nutrition is the act of feeding which is capable of bringing nourishment to the organism	Questioning
II	Types of Nutrition	The teacher asks his students: Do plants eat food, in the same manner as human being eat food?	The students answer the teacher's question by saying no. Plants do not feed as humans. They suspect that some chemical activities do take place within the body of the plants that makes them to grow.	Discussion
		The teacher points out that there are three types of Nutrition generally, which are: holophytic, Holozoic and Saprophytic types of Nutrition	Students' listen attentively to the teacher's explanation	Lecturing
		The teacher explains that holophytic Nutrition is used mainly by green plants whereby through the process of photosynthesis, carbohydrates are build up from simple chemical substances such as carbon(iv)oxide and soil water as raw materials. Sunlight is trapped by chlorophyll of	Student's listen attentively to the teachers explanation	Lecturing

		the green leaf as the source of energy in manufacturing food.		
		He states that Holozoic (Heterotrophic Nutrition on the other hand is a characteristic feeding habit of almost all animals that depend directly or indirectly on Autotrophic living things for food. Organisms with this mode of feeding include: 1) Herbivores: Animals that feed on plants only; 2) Carnivores: Animals that feed on flesh only; 3) Omnivores: Animals that feed on both plants & animals. While the third category is the Saprophytic Nutrition which is the characteristics of non-green plants like fungi, and most bacteria that obtains their food mainly from the dead organic remains of matter		
III	Testing for Starch in a Yam Tissue	The teacher asks the students: how can we test for starch in a yam tissue? He gives instruction to his students: peel off the yam and slice it into pieces. Add 2-3 drops of iodine solution on the slice pieces of yam. What do they observe?	The students will be divided into groups of four (4) each, provided with the materials needed for the activity to be performed by the instructions of the teacher. At the end of the activity the iodine solution turns the slice pieces of yam blue-black. An indication that starch is present in Yam Tissue.	Guided Discovery

IV	Testing for Starch in a green leaf	The teacher outlines and performs the activity with the students as follows: first remove a leaf from a young plant that has been exposed to sunlight for some hours. Next dip the leaf for 30 seconds into a beaker containing boiling water. Then transfer the leaf into a test-tube containing ethanol. After the chlorophyll has been dissolved and extracted out by the ethanol. He removes the leaf and dips into cold clean water. Later the leaf is then covered with iodine solution. For a period of 3-5 minutes the iodine solution is wash off the leaf. The presence of blue-black colour is an evidence that starch is present in green leaves.	Students watch and follow the teacher's demonstration	Demonstration
V	Testing for Starch in a yam tissue and a green leaf	The teacher divides the class into small groups of five or six. The apparatus and the reagents will be provided to each group to test for the presence of starch in a yam tissue and a green leaf according to the instructions as provided in the previous steps. While the teacher guides them	The students go into small groups and begin to test for the presence of Starch in a yam tissue and a green leaf	Guided Discovery or Group Work
VI	Supervision	The teacher moves round the class to supervise the groups and gives assistance to any group that might be having difficulty	Students are busy engage in testing for the presence of starch in a yam tissue and a green leaf	Group Work
VII	Recapitulation	The teacher reviews the lesson by briefly	Students listen and follow the	

		stating and explaining the three types of nutrition, demonstrating on how to test for the presence of starch in yam tissue and a green leaf.	demonstration	
	Evaluation	The teacher asks individual students to answer the following questions in their notebooks: i) State three types of Nutrition ii) Outline the major steps of how to test for the presence of Starch in a yam tissue and a green leaf		
VIII	Summary	The teacher summarizes the major points of the lesson and gives his students assignment to read on conditions necessary for starch formation.		Closure

LESSON PLAN FOR

EXPERIMENTAL GROUP 2 (GUIDED DISCOVERY METHOD)

WEEK TWO

DATE-	05-06-2014
NAME OF TEACHER-	AARON N. DATOM
NAME OF SCHOOL-	GDJSS Wukari
CLASS	J.S.S.II
AVERAGE AGE-	13 years
DURATION-	90 minutes (Double Period)
SUBJECT-	Basic Science
TOPIC-	Conditions Necessary for Starch Formation
REFERENCE-	Nigerian Basic Science Project Pupils Textbook 2
TEACHING MATERIALS:	Variegated leaf, beaker, test-tube, iodine solution, ethanol, water, burner or kerosene stove

BEHAVIOURAL OBJECTIVES:- By the end of the lesson, the students should be able to:

i. mention at least three (3) conditions necessary for the formation of starch.

ii. demonstrate an activity to show that chlorophyll is necessary for starch formation.

PREVIOUS KNOWLEDGE:- Students have been taught types of Nutrition and Test for Starch

TEACHING PROCEDURE

Step	Content Development	Teacher's Activity	Students' Activity	Instructional Strategy
I	Introduction/ or Set Induction	The teacher asks the students What is Starch?	The students answer the teacher's question that starch is produced by green plants with the help of sunlight using the green pigment called chlorophyll.	Questioning
II	Conditions necessary for the Formation of Starch	The teacher asks the students that supposing a young growing plant is kept in a dark cupboard can it grow?	The students answer the teacher's question by saying No, because the young plant has been deprived of light causing the leaves to become yellowish.	Discussion
		The teacher affirms that the students answer is right, because light is one of the conditions needed for plants to make starch (food). He therefore mention that for starch to be formed in green plants, certain conditions must be met, these are: - The presence of chlorophyll - The presence of light, and - The presence of cabon(iv)oxide	The students listen attentively and later jot down the point in their notebooks.	Lecturing

III	Showing that Chlorophyll is necessary for starch formation	The teacher asks the students, what are the reasons for the patches of white, yellow and green colours on the surface of a variegated leaf?	The students answer by saying that: the whitish and yellowish areas on the variegated leaf do not manufacture starch, because they lack chlorophyll.	Discussion
		The teacher pick-up the leaf and shows to the students. He explains that the leaf has been exposed to sunlight for 3-4 hours. He guides the students to demonstrate an activity for testing of starch in a leaf as has been done in the previous lesson. At the end, it will be noticed that the pattern of starch corresponds with the green part of the leaf because it will turn blue-black with iodine solution while the whitish and yellowish patch areas on the leaf do not turn blue-black with iodine solution. This is an indication that chlorophyll is necessary for starch formation.	Students go into smaller groups and begin to follow the steps for the activity, to perform the activity as instructed by the teacher.	Guided Discovery
IV	Demonstrating that chlorophyll is necessary for starch formation	The teacher divides the class into six groups and provides each group with the apparatus, reagents and materials necessary for demonstration of the activity. He moves round the groups to be guiding them as they perform the activity.	Students go into their various groups and begin to carry-out the demonstration of the activity under the guidance of the teacher	Guided Discovery or Group Work

V	Recapitulation	The teacher asks the students to go back to their various seats. He reviews the lesson by mentioning and explaining the conditions necessary for the formation of starch as well as demonstrating briefly an activity to show that chlorophyll is necessary for the formation of starch.	Students listen and follow the steps demonstrating the activity	
	Evaluation	The teacher evaluates his lesson by asking his students the following written questions: - List three(3) conditions necessary for starch formation - Outline the steps to show that chlorophyll is necessary for starch formation.		
VII	Summary	The teacher summarizes the lesson and gives the students assignment to read on proteins.		Closure

LESSON PLAN FOR

EXPERIMENTAL GROUP 2 (GUIDED DISCOVERY METHOD)

WEEK THREE

DATE-	09-06-2014
NAME OF TEACHER-	AARON N. DATOM
NAME OF SCHOOL-	GDJSS Wukari
CLASS	J.S.S.II
AVERAGE AGE-	13 Years
DURATION-	90 min (Double Period)
SUBJECT-	Basic Science
REFERENCE-	Nigerian Basic Science Project Pupils Testbook.2
TEACHING MATERIALS-	Eggs, Million's reagent, Kerosene stove, test tube, Cray fish, groundnut, beans, milk, etc
TOPIC- Proteins	introduction to proteins and test for

BEHAVIOURAL OBJECTIVES:- By the end of the lesson, the students should be able to:

- State two functions of proteins to the body
- List at least four(4) example of food items that contains proteins

- Perform an experiment to test for proteins in an egg

PREVIOUS KNOWLEDGE:- Students have been taught types of Nutrition and Test for Starch

TEACHING PROCEDURE

Step	Content Development	Teacher's Activity	Students' Activity	Instructional Strategy
I	Introduction/or Set Induction	The teacher asks the students What are Proteins?	The students answer the teacher's question by mentioning various examples of food items such as fish, meat, beans or eggs.	Questioning
	Chemical composition of Protein	The teacher explains that proteins are food substances that contains carbon, hydrogen, oxygen, nitrogen, sulphur and phosphorous.	Students listen attentively to the teacher's explanation.	Lecturing
II	Functions of Proteins to the body	The teacher ask the students, what happened to the surface of the wound that is about to heal? He points out that the necessity of proteins to the body by listing the following functions: i. It replaces worn out tissues of the body and form new cells ii. It promotes growth. These are the reasons why children are given more proteins	The students answer a new skin begins to emerge at the surface of the wound. Students listen carefully and later jot down the points in their notebooks.	Discussion

		food than adult.		
III	Examples of Food rich in Proteins	The teacher itemizes food rich in proteins as: fish, meat, groundnut, beans, eggs, milk etc. He later presents some of the samples for the students to observe.	The students handle the food items, observe and study them.	Discussion
IV	Test for Proteins using an Egg	The teacher asks the student what is egg albumen?	The students answer an egg albumen is the whitish portion of an egg	Questioning
		The teacher uses the front table and demonstrates how to test for proteins in an egg as follows: Add few drops of Million's reagent to the egg albumen. Mix well and heat gently. A white precipitate forms which on heating turns brick-red indicating the presence of proteins.	The students follow the practical activity carefully and later ask the teacher questions	Discussion
V	Test for Proteins by the Various Groups	The teacher divides the class into smaller groups of six. He provides each group with the materials and reagent needed for the test of proteins. He moves round the groups and guide them as they perform the activity.	The students go into small groups and begin to test for proteins using an egg albumen while the teacher guide them in carrying out the activity.	Guided Discovery or Group Work
VI	Recapitulation	The teacher reviews the lesson by stating briefly the functions of proteins to the body, list examples of food items that are rich	Students listen attentively and jot down the major points in their notebooks	

		in proteins as well as perform an experiment to test for proteins using egg albumen.		
	Evaluation	The teacher evaluates his lesson by asking the students the following oral questions: i. State at least two functions of protein to the body. ii. Mention four(4) examples of foods that are rich in protein iii. Outline the major steps to test for proteins in an egg	Students are expected to be busy raising up their hands to answer the teacher's question	
VII	Summary	The teacher summarizes the major points of the lesson and gives his students assignment to read on fats and oils.		Closure

LESSON PLAN FOR

EXPERIMENTAL GROUP 2 (GUIDED DISCOVERY METHOD)

WEEK FOUR

DATE-	11-06-2014
NAME OF TEACHER-	AARON N. DATOM
NAME OF SCHOOL-	GDJSS, Wukari
CLASS	J.S.S.II
AVERAGE AGE-	13 years
DURATION-	90 minutes (Double Period)
SUBJECT-	Basic Science
REFERENCE-	Nigerian Basic Science Project Pupils Testbook.2
TEACHING MATERIALS-	White pieces of paper, sample of dry animals fats, palm oil, groundnut oil
TOPIC-	Introduction to Fats and Oils and Test for Fats and Oils

BEHAVIOURAL OBJECTIVES:- By the end of the lesson, the students should be able to:

i. list at least three (3) chemical compositions of fats and oils.

ii. state three functions of Fats and Oils to the body.

iii. demonstrate an activity to test for the presence of Fats and Oils on a white piece of paper.

PREVIOUS KNOWLEDGE:- Students have been taught carbohydrates, protein and test for starch

TEACHING PROCEDURE

Step	Content Development	Teacher's Activity	Students' Activity	Instructional Strategy
I	Introduction/or Set Induction	The teacher asks the students a question; what are Fats and Oils?	The students answer by saying that, Fats are whitish substances gotten from animals' body which can easily solidify at room temperature. Oils, on the other hand, are tapped from fruits an mostly use for daily cooking The students handle, observe and study the samples of the Fats and Oil presented to them.	Questioning
	Chemical compositions of Fats and Oil	The teacher presents samples of dry animal Fats and some samples of Oils such as groundnut oil and palm oil to the students to observe The teacher asks the students, "what are those substances made up of?" The teacher points out that fats and oils are made up of the following chemical compositions: carbon, oxygen and hydrogen.	The students answer that fats are saturated while oils are unsaturated substances.	Discussion
		The teacher states that fats and oils are essential to the body because they serve the following functions:	The students listen attentively to the teacher.	Lecturing

II	Functions of fats and oils to the body	i. Fats and oils give warmth to the body against extreme cold. ii. They serve as protection for 'delicate organs' of our body such as liver, kidney or the heart. iii. The stored fats in the body are also used a source of energy in times of needs.	The students listen attentively and later jot the main points in their note books.	
III	Test for fats and oils	The teacher guides the students in demonstrating how to test for fats and oils. He asks the students, "how can we test for fats and oils on a piece of paper?" He proceeds with the explanations as follows: Put few drop of groundnut oil or animal fat on white piece of paper and rub with the thumb. The paper becomes translucent. This is an indication that fats or oils are present on the piece of paper.	The students watch the teacher carefully and later ask the teacher questions.	Demonstration

IV	Testing for fats and oils in groups	The teacher divides the class into 8 groups of 4 students each. He presents to each group the specimens, samples or materials needed for the activity and gives assistance to each group while performing the activity.	The students go into small groups and begin to carry out the activity under the guidance of the teacher.	Guided Discovery
V	Recapitulation	The teacher asks the students to return to their seats. He reviews the lesson by listing the chemical compositions of fats and oils, stating their functions to the body as well as demonstrating how to test for fats and oils on white piece of paper.	The students listen attentively and follow the demonstration.	
	Evaluation	The teacher evaluates his lesson by asking the students the following written questions: i. List 3 chemical compositions of fats and oils. ii. State 3 functions of fats and oils to the body. iii. Enumerate the steps for an activity to test for the presence of fats and oils on a piece of paper.	The students answer the questions in their note books.	

VI	Summary	The teacher summarizes the major points of the lesson and gives the students an assignment to read on vitamins.		Closure

LESSON PLAN FOR

EXPERIMENTAL GROUP 2 (GUIDED DISCOVERY METHOD)

WEEK FIVE

DATE-	13-05-2014
NAME OF TEACHER-	AARON N. DATOM
NAME OF SCHOOL-	GDJSS Wukari
CLASS-	JSSII
AVERAGE AGE-	13 years
DURATION-	90 minutes (Double Period)
SUBJECT-	Basic Science
REFERENCE-	Nigerian Basic Science Project Pupils Testbook.2
TEACHING MATERIALS-	Eggs, milk, liver, fresh vegetables, palm oil, sample of palm wine, groundnut, cabbage, citrus fruits, fish,

TOPIC- Introduction to Vitamins and Mineral Salts

BEHAVIOURAL OBJECTIVES:- By the end of the lesson, the students should be able to:

i. state what Vitamins are.

ii. mention and least five (5) types of vitamins.

iii. classify food sources according to the Vitamins they provide to the body.

PREVIOUS KNOWLEDGE:- Students are used to eating different sources of food but could not identify the type of vitamin they provide to the body.

TEACHING PROCEDURES

STEP	Content Development	Teacher's Activity	Students' Activity	Instructional Strategy
I	Introduction/Set Induction	The teacher asks, the students if they have eaten fruits, such as mangoes, oranges, cashew, green vegetables?	The students answer the teacher's question by saying 'Yes' they have eaten	Questioning
		He asks the students again, what does these food items provides for the body?	The students answer, by saying, that these food sources gives Nutrient to the body	Discussion
	What Vitamins are?	The teacher explains Vitamins, as nutrients found in our food which are not only essential for growth, but for healthy development and well-being of our bodies. He present to the students the various sample of food sources such as mangoes, oranges, tomatoes, green vegetables, eggs etc. For the students to observe.	The students listen attentively to the teacher's explanation and later handle the various samples of food sources and observe	
II	Types of Vitamin	The teacher collect back the various food samples from the students. He points out that these food sources can be classified into different types of Vitamins which they give to the body. These include: Vitamin A, Vitamin B/complex, Vitamin C, Vitamin D, Vitamin E and Vitamin K.	The students listen attentively to the teacher's explanation and jot down the main points in their notebooks.	Lecturing

III	Classification of Food sources, according to the Vitamin they give to the body	The teacher uses the various food samples such as mangoes, oranges, beans, tomatoes, milk, liver, fresh vegetables, fish, eggs, palm wines etc. He guides the students to classify them according to the vitamin they give to the body. For example, Food items belonging to vitamin A are eggs, milk, liver, fresh vegetables and red palm oil. Those belong to vitamin B complex include groundnut, brown rice, beans, tomatoes, milk, fish, palm wine. He does the same for vitamin C, D, E and K.	Students watch the classification of the food sources into different types of Vitamins and ask question	Demonstration
IV	Classification of food sources according to Vitamins by groups	The teacher divides the class into eight groups of four students each. He provides each group with the various samples of food sources and guides each group in classifying them into the various types of vitamins such as those belonging to Vitamins A, B complex, C, D, E and K.	Students go into small groups and begin to classify the food items into their respective types of vitamins they give to the body under the guidance of the teacher	Guided Discovery or Group Work
V	Recapitulation	The teacher asks the student to go back to their various seats. He reviews the lesson by explaining, what vitamins are, mentioning the different types of vitamins as well as classifying the various food items into the respective types of vitamins they provide to our bodies.	The student listen attentively and follow the teacher's explanation	
	Evaluation	The teacher evaluates his lesson by asking the students the following oral questions: i. What are vitamins? ii. Mention at least five (5) types of vitamins iii. List the food items that belong to Vitamin C	Students are expected to raise up their hands to answer the teacher's question	
VII	Summary	The teacher concludes his lesson by summarizing the major points of the lesson.		Closure.

APPENDIX VI

LESSON PLAN FOR

CONTROL GROUP (LECTURE METHOD)

WEEK ONE

DATE - 16-06-2014

NAME OF TEACHER – Aaron N. Datom

NAME OF SCHOOL – GDJSS Gidan Idi

CLASS – JSS II

AVERAGE AGE – 13 Years

DURATION – 90 minutes (Double period)

SUBJECT – Basic Science

REFERENCE – Nigerian Basic Science Project, Pupils' Text Book 2

TOPIC – Types of Nutrition and Testing for Starch in a Yam Tissue and a Green Leaf

BEHAVIOURAL OBJECTIVES – By the end of the lesson the students should be able to:

i. mention and explain the three types of nutrition.

ii. state at least four functions of food to a living organism.

iii. demonstrate an activity that could test for the presence of starch in leaf and a yam tissue.

PREVIOUS KNOWLEDGE – Students are used to seeing plants growing as well as human beings but could not realize that it is as a result of the food we feed on.

INTRODUCTION – The teacher introduces his lesson by asking his students, "what is Nutrition?". The students answer that nutrition is the act of feeding which is capable bringing nourishment to the organism.

PRESENTATION

STEP I – The teacher explains that all living things feed in order to get energy to carry out their daily activities and also for growth. Energy is required for movement and other activities engaged in by living things such as reading books, running, dancing, sleeping, walking, metabolic processes, growth, blood circulation, etc. He points out that there are 3 types of nutrition generally which are: holophytic (autotrophic) nutrition, which is used mainly by green plants whereby, all green plants make their own food by the process of photosynthesis. They use atmospheric carbon(iv)oxide (CO_2) and soil water as raw materials, sun light which is trapped by the chlorophyll as the source of energy (solar energy) in manufacturing food. Holozoic (heterotrophic) nutrition on the other hand is a characteristic feed habit of almost all animals that depend directly or indirectly on autotrophic living things for their food. Organisms with this mode of feeding include:

i. Herbivores:- Animals that feed on plants only
ii. Carnivores:- Animals that feed on flesh only
iii. Omnivores:- Animals that feed on both plants and animals

While the third category is the saprophytic nutrition which is the characteristic non-green plants like fungi and most bacteria that obtain their food mainly from dead organic remains of matter.

STEP II - The teacher explains that food is a substance which is capable of nourishing the body (after digestion). He points out that the energy required for the activities that living things go through comes from the food they eat. Animals cannot make food by themselves. They feed on plants and other animals. Plants make their own food with the help of sunlight. The process is called photosynthesis. Some of the functions of food to living organisms are as follows:

(i) Food gives energy to the body.

(ii) Food nourishes the body.

(iii) Food helps an organism to grow.

(iv) It builds up the immune system of organisms so as to fight against diseases.

(v) Food helps to replace worn-out or damaged tissues of a living thing.

STEP III – The teacher explains to the students that to test for starch in a leaf, first remove a leaf from a young plant that has been exposed to light for some hours. Dip the leaf for 30 seconds into a beaker containing boiling water. Transfer the leaf into a test tube containing ethanol. After the chlorophyll has been dissolve out and extracted by the ethanol, remove the leaf and dip in clean water. The leaf is then covered with iodine solution. After 3 to 5 minutes the iodine solution is washed off the leaf. The presence of blue-black colour is an evidence that starch is present in the leaf. The teacher also points out that starch can be tested in piece of white yam tissue by putting a drop of iodine solution on a slice piece of yam. The yam slice turns blue-black with iodine solution indicating the presence of starch in the yam tissue.

RECAPITULATION – The teacher reviews the lesson by briefly mentioning and explaining the three types of nutrition, states the functions of food to living organisms as well as explain an activity that could test for the presence of starch in a leaf and a yam tissue.

EVALUATION – The teacher evaluates his lesson by asking the students the following oral questions:

i. Mention and explain the 3 types of nutrition.

ii. State at least 4 functions of food to a living organism.

iii. Enumerate briefly an activity that could test for the presence of starch in a leaf and a yam tissue.

CONCLUSION – The teacher concludes his lesson by giving the students an assignment to read on conditions necessary for starch formation.

LESSON PLAN FOR

CONTROL GROUP (LECTURE METHOD)

WEEK TWO

DATE – 18-06-2014

NAME OF TEACHER – Aaron N. Datom

NAME OF SCHOOL – GDJSS Gidan Idi

CLASS – JSS II

AVERAGE AGE – 13 years

DURATION – 90 minutes (Double period)

SUBJECT – Basic Science

REFERENCE – Nigerian Basic Science Project, Pupils' Text Book 2

TOPIC – Conditions Necessary for Starch Formation

BEHAVIOURAL OBJECTIVES – By the end of the lesson the students should be able to:

i. State what a variegated leaf is.

ii. Mention at least 3 conditions necessary for the formation of starch.

iii. Enumerate an activity to show that chlorophyll is necessary for starch formation.

PREVIOUS KNOWLEDGE: Students have been taught types of nutrition and test for starch.

INTRODUCTION:- The teacher introduces his lesson by asking the students, "What is a variegated leaf?" The students answer a variegated leaf is a leaf that has different patches of colours such as white, yellow and green on the surface.

PRESENTATION

STEP I – The teacher states that a variegated leaf is a leaf having different shades of colours such as white, green or yellow on the surface. He points out that some species of plants with variegated leaves are croton (ice plant).

STEP II – The teacher explains that for starch to be formed in the green leaf of a plant, certain conditions must be available. These are:

i. Presence of chlorophyll

ii. Presence of light

iii. Presence of carbon(iv)oxide

STEP III – The teacher uses the variegated leaves of ice plant (croton) that has different patches or shade of colours as an example to the students. He explains that the leaves have been exposed to sunlight for 3 to 4 hours. He enumerates the activity for the testing of starch as has been done in the previous lesson. At the end, it will be noticed that the pattern of starch corresponds with the green part of the leaf because it will turn blue-black with iodine solution. This is an indication that chlorophyll is necessary for starch formation.

RECAPITULATION - The teacher reviews the lesson by briefly stating what a variegated leaf is, mentioning the 3 conditions necessary for the formation of starch as well as explaining an activity to show that chlorophyll is necessary for the formation of starch.

EVALUATION: - The teacher evaluates his lesson by asking the students the following oral questions:

i. What is a variegated leaf?

ii. Mention at least 3 conditions necessary for the formation of starch.

iii. Explain an activity to show that chlorophyll is necessary for starch formation.

CONCLUSION – The teacher concludes his lesson by summarizing the major points of the lesson.

LESSON PLAN FOR

CONTROL GROUP (LECTURE METHOD)

WEEK THREE

DATE – 23-06-2014

NAME OF TEACHER – Aaron N. Datom

NAME OF SCHOOL – GDJSS Gidan Idi

CLASS – JSS II

AVERAGE AGE – 13 years

DURATION – 90 minutes (Double period)

SUBJECT – Basic Science

REFERENCE – Nigerian Basic Science Project, Pupils' Text Book 2

TOPIC – Introduction to Protein and Test for Proteins

BEHAVIOURAL OBJECTIVES – By the end of the lesson the students should be able to:

i. State two functions of proteins to the body.

ii. Mention at least 4 examples of food items that contain proteins.

iii. Enumerate an activity to test for the presence of proteins in an egg.

PREVIOUS KNOWLEDGE: Students are used to taking food daily but could not realize that the different classes of food taken have different nutrients necessary for activities, growth and well-being of the body.

INTRODUCTION:- The teacher introduces his lesson by asking the students, "What are proteins?" The students answer proteins are food nutrients that help the body in growth and repair of worn-out tissues.

PRESENTATION

STEP I – The teacher states that proteins are food substances that contain carbon, hydrogen, oxygen, nitrogen, sulphur and phosphorus. He points out those proteins are very essential to the body because they serve the following functions:

i. It replaces worn-out tissues of the body and form new cells.

ii. It promotes growth.

These are the reasons why children need more food that are rich in proteins than adults.

STEP II – The teacher mentions that examples of food items rich in proteins are: eggs, meat, fish, milk, beans, groundnut, etc. He lists them on the board for the students to copy.

STEP III – The teacher explains to the students how to test for proteins in an egg as follows: Add few drops of Million's reagent to an egg albumen. Mix well and heat gently. A white precipitate is formed which on heating turns brick-red, an indication that proteins is present in egg.

RECAPITULATION - The teacher reviews the lesson by briefly stating the functions of proteins, mentioning examples of food items that are rich in proteins as well explaining orally an activity to test for the presence of proteins in an egg.

EVALUATION: - The teacher evaluates his lesson by asking the students the following oral questions:

i. State at least two functions proteins to the body.

ii. Mention 4 examples of food items that are rich in proteins.

iii. Enumerate the major step to test for the presence of proteins using an egg.

CONCLUSION – The teacher concludes his lesson by summarizing the major points of the lesson and gives his students assignment to read on fats and oils (lipids).

LESSON PLAN FOR

CONTROL GROUP (LECTURE METHOD)

WEEK FOUR

DATE – 25-06-2014

NAME OF TEACHER – Aaron N. Datom

NAME OF SCHOOL – GDJSS Gidan Idi

CLASS – JSS II

AVERAGE AGE – 13 years

DURATION – 90 minutes (Double period)

SUBJECT – Basic Science

REFERENCE – Nigerian Basic Science Project, Pupils' Text Book 2

TOPIC – Introduction to Fats and Oils and Test for Fats and Oils

BEHAVIOURAL OBJECTIVES – By the end of the lesson the students should be able to:

i. List at least 3 chemical compositions of fats and oils.

ii. State 3 functions of fats and oils to the body.

iii. Narrate an activity to test for the presence of fats and oils on a white piece of paper.

PREVIOUS KNOWLEDGE:- Students have been taught the test for starch (carbohydrate) and proteins.

INTRODUCTION:- The teacher introduces his lesson by asking the students, "What are fats and oils?" The students answer the teacher that fats are whitish substances gotten from animals' meat. It can solidify and becomes hardened under low temperatures. Oils such as palm oil, ground oil and butter are used for cooking food daily.

PRESENTATION

STEP I – The teacher points out that the chemical composition that makes up fats and oils are: carbon, hydrogen and oxygen. They are found in both plants and animals. Fats are solid while oils are liquid at room temperature.

STEP II – The teacher states that fats and oils perform the following functions. These are:

i. They give warmth to the body against an extreme cold.
ii. They serve as protection for 'delicate organs' of our body such as the kidneys, liver or the heart.
iii. Stored fats in the body are also used as source of energy in times of need.

STEP III – The teacher explains to the students how to test for fats and oils in a food item as follows: put 1-2 drops of groundnut oil or an animal fat on a white piece of paper and rub with the thumb. It will be observed that the paper becomes translucent. This is an indication that fat or oil is present on the white piece of paper.

RECAPITULATION: - The teacher reviews the lesson by listing the chemical compositions of fats and oils, stating their functions to the body as well as enumerating an activity on how to test for the presence of fats and oils on a white piece of paper.

+EVALUATION:- The teacher evaluates his lesson by asking the students the following written questions:

i. List 3 chemical compositions of fats and oil

ii. State 3 functions of fats and oils to the body.

iii. Enumerate an activity to test for the presence of fats and oils on a white piece of paper.

CONCLUSION – The teacher summarizes the major points of the lesson and gives the students an assignment to read on vitamins.

LESSON PLAN FOR

CONTROL GROUP (LECTURE METHOD)

WEEK FIVE

DATE – 30-06-2014

NAME OF TEACHER – Aaron N. Datom

NAME OF SCHOOL – GDJSS Gidan Idi

CLASS – JSS II

AVERAGE AGE – 13 years

DURATION – 90 minutes (Double period)

SUBJECT – Basic Science

REFERENCE – Nigerian Basic Science Project, Pupils' Text Book 2

TOPIC – Introduction to Vitamins and Mineral Salts

BEHAVIOURAL OBJECTIVES – By the end of the lesson the students should be able to:

i. State what vitamins are?

ii. Mention at least five types of vitamins.

iii. Classify food sources according to the vitamins they provide to the body.

PREVIOUS KNOWLEDGE:- Students are used to eating different types of food but could not identify the types of vitamins they provide to the body.

INTRODUCTION:- The teacher introduces his lesson by asking the students, "What are vitamins?" The students answer they are food nutrients provided to the body by certain food items such as mangoes, oranges or green vegetables which are essential for growth and well-being of the body.

PRESENTATION

STEP I – The teacher explains that vitamins are food nutrients found in our food that help not only for growth, but they also make us healthy. He points out those examples of vitamins are: mangoes, oranges, tomatoes, green vegetables, fish, eggs, beans, banana, millet, meat, etc.

STEP II – The teacher mentions that the types of vitamins include: vitamin A, vitamin B complex, vitamin C, vitamin D, vitamin E and vitamin K.

STEP III – The teacher explains the different types of vitamins and their respective food sources. For example, vitamin A is essential for growth and development. Absence of vitamin A causes night blindness, an eye disease. Food sources belonging to vitamin A are: eggs, milk, liver, fresh vegetables and red palm oil. Vitamin B complex consists of many form of vitamin B. vitamin B_1 prevents the disease called beri-beri from occurring. Vitamin B_2 is for maintenance of healthy skin and proper coordination of the muscles. Vitamin B_6 prevents abdominal pains, anaemia and general weakness of the body. Food sources belonging to vitamin B complex are: groundnut, brown rice, beans, tomatoes, milk, fish, palm wine, etc. The teacher gives the same explanation for vitamins C, D, E and K.

RECAPITULATION - The teacher reviews the lesson briefly by stating what vitamins are. He mentioned the various types of vitamins as well as classification of food items into their respective types of vitamins.

EVALUATION: - The teacher evaluates his lesson by asking the students the following written questions to be answered in their note books:

i. What are vitamins?

ii. Mention at least 5 types of vitamins.

iii. Mention the food items belonging to vitamin C.

CONCLUSION – The teacher concludes his lesson by summarizing the major points of the lesson.