

**EFFECTS OF TWO TEACHING METHOD (GUIDED AND UNGUIDED) ON THE  
ACADEMIC ACHIEVEMENT OF BIOLOGY STUDENT IN SENIOR SECONDARY  
SCHOOL IN MINNA METROPOLIS**

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## ABSTRACT

The menace or issue of poor achievement in Biology in external examination has been a matter of concern to the nation and the society as well, Regardless of the problem and as part of the contribution to arrest the situation this study was designed to determine the effect of inquiry method of teaching (Guided and Unguided inquiry method of teaching) on the student achievement in Biology. In order to carry out the study, three research question and three null hypothesis was formulated. The literature of the study was reviewed under three main categories namely: Conceptual framework, Theoretical framework and Emperical studies. Design for the study is a quasi-experimental pre-test and post-test design. The study for the work was carried out in two purposely selected co-education secondary school in Minna Metropolis, Niger State. Data for the study was collected through a researcher developed instrument: Biology Achievement Test (BAT). Sample for the study consisted of eighty (80) senior secondary one (SS1) students from two randomly selected intact classes in the sampled school. The two intact classes of forty (40) students each was assigned to experimental group I&II respectively. The experimental group I&II was exposed to guided and unguided inquiry method of teaching respectively. Data for the study was analyzed using mean, standard deviation and t-test. The null hypothesis was tested at 0.05 level of probability. Findings of the study revealed that guided inquiry enhanced students achievement in Biology more than unguided inquiry. Also findings of the study revealed that there was no significant difference in the achievement of male and female students in Biology. Recommendation and suggestions for further study was made based on the findings of the study.



## **CHAPTER ONE**

### **1.0 INTRODUCTION**

#### **1.1 Background of the study**

Education is a highly rated public venture used as an instrument par excellence in national development. Education is the act or way of impacting or gaining knowledge through a systematic instruction especially at primary, secondary school or tertiary institution. According to Igbo (2006), Education is the process by which society deliberately transmit cultural heritage through institutions such as schools, colleges, and universities. Also, according to Fafunwa (2004), Education is an aggregate of all processes by means of which a person develops ability and other forms of behavior of positive value in the society. In education, there are various disciplines or aspect to master or even gain full and adequate knowledge in, one of such is biology.

Biology is the science that studies living organisms and characteristics of life processes and phenomenon of living organisms. Relatively, biology is a branch of natural science that properly deals with the study of living things, as well as the structure, evolution, distribution, and various relationships among organisms (Houghton Mifflin, 2014). Biology as a science subject act as the foundation for other science courses like; Medicine, Pharmacy, Genetics, Agriculture among others, which are of enormous value and importance to any nation. Biology deals with non-abstract things which makes it more easy and preferably loved by secondary school students, unlike Mathematics, Chemistry, Physics; Biology deals basically with theory than calculation. Regardless of number of student enrolment in Biology in the senior school examinations conducted, by the West African Examination Council (WAEC) and National Examination Council (NECO), Chief Examiner's Report 2007;( Ige-2009) and (Opara-2011) indicated that student's achievement in biology is poor.

The poor achievement of students in Biology in external examination is linked to many factors, chief among which is the use of traditional method in teaching secondary school biology (Long-John&Ibiene-2010). The traditional teaching methods often used by teachers in teaching Biology include the lecture/expository method, demonstration and direct instruction among others. These traditional methods of teaching stress more on the transmission of knowledge in a manner that emphasizes memorization hence they have been categorized by some educators, Ibe and Nwosu (2003), Kirshner, Sweller and Clark, (2006) and Sawa, (2011) as a poor method of teaching biology and other science subjects. The traditional teaching methods involve unidirectional flow of information/knowledge from teacher to the students and do not encourage process skill acquisition needed for proper understanding of biological principles, concepts and facts. Guisti (2008) referred to these traditional teaching methods as teacher-centered approaches to learning in the sense that the teacher and those up in the educational hierarchy are considered as the possessor of knowledge to be transferred to the students, and as such decides how the knowledge transfer takes place.

The unidirectional flow of information in the traditional teaching method makes students passive and unable to construct meaningful knowledge in the teaching and learning of Biology. This calls for the use of other method in which the students will be fully involved. Inquiry method is one of them among others. Inquiry method as one of such methods, is therefore considered in this study, to determine its efficacy on student achievement in Biology using two different types of inquiry methods (guided and unguided inquiry) respectively. Educational Broadcasting Corporation (2004) defined inquiry as “seeking for truth, information or knowledge by questioning, while Martin-Hansen (2002) referred to inquiry as “the work scientist do when they study the natural world, proposing explanations that include evidence gathered from the world around them as well as the activities of

students. Such activities include posing questions, planning investigations and reviewing what is already known in the light of experimental evidence. One of the major objectives of inquiry is to encourage investigation in students. When students are encouraged to investigate into natural phenomena, a meaningful and relevant knowledge is constructed and sustained. Inquiry method can be in the form of guided or unguided.

Guided inquiry is thus defined as the type of inquiry in which students are provided with direct instructional guidance by the teacher as regards to the concepts and procedures required by a particular discipline, requiring the students to make generalizations (Kirschner, Sweller and Clark (2006) &Guisti (2008)). Here, the teacher develops a working plan, while the students perform the activities, gather data and draw conclusion. On the other- hand in Unguided or Open inquiry, the students state the problem for investigation, formulates hypothesis and develop the working plan in line with stated generalization (student identify or pose questions, discover specifics construct essential information with reference to generalized principle) (Kirschner, Sweller and Clark (2006)). In view of the above definitions the major difference identified by the researcher between the two methods is in the degree of student centeredness: In the guided inquiry students are provided with some assistance and guidance from the teacher to enable investigation into a problem and construction of knowledge. In the unguided inquiry the students solely rely on their ability to utilize various scientific processes to solve or arrive to a conclusive solution. Perhaps in this way, their achievement in biology might be influenced. Achievement is an important academic factor that has been identified to be influenced by teaching methods. Achievement is the accomplishment of a goal. Hence academic achievement refers to the accomplishment of academic goals, the educational outcomes of students or rather the extent to which a student, a teacher or an instructor has achieved the stated educational objectives. Achievement however, has been noted by some researchers to be influenced by gender.

Gender is a socio-cultural construct of ascribing characters and roles to sex such as male and female (Okeke, 2007). The stereotyping bias that science is a male enterprise is of great concern in the field of science education and has resulted to a controversial issue and conflicting reports from different researchers. Other studies indicated that a significant difference exist in the achievement and interest of male and female student in biology. This study therefore intends to identify the effects of inquiry methods (Guided and unguided) on student academic achievement in Biology.

## **1.2 Statement of the problem**

Despite the recommendation for use of inquiry teaching method for teaching and learning science including Biology by the Federal Ministry of Education's 6-3-3-4 curriculum reform, and suggestions by many Science Educators, reports from educators and researchers indicated that student achievement in Biology is still poor. The poor academic achievement of students in Biology has been related with the use of substandard methods of teaching, lack of interest and sometimes influence of gender. In view of these, researchers in science education have continually looked for better teaching methods that will enhance student academic achievement, and bridge the gender gap in academic achievement in Biology. The question is could the use of inquiry teaching ultimately and positively affect student academic achievement in biology. Some other researchers have also suggested using different forms of inquiry in teaching (guided and unguided). The problem of this study posed as a question is which of the inquiry method (guided or unguided) when used by teachers would enhance more student academic achievement in senior secondary school Biology in Minna Metropolis.

### **1.3 Aim and Objectives of the Study**

The main aim of this study is to investigate the effects of guided and unguided inquiry methods of teaching on student academic achievement in secondary school Biology student in Minna Metropolis. More specifically, this study attempts to:

- i. determine the relative effects of the guided and unguided inquiry method of teaching on student achievement in Biology.
- ii. determine the influence of gender on the achievements of students taught Biology using guided inquiry method of teaching.
- iii. determine the influence of gender on the achievements of students taught Biology using unguided inquiry method of teaching.

### **1.4 Research Questions**

The following research questions were posed to guide the study:

- i. What are the relative effectiveness of guided and unguided inquiry methods of teaching on student academic achievement in biology?
- ii. What is the influence of gender on the mean achievement scores of students taught biology using guided inquiry methods of teaching?
- iii. What is the influence of gender on the mean achievement scores of students taught biology using unguided inquiry methods of teaching?

## **1.5 Research Hypotheses**

The following hypotheses were formulated to guide the study and were tested at a probability level of 0.05.

**HO<sub>1</sub>:** There was no significant difference in the mean achievement scores of students taught Biology using guided inquiry method and those taught using unguided inquiry method.

**HO<sub>2</sub>:** There was no significant difference in the mean achievement scores of male and female students taught Biology using guided inquiry method.

**HO<sub>3</sub>:** There was no significant difference in the mean achievement scores of male and female students taught Biology using unguided inquiry method.

## **1.6 Scope of the study**

This study basically focuses in Niger state, using senior secondary school one (SSI) students. The scope of the study is limited to all SSI students in selected secondary school in Bosso Local Government Area of Niger State. The choice of Bosso Local Government Areas is because of the available record which indicates that student academic achievement in Biology is poor despite the urban location of most schools in the area with appreciable number of qualified Biology teachers among others. The Senior Secondary One (SSI) students were chosen for the study because they are at the beginning stage of studying Biology. The content scope for the study is Animal Nutrition which includes: Food substances, Mammalian Teeth and Digestive Enzymes. This topic was selected due to the unifying role it plays in fostering students interest and understanding in Biology.

## **1.7 Significance of the study**

The recognition of a more effective conceptualization of the inquiry method will be of immense benefit to the nation, students, teachers, science, educators, other researchers and educational administrators.

To the nation, evidence of a better method of inquiry will enhance student academic achievement in biology and increase the number of students who will go into the study of important science courses like Medicine, Pharmacy, Nursing and Agriculture. These courses of study will promote the national economic development and also increase the number of scientifically skilled and literate citizens.

To the students, identification of a more effective inquiry method (guided or unguided) will help the students to achieve high in biology which will make them to opt for science courses in higher institution and also appreciate the things around them.

To the teachers and science educators the identification of better inquiry methods will enable teaching and learning process to be more beneficial because student academic achievement will be improved upon and their interest sustained, thus enabling the realization of the stated instructional objectives which is the goal of any academic enterprise.

## **1.8 Operational Definitions of terms**

**Achievement:** The action or process of accomplishing and completing something successfully with special effort, skill, as well as courage.

**Effect:** This is a change or phenomenon which can be as a result or consequence of an action and other causes or other phenomenon.

**Performance:** The process of functioning or doing a task successfully. How proper a person or machine executes a piece of work effectively.

**Academic achievement:** This represents performance outcomes that indicate the extent to which a person has accomplished specific goals that were the focus of activities in instructional environments specifically in schools, university, college etc.

**Teaching Method:** This refers to the general principles, pedagogy and management strategies used for classroom instruction.

**Guided:** To assist a person or show point of interest by accompanying or giving directions to someone.

**Unguided:** Something or someone not subject to control or particularly not guided in a path or direction.



## CHAPTER TWO

### 2.0 REVIEW OF LITERATURE

#### 2.1 Conceptual Framework

##### 2.1.1 Concept of Biology and teaching learning process

Biology is one of the fields in the natural sciences that studies living things. The word 'Biology' is coined from two Greek words; Bios meaning life, and logy (logia) which means study. Thus the concept biology is concerned with the study of life. Levine and Miller (2002) state that Biology in addition to studying life, studies also the structures, functions, growth, origin, evolutions, distributions, inter-relationships, problems such as diseases and adaptations of living things and proposes solutions where possible. However, Biology is the branch of science that studies life using inquiry methods and discoveries. Inquiry process regards to asking questions that interest students to think properly which enables student develop scientific idea and knowledge, being open minded, creativity, scientific curiosity which is needed for understanding biological concepts knowledge construction and knowledge transfer to similar situations. Biology as science of life provides potentials for the use of many inquiry methods. In view of this, the present study intends to identify among two types of inquiry teaching methods (guided and unguided) to determine the more effective method that will improve student's achievement in Biology.

Teaching is a concept central to education and any academic setting. There are various definitions of teaching as well as many activities that are involved in the teaching and learning process. Nzeribe, (2002) defined teaching as the conscious and deliberate effort by a matured or experienced person to impact information, knowledge, skills among others to an immature or less experienced person, with the intention that the latter will learn or come to believe what is taught. In view of the above assertions, teaching can be defined as a

systematic activity designed by a teacher or instructor to facilitate learning in order to enable learners construct worthwhile knowledge and skills. Teaching is an academic process that involves two groups of people: the teacher/instructor and students/learners. Due to these activities involved in teaching the concept of teaching are preferably discussed as teaching and learning. According to Sawa, (2002) teaching and learning are considered as two sides of a coin, because teaching is meaningless without learning. Hence, teaching without learning is considered mere talking, for teaching to be meaningful it must be effective in promoting knowledge, skills and values.

Borich, (2008) stated that an effective teaching and learning should;

**1. Be Inquiry based:** Teachers should build the subject program around inquiry process by;

Selecting content and adapting curricular to address students learning needs, developing activities and assessments that promote student's depth of understanding, working together as colleague across disciplines and class levels.

**2. Facilitate Learning:** Teachers should guide and facilitate learning with a variety of strategies such as;

Helping students focus their inquiries and ideas, orchestrating student to discuss, requiring students to share responsibility for their own learning.

**3. Create classroom community:** Teachers should develop communities of learner in which all members;

Respect the ideas and diverse experience of others, collaborate and make decisions about the contents and context of their work, engage in on-going formal and informal discussion.

From the above assertions, an effective pedagogy is that which engages students actively in

the teaching and learning process and guides students successfully through exploration to become creative and critical thinkers as well as problem solvers. Effective teaching encourages students to grapple with the ideas which they need to develop their own understandings and construct meaningful knowledge. Pedagogy with these inherent qualities includes inquiry method of teaching among the innovative teaching methods. Inquiry as an effective method for teaching biology encourages questioning or seeking for information about phenomena; it fosters and encourages scientific process such as:

Observation - Observing matters or phenomena

Measurement - Quantitative description of objects and phenomena

Experimentation - Testing Questions and ideas

Communication - Communicating results to the scientific community and the public. Inquiry involves mental process - such as inductive reasoning, formulating hypothesis and theories, deductive reasoning, analogy, extrapolation, synthesis and evaluation which are needed in various activities in the teaching and learning of biological concepts.

### **2.1.2 Methods of teaching**

Teaching is a process of impacting knowledge which involves many activities on the part of the teacher and the learners. There are different types of teaching methods: Lecture/expository method, discussion method, demonstration method, recitation method, lecture/discussion method, Games and simulations method, problem-solving method, Role-play method, scaffolding method, inquiry learning methods among others.

### **2.1.2.1 Teacher-centered Approach**

Teacher-centered approach includes all the teaching methods that the teacher dominates in the lesson procedure and takes the lead in coordinating the classroom activities as regards to what to be done. Teacher-centered classroom is thus rigidly structured and only factual information is conveyed to learners. For instances in the lecture method, the instructor presents fact and principles orally. Considering other teacher—centered approaches; O’Bannon (2002) described demonstration as a teaching method that involves the teacher showing students a process or procedure involved in a learning process. The demonstration method has some advantages over the lecture method in skill acquisition, the disadvantage remains that the learners follow the rigidly prescribed probed procedure by the teacher and this makes it not effective for science teaching. Then the discussion method among other teacher-centered approach is a more advanced teacher-centered approach in which an issue in the learning content is posed as a question by the teacher and each of the students chips in different ideas etc. The discussion method also has its prone and cones with some degrees of student-centeredness as the teacher decide what is to be discussed. However, in all the mentioned teaching methods the teacher determines the content and the questions and takes upper control in the flow of information or knowledge hence they are considered as teacher-centered approach to teaching.

### **2.1.2.2 Student-centered Approach**

Student-centered approach includes all teaching methods that underscore the teacher as a decision maker and problem solver in the class room but rather see teachers as guides, facilitators, mentors, coach or consultants in the teaching and learning process. In the educational sector the term ‘student-centered’, ‘child- centered’ or ‘learner-centered’ are interchangeably used to refer to teaching methods that allow students to share some degree of

responsibility and decision making in the classroom. According to O'Bannon, (2002) student-centered approach is grounded in constructivism, with the epistemological view that learners are the architects of their own idiosyncratic meanings of concepts and natural phenomena. In view of this, student-centered approach is based on constructivists principles and ideas.

How-ever Campbell (2006) inferred that the cognitive learning theory also advocate for student-centered idea. Thus student-centered approach is based on the constructivists as well as cognitive theories with the educational applications linked to the works of Dewey and Piaget among others. In discussing student- centered teaching methods, such terms like constructivism, inquiry and discovery learning are often interchangeably used. Nevertheless, in today's educational discussions the term student-centered approach is a broad term that includes all innovative teaching methods that are usually activity oriented, where learners are expected to observe, analyze, synthesize and evaluate ideas or phenomena using materials or previous knowledge. The student-centered approach is relevant to Biology teaching because in biology teaching, creating an environment that will encourage students to interact with materials and specimens enables students to construct meaningful knowledge and learn Biology first hand.

### **2.1.3 Inquiry methods of teaching**

Inquiry teaching method is recommended for teaching Biology because it provides students with the opportunity to explore the world of things around them through the scientific process.

#### **2.1.3.1 Guided Inquiry**

With respect to the present study, guided inquiry entails instructional process where the search for knowledge is initiated by the teacher's questions; the teacher also provides assistance to learners during the teaching and learning process to enable the learner construct

meaningful knowledge. In guided inquiry method, teachers and learners play crucial roles in asking questions developing answers and procedures that will enable learning to take place. Thus, Campbell (2006) defined guided inquiry as a range of investigative structured activities where an instructor provides problems or questions and encourages learners to work out procedure for solving problem or answering question. This definition indicates that in guided inquiry that the students are provided with the specifics, data or facts to solve a problem or answer a question but are allowed to discover the solution or answer with which to make generation. In guided inquiry the instructor through structured learning activities, states problem, formulates hypothesis thereby structuring the reasoning ability of the learner.

The followings are the prospects of guided inquiry:

- i. It provides students direction towards information location.
- ii. The structured questions compel students to think critically and analytically
- iii. It helps students to organize and facilitate learning
- iv. It ensures that students do not get frustrated and experience failure in the teaching and learning process
- v. It limits student creativity unlike the unguided or open inquiry etc.

### **2.1.3.2 Unguided Inquiry**

Unguided inquiry includes all instructional process by which questions or problems and procedure for investigation are carried out by the students with little or no form of assistance from the teacher; in which case the questions are open- ended and less structured. Bilgin (2009) defined unguided/open inquiry as a student-centered approach to learning that begins with students designing questions, conducting an investigation and communicating results to others. Unguided inquiry is referred to as full inquiry in the sense that learners are given freedom to carry out all the inquiry process; select the research questions, carry out method

of investigating the hypothesis and draw conclusions. The teacher may control only the materials provided or encourage student-initiated materials. Unguided inquiry allows students to work directly with the concepts, materials and environment in order to discover the specific and facts that is used for generalization. The benefits of unguided inquiry include that:

- i. It encourages no wrong results
- ii. It enables students to obtain results and decide the values
- iii. It encourages high engagement of students in the learning process
- iv. It involves high order thinking thus it promotes creativity in students.

#### **2.1.4 Students Achievement in Biology**

Achievement is an important educational variable that expresses the success or failure of a teaching and learning process. Adeyemi (2008) described academic achievement as the scholastic standing of a student at a given moment which states individual's intellectual abilities; which can be measured by grades obtained from examinations or continuous assessments (tests or quiz). In Nigeria, the level of student academic achievement in the senior secondary school is determined by grades obtained from external examination; Senior School Certificate Examination conducted by external examination bodies WAEC and NECO respectively. The pattern of grading candidates score in the examination is such that distinction grades were represented by A1-B2, credit grades C4-C6, ordinary pass D7-D8 and failure grade F9. Ibe (2004), Adeyemi (2008) and Opara (2011) indicated that inquiry teaching method improves student academic achievement as opposed to the traditional teaching methods. Nevertheless, these previous studies did not determine the effects of different types of inquiry on student's achievement. The limitations of these previous studies therefore call for the present study which intends to determine the effects of guided and

unguided inquiry on student's academic achievement.

Available studies Ibe (2003) and Opara (2011) indicated that inquiry teaching method improves student academic achievement as opposed to the traditional teaching method. Nevertheless, these previous studies did not determine the effect of different types of inquiry on student achievement. The limitations of this previous studies therefore call for the present study intends to determine the effect guided and unguided inquiry on student academic achievement.

### **2.1.5 Gender issues on Students Achievement in Science (Biology)**

Gender is a socio-culturally constructed concept of ascribing some characteristics and roles to sex such as male and female within the society. In Nigeria the issue of gender and gender stereotyping permeate every aspect of human endeavor. Okeke (2007) observed that the circumstances of gender have strongly interacted with culture to produce sex role-stereotypes which cut across social, economic, political and educational development especially in the areas of science and technology. Nzewi (2010) explained sex role-stereotypes as the socio-cultural classification of human activities by sex in line with what the society considers as appropriate for one sex or the other. The arbitrary assigning of roles and expectations to different sex (male and female) within the society has given rise to such misconception of perceiving science as 'masculine' and of male domain only. Oludipe (2012) observed that in Nigeria that certain vocations and professions have traditionally been regarded as men's (Medicine, engineering and architecture among others.) and others as women's (nursing, catering, typing among others.). The society's socio-cultural construct of females as weaker sex together with female self-perception of themselves as weaker sex, inferior and subordinate to the males have impose some socio-cultural limitations on female aspirations and achievement in sciences (Ojobo, 2008).



Similarly, Nzewi (2010) inferred that the socio-cultural upbringing of females within most Nigerian homes tends to shape the girl-child away from science and science related disciplines. For- instance in most homes what are regarded as complex and difficult tasks are allocated to boys whereas girls are expected to handle the relatively easy and less demanding tasks. Consequently, fewer females opt for science subjects thereby creating some differences in the number of males and females in science discipline in favor of the males. Gender issues and its effects in student academic achievement in science has persisted over the years with contradicting results and stands out as a controversial issue in science education due to varying reports from different researcher. Some researchers: Ibe (2004), Iweka (2006), Obiekwe (2008), and Okoro (2011) are of the view that males perform better than females in sciences whereas some other educators: Okeke (2007); Oludipe (2007) and Nzewi (2010) are of the view that both males and females achieve equally in science when given equal opportunity and facilities.

## **2.2 Theoretical framework**

Theories are formulated to explain, predict and understand phenomena and in many case to challenge and extend existing knowledge within the limits of critical bounding assumptions. The theoretical framework is the structure that holds or support a theory of a research study. In education there are many learning theories which include: Cognitive, social learning theories etc. The views and perceptions of these theories on knowledge construction acquisition vary. According to Ngwoke (2008), the social learning theorist understand learning simply as imitation while the cognitive theorist view learning as change in perception that involves active mental process.

### **2.2.1 Constructivists Views on Learning**

Constructivism according to Educational Broadcasting Corporation (2004) is not a teaching theory but rather a theory of learning which argued that human beings generate knowledge and meaning from interaction between their experience and ideas. Thus to the constructivists, learning is simply the experience gained by learner's interaction with the environment. Hence, the Constructivists like the cognitive theorists see learners as active creator of knowledge. To construct knowledge Donald C. Orlich (1998) noted that learners must ask questions, explore and assess what are known - which are the elements of inquiry teaching methods.

In view of the application of inquiry process into knowledge construction (constructivism), inquiry and constructivism are interrelated and share some common characteristics which are summarized by Donald C. Orlich (1998) as follows:

- i. The focus is on the student
- ii. The pace of instruction is flexible not fixed
- iii. Students are encouraged to search for implications
- iv. Students are encouraged to generate multiple conceptions
- v. Students must justify their methods for problem solving
- vi. Neither constructivism nor inquiry sees itself as the sole learning model for Content.

Considering the interrelationship of inquiry and constructivism, this study poses as a question. How constructive can a learner be when guided or unguided? To provide an answer to the above question, the researcher intends to review the ideas and philosophies of John Dewey and Jean Piaget, as the base for this study.

## **2.2.2 Cognitive and Social Constructivist's Learning Theories:**

### **2.2.2.1 John Dewey's cognitive Theory**

John Dewey was a philosopher, psychologist and educational reformer who contributed and influenced education and social reforms especially in such topic like inquiry teaching and learning among others. Dewey states that knowledge emerges only from situations in which learners have to draw them out of meaningful experience. Dewey argued that education and learning are social and interactive processes and that the school as a social institution provides an environment in which social reforms can and should take place. He sees the classroom as a social context where students can take part in manipulating materials and thus form a community of learners who construct their knowledge together. Dewey believed in one permanent frame of references; namely the organic connection between education and personal experience. He maintained that every experience enacted modifies further experience and results in positive attitude and growth of understanding. Another vital issue raised by Dewey is that, he believed that students thrive in an environment where they are allowed to experience and interact with the curriculum, as such Dewey emphasized that all students should have the opportunity to take part in their own learning. The obvious implication of Dewey's theory in this study is that in the learning process, students must be engaged in meaningful activities that induce them to apply the concepts they are trying to learn. The teacher's role should be to provide enabling environment for active learning to take place such an environment could be the guided inquiry approach.

### **2.2.2.2 Jean Piaget cognitive learning theory**

Jean Piaget proposes that the basis of all learning is the child's own activity as the child interacts with the physical and social environment. To Piaget knowledge does not and cannot have the same purpose of representation of an independent reality but instead has adaptive function. Piaget recognized that human beings are born as active exploratory information

processing organisms and actively construct their own ways of thinking about things based on their current level of maturation, actual experiences with objects, people and ideas. Piaget believed that the child's mental activity is organized into a structure called 'schema' or pattern of behavior which develops as the child passes through stages of mental development, through the sensory motor, preoperational concrete and formal operational stages (from infancy to maturation). Thus as children grow and develop, they go through stages in which they accept ideas that they may later discard as wrong. Understanding is therefore built up step by step through active participation and involvement.

Piaget used the term assimilation, accommodation and reorganization to explain his views about the learning processes in children. The child assimilates new objects by making accommodation that build new cognitive structures. Nnachi (2007) observe that although Piaget recognized the importance of environment in child development but he laid much emphasizes on the role of cognitive structure which helps the child to build experience from important event to be superior to the environmental influences. To Piaget true learning is not something handed down by the teacher, but something that comes from the child through the process of spontaneous invention and discovery. Piaget then maintained that the basis of learning is discovery hence 'to understand is to discover or reconstruct by rediscovery and such conditions must be complied with, if in the future individuals are to be formed who are capable of productivity (critical thinkers), creativity and not simply repetitions

## **2.3 Review of Empirical Studies**

### **2.3.1 Studies on Effects of Inquiry Methods of Teaching on Students Achievement in Biology**

Nwagbo (1997) carried out a study on the Effects of Guided Inquiry and Expository teaching methods on the Attitude and Achievement in biology of students of different levels of scientific literacy. A pre-test, post- test non-equivalent control group design was used for the

study. One hundred and forty-seven (147) SS 11 students from 4 secondary schools (two school assigned to treatment and the other two schools assigned to control) in Nsukka Urban area of Enugu State, were selected through simple and stratified random sampling techniques. Three instruments: Scientific Literacy Test (SLT), Attitude to Biology Scale (ABS) and Biology Achievement Test (BAT) were used to collect data. The data were analyzed using mean, standard deviation and ANCOVA. The findings of the study indicated among others that the guided inquiry approach favored the students in the high level group better than the medium and low level groups respectively in enhancing achievement in biology more than the expository method. The researcher concluded that guided inquiry approach was significantly better than expository method of teaching in enhancing student's cognitive achievement in biology for all levels of scientific literate student.

In a study, Ibe and Nwosu (2003) investigated the Effects of Guided Inquiry and Demonstration Methods of teaching on Science Process Skills Acquisition among secondary school biology students. The design for the study was quasi-experimental, specifically the non-equivalent pre-test, post-test. One hundred and fifty (150) senior secondary one biology students in co-educational schools formed the sample. Three (3) co-educational schools were randomly drawn from the seventeen (17) co-educational secondary schools in Minna Metropolis of Niger State. Intact classes were randomly assigned to two experimental groups. Groups one and two were taught using guided inquiry and demonstration methods respectively. The control group was taught using conventional (lecture) method only. A test of science process skills Acquisition

(TOPSA) of twenty (20) items was developed and used in obtaining data on student's acquisition of the process skills of science. The data was analyzed using mean, standard deviation and ANCOVA at 0.05% level of significance. Result obtained from the study

revealed that the students taught through guided inquiry method performed significantly better than those taught through demonstration and conventional (lecture) methods. The researcher recommended that teachers should use guided inquiry method of teaching as it challenges students to be actively involved in the classroom.

### **2.3.2 Studies on student Achievement in Science (Biology)**

In a related study, Yong (2009) carried out a study on students Motivational Orientations and their Association with Achievement in Biology in Brunei Darussalam. Population for the study included 296 grade 11 students from a government secondary schools (142 males and 154 females) randomly selected from science stream classes. Data for the study was collected using Students Motivational orientations in Learning Biology Questionnaire (SMOLQ) adapted from Sideridis (2002) which consisted of seven constructs namely: behavioral intention, behavioral beliefs, outcome evaluation, normative belief, motivation to comply and goal importance. Data collected from the study were analyzed using pearson product-moment correlation. The results obtained showed that behavioral intentions outcome evaluation and goal importance were significantly correlated with achievement. This indicated that high achievement score is associated with student interest.

### **2.3.3 Studies on influence of Gender on Students Achievement in Biology**

Gender differentiation is an old and long controversial issue in education. Different opinions and views abound on the issue of gender and its effect on student achievements especially in sciences. There are two strong arguments as regards to the effect of gender and achievement in science. The proposing argument and researchers; Obiekwe (2008) Yong (2009), Okoro (2011), Opara (2011) and Nasr and Asghar (2011) contend that there is a significant difference in the achievement and interest between male and female students in Biology, whereas the opposing argument and researchers Ibe (2004), Nwagbo and Chukelu (2011),

Bello and Abimbola (2012) and Oludipe (2012) are of the view that there are no significant difference in the achievement and interest of male and female students in biology that both male and female students achieve equally in biology when exposed to the same treatment and given equal opportunity.

Similarly, Oludipe (2012) investigated the influence of gender on Junior Secondary Students Academic Achievement in Basic Science Using Co-operative Teaching Strategy. The study employed a quasi- pre-test, post-test experimental design. Sample for the study consisted of One hundred and twenty (120) students drawn from intact classes of 3 selected Junior Secondary Schools in Ogun state. Data for the study was collected using lesson notes based on Jigsaw II cooperative learning strategy and Achievement Test for Basic Science Students (ATBSS). The data collected was analyzed using descriptive and independent samples T-test Statistical methods. Findings from the study revealed that there was no significant difference in the academic achievement of male and female students in the pre-test, post-test and delayed post-test levels respectively. However, this study did not investigate the influence of gender on interest in the use of cooperative learning teaching strategy in Biology.

From the studies reviewed on the issues of gender and student achievement in Biology there are limited studies on the effects of gender on student and no consensus reached on the effects of gender differentiation on the achievement of male and female student in Biology. In view of this, the present study intends to investigate and determine the effects on gender differentiation on male and female student achievement using inquiry teaching methods (guided and unguided) and also the interactive effect of gender and the inquiry teaching methods (guided and unguided) on student achievement in Biology.

## **2.4 Summary of Literature Reviewed**

Biological knowledge is an essential element for national and human development. Over the years use of ineffective teaching methods in teaching biology has contributed to the reduction in the number of students that could have opted for biological sciences and also in harnessing of the potentials in students of biology. In view of these shortcomings, researchers in Biology Education have continued to search for an effective teaching method that could facilitate teaching and learning of Biology to enhance student achievement and interest in Biology. The persistent search for an effective method of teaching Biology culminated to the identification of inquiry teaching method among other innovative teaching methods (student-centered approach).

Inquiry teaching methods are grounded in constructivism and grouped into different types; guided, unguided and coupled inquiry. The present study intends to determine the effects of two types of inquiry guided and unguided on students' achievement and interest in biology, guided and unguided inquiry teaching methods emphasize different degrees of student-centeredness in the teaching and learning process and may have different effects on students' achievement and interest in Biology. This study intends to determine the effects of independent variable (Guided and Unguided Inquiry Teaching Method) on dependent variables (Achievement and Interest) as well as the effects of gender as a covariant on student's achievement in Biology. In view of the limited studies on the effects of guided and unguided inquiry teaching methods on students achievement in Biology and the inconclusive issue of the influence of gender on students achievement in Biology, this study deemed it necessary to investigate the effects of Guided and Unguided Inquiry teaching methods on students achievement in biology and also the influence of gender on students achievement in Biology using guided and unguided methods of teaching respectively.



## CHAPTER THREE

### 3.0

### RESEARCH METHOD

This chapter describes the method that will be used to carry out the study.

#### 3.1 Research Design

The design for the study is quasi-experimental. Specifically, the study applied pre-test, post-test Non-equivalent control group design. Quasi--experimental design is considered appropriate for the study because intact classes were used to avoid disruption of normal class lessons. The pre-test was used to partial out initial difference in the two groups and also to control selection bias which is a threat to internal validity.

The study design is illustrated in the figure below:

Group 1	$O_1$	$X_1$	$O_2$
Groupn2	$O_1$	$X_2$	$O_2$

Where

$O_1$  – Pre-test

$X_1$ –Treatment for Experimental group 1

$X_2$  – Treatment for Experimental group 2

$O_2$  – Post test

#### 3.2 Population of the Study

The proposed Population for this study includes students of all selected senior secondary one (SSI) Biology students in Bosso Local Government Niger state. However, a sample

population of eighty (80) Senior Secondary one (SSI) Biology students from two co-education secondary schools purposely selected in Bosso Local Government from two intact classes of forty (40) students each was used for the study.

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

The random sampling technique was used to select schools from Bosso Local Government area, two schools were purposely selected. The choice of co-education schools was because gender is one of the variables under studied. One intact class of 40 Biology students of SSI will be randomly selected from each of the schools sampled making a total of two intact classes of 80 SSI Biology students from the two co-education schools.

### **3.4 Research Instrumentation**

One instrument; Biology Achievement Test (BAT) was developed by the researcher and used to collect data for the study.

#### **3.4.1 Development of Biology Achievement Test**

BAT is made of 30 multiple choice objective questions developed by the researcher. The multiple choice question items were developed using Biology text books based on the content taught in the lesson. The questions were positively scored and consists of only one section which comprises of four options of answers for each question (A, B, C and D). Each of the questions carries one mark each.

Content validity was done using Table of Specification/Test Blue Print. The questions were based on low order cognitive domain (knowledge, comprehension

### **3.5 Validation of Research Instrument**

Validity refers to the preciseness, accuracy and meaningfulness of inferences which are based on the research results. In order to ensure validity, the research instrument (Biology Achievement Test) was face validated by two experts from Science Education Department.

### **3.6 Method of Data collection**

Data for this study was collected through pre and post tests using the BAT. The researcher first visited the two co- educational schools to be used for data collection simultaneously, the pre-test was administered to the subjects before the treatment to measure the students group equivalence and to provide the researcher with baseline data about the subjects. The treatment was carried out by the researcher twice in one week to ensure proper understanding of the topics treated, while post-test was administered to the students one week after the treatment. Data collected from the two tests (pre and post) after treatment will be used for data analysis.

### **3.7 Method of Data analysis**

The scores obtained from the pre and post-test will be analyzed using T-test. The statistical tools used for analysis of hypothesis was T-test. A T-test was carried out on the pre-test and post-test mean achievement scores in the two groups at  $P \leq 0.05$  level of significance.

## CHAPTER FOUR

### 4.0 DATA ANALYSIS AND RESULTS

#### 4.1 Presentation of Results

The data analysis of this study and result obtained are presented according to the research questions and hypothesis of the study. All the hypothesis were tested at the 0.05 level of significance.

##### 4.1.1 Anova Analysis of Pre-test Scores of Experimental I and Experimental II

###### Group

##### 4.1.2 Table 4.1 T-test Comparison of the Mean Scores of Students Exposed to Guided Inquiry and Unguided inquiry.

Variable	N	Mean	S d	df	t cal	P value
Experimental I	40	13.98	4.46			
Experimental II	40	11.95	3.92			

Significant at  $P < 0.05$  level.

The result in the table 4.1 shows that t cal (2.15) is Significant at  $P < 0.05$  level alpha level.

The total number of students exposed to guided and unguided (Experiment I and II) inquiry learning was 40 respectively, while the mean achievement score were 13.98 and 11.95 respectively with standard deviation 4.46 and 3.92 as well as P value at 0.03. Therefore, there was significant difference in the mean achievement scores of experimental I and II groups.

## 4.2 RESEARCH QUESTION ANALYSIS

### 4.2.1 Research Question 1: What are the relative effectiveness of guided and unguided inquiry methods of teaching on student academic achievement in Biology?

**Table 4.2: Mean and Standard Deviation of the post test Mean Achievement Scores Experimental I and Experimental II group**

Variable	N	Mean	Sd
Experimental I	40	16.33	5.29
Experimental II	40	13.75	4.93

The result in Table 4.2 shows the analyzed result of the mean and standard deviation of the guided and unguided inquiry method of teaching on student academic achievement in biology. The mean and standard deviation of guided inquiry was (16.33) and (5.29) respectively while the unguided was (13.75) and (4.93) respectively. The mean difference also was (2.58).

#### 4.2.2 Research Question 2: What is the influence of male and female students taught Biology using guided inquiry method?

**Table 4.3: Mean and Standard deviation of male and female student taught Biology using guided inquiry method.**

Variable	N	Mean	Sd
Experimental I (Male)	20	17.05	5.92
Experimental I (Female)	20	15.35	4.25

The result in Table 4.3 shows the analyzed data of the mean and standard deviation of achievement scores of male and female student taught biology using guided inquiry method. The result shows the mean and standard deviation of guided male as (17.05) and (5.92) respectively as well as guided female (15.35) and (4.25) respectively. The mean difference score was (1.70).

**4.2.3 Research question 3: What is the influence of male and female students taught Biology using unguided inquiry method of teaching?**

**Table 4.4: Mean and Standard deviation of achievement scores of student taught biology using unguided inquiry method.**

Variable	N	Mean	Sd
ExperimentalII (Male)	20	12.35	4.18
Experimental I (Female)	20	12.15	4.27

The result in Table 4.4 shows the analyzed data of the mean and standard deviation of achievement scores of male and female student taught biology using unguided inquiry method. The result shows the mean and standard deviation of unguided male as (12.35) and (4.18) respectively as well as unguided female (12.15) and (4.27) respectively. The mean difference score was (0.20).

**4.3 Hypothesis Testing**

**4.3.1 Hypothesis 1: There was no significant difference in the mean achievement scores of students taught Biology using guided inquiry and unguided inquiry method.**

**Table 4.5: t-test comparison of the post test mean achievement scores of experimental I and experimental II groups mean achievement scores in Biology.**

Variable	N	Mean	S d	d f	t cal	Pvalue	Remark
Experimental I	40	16.33	5.29				Significant
				78	2.25	0.02	P<0.05
Experimental II	40	13.75	4.93				

The result in the table 4.5 shows that  $t_{cal}(2.25)$  is significant at  $P < 0.05$  level of significance at alpha level. The total number of student exposed to the study was 40 respectively for both the experimental and control group, the mean and standard deviation respectively for the experimental was (16.33) and (5.29) while control group was (13.75) and (4.93) respectively. Thus, the null hypothesis is not rejected. Therefore, there is significant differences in the mean achievement scores of student taught biology using guided and unguided inquiry method of teaching.

**4.3.2 Hypothesis 2: There was no significant difference in the mean achievement score of male and female students taught biology using guided inquiry method of teaching.**

**Table 4.6: t- test comparison of the post test mean achievement scores of male and female student in inquiry method of teaching.**

Variable	N	Mean	S d	d f	t cal	P value	Remark
Experimental I	20	17.05	5.92				Not
				38	0.14	0.88	Significant
Experimental II	20	15.35	4.25				$P > 0.05$

The result in the table 4.6 shows that  $t_{cal} (0.14)$  is significant at  $P > 0.05$  level of significance at alpha level. The total number of student to this study was 20 respectively for both experimental groups. Experimental I had a mean score of (17.05) and standard deviation of (5.92) while the mean and standard deviation respectively of Experimental II was (15.35) and (4.25). The P value was (0.88), Therefore the null hypothesis was accepted. Thus, there is no significant difference in the mean achievement scores of male and female students taught biology using guided inquiry method of teaching.



**4.3.3 Hypothesis 3: There was no significant difference in the mean achievement score of male and female students taught biology using unguided inquiry method of teaching**

**Table 4.7: t- test comparison of the post test mean achievement scores of male and female student in inquiry method of teaching.**

Variable	N	Mean	S d	Df	t cal	P value	Remark
Experiment I (Male)	20	12.35	4.18				Not
				38	0.14	0.88	Significant
Experiment II (Female)	20	12.15	4.27				P>0.05

The result in the table 4.7 shows that t cal (0.14) is significant at  $P < 0.05$  level of significance at alpha level. The total number of student to this study was 20 respectively for both control groups. Control I had a mean score of (12.35) and standard deviation of (54.18) while the mean and standard deviation respectively of Control II was (12.15) and (4.27). The P value was (0.88), Therefore the null hypothesis was accepted. Thus, there is no significant difference in the mean achievement scores of Control I & II students taught biology using guided inquiry method of teaching.

**4.4 Summary of major findings**

The following findings were derived from the study:

Findings from hypothesis one using t-test revealed a significant difference on the effect of guided and unguided inquiry method of teaching on student achievement in biology in favor of guided inquiry method of teaching with Pvalue= 0.02

Result from hypothesis two indicated that there is no significant influence of gender on student achievement in biology using guided inquiry method of teaching with Pvalue=0.88

The result from hypothesis three showed that there is no significant influence of gender on student achievement in biology using unguided inquiry method of teaching with Pvalue=0.88s

## CHAPTER FIVE

### 5.0 SUMMARY, CONCLUSION AND RECOMMENDATION

#### 5.1 Introduction

This chapter presents the summary, conclusion and recommendation of this study as well as suggestions for further study.

#### 5.2 Summary

The purpose of this study was to determine the effects of guided and unguided inquiry method of teaching on student academic achievement in biology. Three research questions and three null hypothesis guided the study. The hypothesis was tested at 0.05 level of significance and they include:

**HO<sub>1</sub>:** There was no significant difference in the mean achievement scores of student taught biology using guided inquiry method and those taught using unguided inquiry method.

**HO<sub>2</sub>:** There was no significant difference in the mean achievement scores of male and female student taught biology using guided inquiry method.

**HO<sub>3</sub>:** There was no significant difference in the mean achievement scores of male and female student taught biology using unguided inquiry method.

Related literature was reviewed under three major headings namely; Conceptual framework, theoretical framework and empirical studies. Three research questions was analyzed using mean and standard deviation while three null hypothesis was analyzed using T- test statistics tested at  $P < 0.05$  level of significance.

Results of the study indicated that:

1. Students exposed to guided inquiry method had higher achievement more than those exposed to unguided inquiry method.
2. Gender has no significant effect on student achievement using guided inquiry method.
3. Gender has no significant effect on student achievement using unguided inquiry method.

The educational implications of this study was examined and it was also recommended that inquiry method both guided and unguided should be adopted by biology teachers to improve on student achievement in biology. Suggestions were made for further research.

### **5.3 Conclusion**

Based on the findings and experiment of this study, the following conclusions were made;

1. Guided inquiry method enhances student achievement in biology more than unguided inquiry method.
2. Gender has no significant influence on student achievement in biology using guided inquiry method.
3. Gender and inquiry method (guided and unguided) have no significant interactive effect on student achievement in biology.

### **5.4 Recommendation**

Based on the conclusions of this research work, the following recommendations were made;

1. Guided inquiry method should be used more with unguided inquiry method in teaching biology lessons in the classroom. The use of guided inquiry in teaching and learning biology will enable the student to develop inquiry skills needed for concept and knowledge construction which will help them to

appreciate biology better and improve on their achievement, while the use of unguided inquiry method will help teacher to Accommodate individual difference that may exist between male and female student in the classroom.

2. Biology teachers should be trained and retrained on the job to adopt the use inquiry teaching method in the teaching and learning process of biology in the classroom. Training of these teachers could be done by the government or relevant professional bodies like Science Teachers Association of Nigeria(STAN). through seminars, workshop and conferences.
3. Enough time should be allocated in school time table for effective use of inquiry method
4. Good learning environment with adequate instructional materials used to be put in all technical colleges to enhance achievement and good success.

## **5.5 Suggestions for Further Studies**

The following suggestions are made for further research;

1. Replication of the same study can be done in other educational zones within or outside the state.
2. Similar study could be carried out using another topic in biology.
3. Further study could be carried out to determine the effect of guided and unguided inquiry method of teaching on student academic achievement and retention of biology concepts.

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**APPENDIX I**  
**BIOLOGY ACHIEVEMENT TEST (BAT)**

**PRE-TEST AND POST-TEST FOR GUIDED AND UNGUIDED TEACHING METHOD**

**Sex:**

**Duration: (30) Minutes**

**Name of School**

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**Instruction: Answer all the questions.**

1. Which of the following food substances would be required by a farmer after Strenuous farming activity?
  - A. Unripe plantain
  - B. Beans
  - C. Jollof Rice
  - D. Orange juice and salad
2. Which of the following food substances is not a major source of protein?
  - A. Egg
  - B. Milk
  - C. Cow pea
  - D. Guinea corn
3. Which of the following sugar is a monosaccharide?
  - A. Cellulose
  - B. Fructose
  - C. Starch
  - D. Sucrose
4. A growing child requires relatively high amount of proteins in the diet because proteins
  - A. Maintains body weight
  - B. Yield high amount of energy needed for work
  - C. Promotes growth
  - D. Promotes bones and teeth formation



5. Which of these processes describes the formation of complex sugar from two molecules of simple sugars?
  - A. Condensation
  - B. Hydrolysis
  - C. Photosynthesis
  - D. Oxidation
6. A balanced meal for an adult man may consist of
  - A. 2 pieces of chicken, 4 balls of bean cake, 2 eggs and 2 cups of tea with milk
  - B. 4 slices of bread, a bowl of pap, 2 oranges and 2 banana fruit
  - C. 4 slices of yam with stew, 2 pieces of beef, a cup of tea with milk and 2 oranges.
  - D. A plate of beans, 2 pieces of meat, 2 eggs, a cup of tea with milk and 2 oranges
7. Which of the following statements about a balanced diet is correct?
  - A. It promotes health growth and development of body
  - B. It encourages under nutrition
  - C. It is a form of malnutrition
  - D. It gives energy only to the body
8. A urine sample of a patient tested with fehling's solutions A\$B gave an orange precipitate indicating the presence of
  - A. Glucose.
  - B. Sucrose.
  - C. Maltose.
  - D. Amino-acid.
9. The enzyme invertase will hydrolyse sucrose to give
  - A. Mannose and galactose
  - B. Glucose and fructose
  - C. Maltose and galactose
  - D. Glycerol and fatty acids
10. An individual whose diet consists mainly of cassava with melon soup, breadwith butter and ground nut is likely to feel
  - A. Tired on a cold weather
  - B. thirsty on a cold weather
  - C. Warm on a cold weather
  - D. Cold on a cool weather

11. Organisms that depend on manufactured food substances by other living organisms are called?
- A. Parasites
  - B. Chemotrophs
  - C. Autotrophs
  - D. Heterotrophs
12. Parasitism can best be defined as association between two organisms which?
- A. Both organisms benefit from each other
  - B. Both suffer same disadvantages
  - C. One organism gains and other loses
  - D. One organism gain and the other lose.
13. Which of these organisms is likely to be found at a refuse dump site?
- A. Amoeba
  - B. Mucor
  - C. Paramecium
  - D. Chlamydomonas
14. A stale loaf of bread changed taste and colour due to degradation caused by
- A. Parasitic feeding by bacteria
  - B. Saprophytic feeding by Rhyzopus
  - C. Symbiotic growth by lichen
  - D. Autotrophic feeding by spirogyra
15. Which of these structures is common to fluid feeders?
- A. Proboscis
  - B. Mouth brushes
  - C. Mandibles
  - D. Mouth parts
16. The four common types of teeth in mammals are arranged in the following order
- A. Incisors, canines, molars and premolars
  - B. Incisors, canines, premolars and molars
  - C. Canines, incisors, molars and premolars
  - D. Incisors, premolars, canines and molars.

17. The pulp cavity of the tooth contains which of the followings?
- A. Blood vessel
  - B. Enamel
  - C. Cement
  - D. Bones
18. Diastema is a dental modification found in which of these organisms
- A. Herbivores and omnivores
  - B. Carnivores only
  - C. Herbivores and carnivores
  - D. Omnivores only
19. Which of these parts of tooth will bleed when damaged?
- A. Enamel
  - B. Crown
  - C. Dentine
  - D. Pulp cavity
20. Which of the followings can cause tooth decay in man?
- A. Regular brushing of the teeth with fluoride paste
  - B. Intake of diet rich in calcium and phosphorus
  - C. High intake of pastries and sweeteners
  - D. Rinsing of the teeth with saline water before going to bed.
21. The hardest part of the teeth is called
- A. Gum
  - B. Root
  - C. Enamel
  - D. Cement
22. Which of the followings is not a types of teeth?
- A. Molar
  - B. Canine
  - C. Incisor
  - D. Canin
23. Herbivores lack canines because canines are used for?
- A. Cutting and holding food
  - B. Tearing of food and removing flesh from bones
  - C. Chewing and grinding food
  - D. Masticating and holding food from falling off

24. Longitudinal section of a tooth shows these major parts
- A. Enamel, dentine, pulp cavity, cement and blood vessels
  - B. Crown, neck, gum and root
  - C. Crown, neck, root and gum
  - D. Crown, neck, gum and cement
25. Children within the teething age are advised to take food substances rich in calcium and vitamin D because lack of calcium and vitamin D may result to
- A. Tooth decay
  - B. Malformation of the teeth and bones
  - C. Bleeding of the gum
  - D. Long teeth formation
26. Which of the following is not a characteristic of enzyme?
- A. They are proteins which are activated by co-enzymes
  - B. They are specific in action and can only act on a specific substrate
  - C. They are organic catalysts
  - D. Enzymic reactions are irreversible
27. Which of the following structures produces the greatest variety of digestive enzymes?
- A. salivary glands
  - B. Pancreas
  - C. Stomach
  - D. Colon
28. Which of this part of the alimentary canal of a bird when damaged can affect the digestion of grains?
- A. Crop
  - B. Proventriculus
  - C. Gizzard
  - D. Beak
29. The optimum temperature range for enzymic reaction is
- A. 20°C-25°C
  - B. 250C - 400C
  - C. 50C - 100C
  - D. 480C - 450C

30. If an enzyme works best in an acidic medium, in which of the following parts of the human gut is the pH best for enzymic activities?
- A. Ileum pH 9.0
  - B. Stomach pH 2.0
  - C. Duodenum pH 7.0
  - D. Mouth cavity pH 8.0

**Marking/Scoring guide for the biology achievement test (one mark for each correct answer)**

<b>1</b>	<b>C</b>	<b>16</b>	<b>B</b>
<b>2</b>	<b>D</b>	<b>17</b>	<b>A</b>
<b>3</b>	<b>B</b>	<b>18</b>	<b>B</b>
<b>4</b>	<b>C</b>	<b>19</b>	<b>D</b>
<b>5</b>	<b>A</b>	<b>20</b>	<b>C</b>
<b>6</b>	<b>C</b>	<b>21</b>	<b>C</b>
<b>7</b>	<b>A</b>	<b>22</b>	<b>B</b>
<b>8</b>	<b>A</b>	<b>23</b>	<b>B</b>
<b>9</b>	<b>B</b>	<b>24</b>	<b>A</b>
<b>10</b>	<b>C</b>	<b>25</b>	<b>B</b>
<b>11</b>	<b>D</b>	<b>26</b>	<b>D</b>
<b>12</b>	<b>C</b>	<b>27</b>	<b>B</b>
<b>13</b>	<b>B</b>	<b>28</b>	<b>C</b>
<b>14</b>	<b>B</b>	<b>29</b>	<b>B</b>
<b>15</b>	<b>A</b>	<b>30</b>	<b>B</b>

## APPENDIX II

### LESSON NOTES ON ANIMAL NUTRITION BASED ON GUIDED INQUIRY METHOD OF TEACHING

**SUBJECT:** BIOLOGY  
**CLASS:** SS 1  
**TOPIC:** FOOD SUBSTANCE  
**DURATION:** DOUBLE PERIOD (1hr :20mins)  
**DATE:** SEPTEMBER 2019.  
**WEEK (ONE):** PERIOD I

#### **Instructional Objective**

**By the end of the lesson the students should be able to:**

- (i.) define food substances
- (ii.) list 6 different types of food substances.
- (iii.) state 2 sources of carbohydrates and protein.
- (iv.) name 6 food constituent of a balanced diet, the importance and deficiency diseases
- (v.) state 3 importance of a balanced diet (vi.) carry out experiments on simple food tests,
- (vii.) report an experiment on a simple food test e.g. test for starch.

#### **Instructional Materials:**

The following materials and teaching aids would be provided and used for the lesson.

Different food substances such as: Garri, yam, rice, meat, butter, olive oil, common salt, fish, prawn, pepper, cowpea, crabs and onions etc. Charts; showing different classes of food and constituents of a balanced diet.

#### **Materials (Apparatus and reagents) for food tests.**

Fehling's and Benedict's solutions, dilute solution of sodium hydroxide ( NaOH) dilute hydrochloric acid (HCl) Cupper II Sulphate solution (CuSO<sub>4</sub>) e.t.c.

**Apparatus:** Test-tubes, test tube holders, filter paper, water, source of heat (Kerosene stove) chalk, chalk board and duster.

Entry behavior

The students have knowledge of nutrition in the previous lessons on characteristics of living things. The students eat different food substances and see different food substance at homes, markets places e.t.c.

### **Test of entry behavior**

The students were asked to:

- (i) define nutrition
- (ii) name some food substances.
- (iii) list 2 importance of food.

### **Instructional procedures**

#### **Step 1**

##### **Food Substances**

**Teacher's activities:** The teacher states instructional objectives on the board and provides the students with different food substances for identification and explanation.

**Students' activities:** The students identify and explain food substances and the importance of food. From the explanations and importance of food the students were able to deduce the definition of food substances.

#### **Step II**

##### **Six Classes of Food.**

**Teacher's activity:** The teacher divides students into 4 small groups of 10 students for each group and provides each of the groups with different food substances and asks the students to classify the food substances into six different classes of food.

**Students' activities:** The students in each of the small groups try to classify the different

food substances with the teacher's supervision and assistance.

### **Step III**

#### **Sources of Food Substances:**

**Teacher's activities:** The teacher asked each of the groups to list the local sources of the food substances and importance of each type of food substance.

**Students' activities:** Each of the groups tries to list the local sources of the food substances and their importance to man.

### **Step IV**

#### **Balanced Diet:**

**Teacher activity:** The teacher re-grouped the students into small groups and showed each group of the students a chart illustrating a balanced diet and asked the students to deduce the definition of a balanced diet from the illustrations on the chart, build up a balanced diet from the food substances provided and list the importance and some diseases caused by unbalanced diet.

**Students' activities:** Each of the groups observes the chart and tries to define balanced diet from the illustrations on the chart. Each of the groups builds up a balanced diet from the food substances provided to them, lists the importance of balanced diet and some diseases caused by unbalanced diet.

### **Step V**

#### **Simple Food Tests**

**Teachers' activity:** The teacher divides the students into 4 small groups of 10 students in each group and provides each of the groups with some apparatus and reagents for food test, some food specimens (starch, simple sugar, protein and lipids), a manual guide stating the procedure for food test and asked the students to carry out experiments on simple food test (starch, simple sugar, protein and lipids).



**Students' activities:** Each group of the students carry out the experiments following the procedures stated in the manual guide, observe and make inferences.

## **Step VI**

### **Reports on experiment on simple food test**

**Teacher's activity:** The teacher asks each group to report the experiment Students' activities: Each of the groups reports the experiment and submits to the teacher.

**Summary:** The teacher briefly goes through the lesson topic and highlights important points.

### **Evaluation:**

By the end of the lesson the students would be asked the following questions:

- (i) define food substances?
- (ii) list 6 different classes of food substances.
- (iii) name 2 local sources of carbohydrate and fat and oil.
- (iv) List 2 nutritional importance of carbohydrates.
- (v) list 6 constituents of a balanced diet.
- (vi) name a deficiency disease caused by lack of protein.
- (vii) using a piece of yam, demonstrate test for starch.

### **Assignment**

- (i) Find out the differences in the element composition of carbohydrates, proteins and lipids.
- (ii) List 3 types of carbohydrates and 2 types of proteins
- (iii) In a tabular form, list types of vitamins, sources, importance and deficiency effects.