EFFECT OF CONCEPT MAPPING ON STUDENTS ACADEMIC PERFORMANCE IN BIOLOGY AMONG SENIOR SECONDARY SCHOOL STUDENTS IN FUNTUA EDUCATION ZONE, KATSINA STATE

BY

ABUBAKAR HAMZA	14101110113
SANI ALIYU MUHAMMAD	14101110122
AKILU ABDULLAHI	I4101I0001
ASHAFA SANI	I4101I0084
ABUBAKAR DAHIRU	I4101I0095

Department of Science Education
Faculty of Humanity and Education
(FUGUS)

OCTOBER 2018

EFFECT OF CONCEPT MAPPING ON STUDENTS' ACADEMIC PERFORMANCE IN BIOLOGY AMONG SENIOR SECONDARY SCHOOL STUDENTS IN FUNTUA EDUCATION ZONE,KATSINA STATE

BY

ABUBAKAR HAMZA	1410110113
SANI ALIYU MUHAMMAD	1410110122
AKILU ABDULLAHI	1410110001
ASHAFA SANI	1410110084
ABUBAKAR DAHIRU	1410110095

BEING A PROJECT SUBMITTED TO THE DEPARTMENT OF SCIENCE EDUCATION, FACULTY OF HUMANITY AND EDUCATION, FEDERAL UNIVERSITY GUSAU, IN PARTIAL FULFILMENT FOR THE AWARD OF BACHELOR OF SCIENCE DEGREE IN EDUCATION BIOLOGY

NOVEMBER, 2018

APPROVAL PAGE

This project has been carefully read and approved as having satisfied the requirement for the award of degree of Bachelor of Science in Education (Biology) in Department of Science Education, Federal University Gusau.

Mal. Akilu Isma'il
Project Supervisory

28/11/2018
Date

Mal. Abdullahi Bello
Project Coordinator

29-11-18
Date

Dr. Bashir Suleiman
Head of Department

3/12/2018
Date

External Examiner

Date

ACKNOWLEDGEMENTS

We are indebted to all the people that have contributed in the course of this research work. We are gratefully acknowledging our supervisor in person of Mal. Akilu Isma'il for his contributions, informed criticisms and valuable suggestions throughout the preparation of this work. Without his persistent encouragement, patience and observations, the completion of this work would not have been made possible. We also like to express our profound gratitude to our HOD in person of Dr. Bashir Suleiman for his guidance, intellectual advice and patience in sharing his wide experience and ideas in different aspects during our study. In the same vain our sincere gratitude goes to our lecturers in the Department of Science Education, Educational Foundations and Biological Science, Federal University Gusau. And other staff of the Department of Science Education whose moral support and guidance encouraged us toward the successful completion of this study.

It is also our privilege to express our sincere appreciation and indeptness to Saifudden Shehu Aliyu for his moral and guidance support during the completion of this project. Also worth mentions our colleagues in the Science Education Section and all our friends at Federal University Gusau. We are also indebted to our dear parents for their efforts in our entire training and upbringing.

Finally, we are grateful to our brothers and sisters for their understanding, relentless prayers and patience throughout our stay in the university. May Allah (S.W.A) bless and reward them all.

TABLE OF CONTENTS

LIST OF APPENDICES

Appendix pages

ABSTRACT

The study investigated the effect of concept -mapping strategy and academic performance in excretion among secondary school students in Katsina state, Nigeria. A total of forty three (43) SS2 students from two public schools in Funtua Education Zone were randomly selected from a population of seven hundred and fifty nine (759) SS2 science students using balloting technique. This study adopted pre-test, post-test quasi-experimental-control group designs. Two groups were formed: The Experimental and the Control group. The experimental group students were taught Excretion using concept-mapping strategy while the control group students were taught the same concept using lecture method. The instruments used for data collection were Excretion Concept Performance Test (ECPT). The instruments were validated by both biology teachers .The Reliability coefficient of ECPT (0.59) respectively. The results of the study revealed that, Students in experimental group taught using concept- mapping strategy achieved significantly higher than the subjects in the control group taught using lecture method and there was no significant difference between male and female students' ability to construct concept mapping. It was recommended among others that, concept mapping strategy has been shown to improve academic performance for both sexes; therefore teachers should be advised to adopt the approach in teaching, and that, concept mapping strategy should be incorporated in Science curricula at Senior Secondary School level to encourage use of the strategy among science teachers.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

The economic strength of a nation is always assessed in term of its performance in science and technology (Olarinoye, 2006). In view of this importance, the Federal Government of Nigeria emphasized the teaching of science and technology in all institutions as contained in the national policy of education, Federal Republic of Nigeria (FRN, 2013). The country educational policies and programs are being directed toward science which includes biology. Biology is a science subject that deals with the study of living organisms. It has been discovered that our day to day activities was mainly on biology.

The term biology is coined from two Greek words, bios meaning life and logos meaning the study. Hence biology can simply be defined as the study of life Michael (2012). (Biology as a subject is made compulsory for all science students and it is pre-requisites to many disciplines such as Medicine, Pharmacy, Nursing, Biochemistry and Microbiology (Enjayewu, 2005). Science education provides a systematic understanding of nature, which comprises plants and animals. It equally studies adaptation of organisms to a specific function or environment. Consequently, at senior secondary school level in Nigeria, it is highly importance to give biology students foundation in biology education, this is necessary because a sound foundation from the early stage, will lead to more effective learning in the years ahead. Therefore, to achieve these, Biology teachers must be acquainted with different methods or strategies of teaching, so that they will be able to

teach different concepts in biology. There are different methods or strategies of teaching Biology by which a Biology teacher can use to teach many concepts of biology, some of these methods are demonstration method, discovery method, experimental method, excursion, field trip, expository approach, inquiry problem solving, participatory and host of others (Michael, 2012). But most of the Biology teachers depend on lecture method, to teach all concepts in biology. Adamu& Ahmad (2000) and Akibuilo (2004) viewed the use of inappropriate teaching methods as a major case of student's poor academic performance in biology examinations.

Academic performance is defined as the extent to which a students, teachers and institution has achieved their short and long term educational goals. Cumulative GPA and completion of educational degrees such as high school and bachelor s degrees. Academic performance is commonly measured through examination or continuous assessments but there is no general agreement on how it is best evaluated or which aspects are most important. According to Achino (2002), Academic performance is defined as the level of individual growth in the scores obtained in a test when compared with the scores of others of the same level Academic Performance is the level of individuals growth in a test when compared with the scores of others at the same level (Achino, 2002). The West African Examination Council (WAEC) and National Examination Council (NECO) lamented the poor students performance in public examinations (Oranu, 2012). Report of June 2009 NECO examination showed that out of 1,1376,906 candidates only 24.9%, 44.17%, 30.4% and 37% obtained credit and above in Mathematics, Biology, Physics and Chemistry respectively (Mosadomi, 2010).

The problem of poor academic performance in science subjects including biology has persisted over the years (Eguabor, 2001; Olalekan& Jerome, 2006; and Enesi, 2007). This observation has evoked much research effort aimed at evolving means of re-addressing the situation. Akibuilo (2004) attributed the Poor academic performance in science including Biology with Problems such as low morale of students, Poor Preparation of teachers, overcrowded classroom, inadequacy of laboratory, Poor attitude of students to work. Gross underfunding and inadequacy of rewards for excellence in science teaching and learning. Hence, this study investigated the influence of the concept mapping, academic performance and excretion in Biology.

The concept of excretion can be termed as the removal of waste Products from the body of a living organism. The common excretory Products formed in the bodies of animals are water, carbon dioxide, mineral salts and nitrogen compounds such as urea, uric acid and ammonium compounds. Excretion is the Process by which metabolic waste and other non-useful materials are eliminated from an organism. In vertebrates this is primarily carried out by the lungs, kidney and skin.

Concept mapping is an educational tool that is used to facilitate and demonstrate students' comprehension through the use of visual medium (Bienstein). Concept mapping are two or three dimensional spatial or graphical displays that make use of labeled nodes to represent relationship between pairs of Concepts (Bamidele, Adetunji, Awodele&Irinoye,2013). Concept maps have been found to be a useful classroom tools for observing nuances of meaning, helping students organize their thinking and summarizing subjects of study (Canas, Hill, Granados & Perez, 2003). From an educational perspective, a growing body of research indicates that the use of concept

maps could facilitate meaningful learning (Canas, Hill, Craft, Suri, & Lott, 2004). Concepts mapping teaching strategy have been found to enhance learning in the following manners as:

i) scaffold for understanding

ii) for consolidation of educational experiences

iii) to improve affective conditions for learning

iv) as an aid or alternative to traditional writing and as a mediating representation(Canas, *et al*, 2003)

v) Concept Mapping serves as a strategy to help learners organize their cognitive frameworks into more powerful integrated patterns (Kinchin, 2005)

Novak and Gowin noted that the act of mapping is a creative activity, in which the learner must exert effort to clarify meanings, by identifying important concepts, relationships, and structure within a specified domain of knowledge. The activity fosters reflection on one's knowledge and understanding, providing a kind of feedback that helps students monitor their learning and, perhaps with assistance of teachers or peers, focus attention on learning needs. Concept mapping is activity oriented, which involves students to think reflectively when linking concepts together to give meaning.

1.1.1 Theoretical Framework

Concept mapping is a meta-cognitive learning strategy based on the Ausubel-Novak-Gowin theory of meaningful learning (Ausubel, Novak, &Hanesian 1978; Novak &Gowin, 1984). It has its origins in a research done at Cornell University with a view to studying changes in students' understanding of science concepts over a 12-year span of

schooling (Novak, 1990). The research group led by Novak worked with the idea that new concept meanings were acquired through assimilation into existing propositional frameworks. This idea of hierarchical representation of concepts propositional frameworks was eventually described as cognitive mapping or concept mapping. Inquiry-based strategy of instruction is a constructivist based approach to education and according to Mayer (2004), it is supported by the work of learning theorists and psychologists such as Jean Piaget, Jerome Bruner and since then it has gained a lot of popularity. Martins &Oyebanji (2000) maintained that inquiry based activities are designed to enhance the development of skills among the learners. The inquiry based strategy is a child-centered activity oriented teaching method in which the teacher directs students through problem solving approach with the aim of discovering answers to instructional topics at hand (Nwagbo 2001).

Historically, the early paths of science instruction followed the philosophy of exercising student's minds through rote memorization of information. During the 1960's however, research done by Jean Piaget and Jerome Bruner, as well as others, began to change this approach of thinking about science instruction. These newly developed philosophies of learning styles and learning environments supported the assumption that "learners actively construct individual world views based on personal observations and experiences, and that learner's respond to instruction in terms of pre-existing intuitive perspectives (Andi, 2010). The theory of creativity begins with the creative process, and according to Wakili (2007), agreeing in total with the creative process is the process of becoming aware of problem deficiencies, gaps in knowledge, missing element disharmonies, bringing in new relationship and formulating hypotheses.Wakili (2007)

maintained that science and creativity are sensitive to reducing gaps in knowledge, deficiencies, missing elements, identifying difficulties and search for solutions to problems. They also asserted that creativity is related to many aspects of science when confronted with unfamiliar events including generating relevant and unique questions, identifying possible explanations, testing such ideas and predicting probable effects. Science should therefore produce students who are experienced in understanding the world and also generating novel scientific ideas which require a lot of creativity. The importance of students' learning to put their latent skills to optimal use is self-evident as education inculcates decision-making abilities. Learning of different subjects may not yield similar results as there are many factors that affect students 'achievement but teaching methods almost have same effect on students learning. Teaching of biolgy is facing dilemma for teachers as well as students. Biology curricula should inculcate creative thinking, critical analysis and theory in students.

It was on this premise that the theory of meaningful learning by (Ausubel, Novak, &Hanesian 1978; Novak &Gowin, 1984) on concept mapping and the constructivist theory on inquiry strategy that this study employed to find out the academic achievement and creativity of in Senior Secondary students in biology in Funtua zonal education.

1.2 Statement of the Problem

Teachers put limitations upon themselves and their students by adhering to traditional methods of teaching Biology. Smith, et al. (2001). Thus, the question of how student's academic performance in Biology can be improved still a pedagogical problem. Similarly, researchers such as lakpini (2006) emphasized that teachers shy away from

activity based of teaching and rely on methods such as lecture method that are esey but most often inadequate and inappropriate. This makes students to achieve poorly in secondary school subjects especially Biology which may eventually affects the students overall the performance.

Similarly, Abdulhamid (2012) suggested that teaching with the traditional lecture method, encourages students to most often think at the lower middle levels of cognition. Therefore, that gave way for the researcher to investigate the effect of concept mapping on the academic performance of senior secondary school Biology students in Funtua Education Zone, Katsina state.

1.3 Objectives of the Study

This study has the following objectives; to determine:

i. The effect of concept mapping strategy on biology students□ academic performance in excretion.

ii. Gender difference in academic performance when taught using concept mapping.

1.4 Research Questions

This study was guided by the following research questions:

1. What is the difference between academic performance mean scores of biology students taught excretion using concept mapping strategy and those taught excretion using lecture method?

2. What is the difference between the academic performance mean scores of male and female students exposed to concept mapping strategy?

1.5 Null Hypotheses

The following hypotheses were formulated to answer the research questions at 0.05level of significance:

$H0_1$: There is no significant difference between the mean performance scores of Biology students taught the concept excretion using concept mapping and those taught the using lecture method.

$H0_2$: There is no significant difference between the mean performance scores of male and female Biology students taught the concept of excretion using concept mapping.

1.6 Significance of the Study

The findings of this study would hatefully be useful in the following ways;

The findings of the study would facilitate the improvement of science teaching and learning of biology in secondary school, by using suitable teaching method that require students to brain storm. Text book publishers may find the study useful to design activities that involve.

The use of concept mapping to aid meaningful learning among students. Curriculum planners may incorporate the use of concept mapping teaching strategy in biology curriculum.

The findings would assist the science teachers to know the effect of concept mapping strategy on student's academic performance thereby adopting the method. Fellow researchers and professional bodies such as STAN may use outcome of the study to replicate it in the other study areas, improve on it or adapt it for similar studies. This study would add new information to the existing literature in biology.

i) Curriculum planners may incorporate the use of concept mapping teaching strategy in biology curriculum.

ii) Text book publishers may find the study useful to design activities that involve.

iii) Fellow researchers and professional bodies such as STAN may use outcome of the study to replicate it in the other study areas, improve on it or adapt it for similar studies.

iv) The findings would assist the science teachers to know the effect of concept mapping strategy on student's academic performance thereby adopting the method.

v) The use of concept mapping to aid meaningful learning among students.

1.7 Scope of the Study

This research investigated the effect of concept mapping teaching and academic performance in excretion among secondary school biology students in Funtua zonal education Katsina state, Nigeria. The research was delimited to all the 14 public secondary schools in Funtua education zone. The choice of public school was made because the schools comprise of students with average academic performance, average

age and financial status which makes them viable for the study. The study comprised seventy six SS2 students with average age of 16years. The choice of seventy six students selected was viable for the study and is in line with the central limit theorem. The SS2 students were also selected purposively for the study, because the concept of excretion in SS2 curriculum. The selected concepts taught were how plants excrete and how animals excrete. The hierarchical type of concept mapping was used in this study.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This study investigated the effect of concept mapping and academic performance among secondary school biology students in Funtua education zone Katsina state, Nigeria. The purpose of this chapter was to review the studies that were related to the research and is presented with the following sub-headings: Biology as a Science Subject in Secondary School. Academic performance in biology gender and academic performance in secondary school.

Overview of Similar Studies Implications of Literature Reviewed on the Present Study.

2.1.1 Biology as a Science Subject in Secondary School

2.2 Historical Background of Concept Mapping

2.3 Types of Concept Mapping

2.4 Uses of Concept Mapping in Teaching and Learning of science

2.5 The concept of excretion

2.6 Science Teaching Methods

2.6.1 Concept Mapping Teaching Strategy

2.7 Lecture Method of Teaching Science

2.8 Academic Performance in Biology at Secondary School

2.9 Implication of literature reviewed on present study

2.1 Biology as a Science Subject in Secondary School

Ogunleye (2000) observed that science is a dynamic human activity concerned with understanding the workings of our world. This understanding helps man to know more about the universe. Biology is one of the Science subjects taught in Nigeria Secondary Schools.

The term Biology is coined from two Greek words- bios meaning life and logos meaning the study. Hence biology can simply be defined as the study of life. Michael (2012). Biology as a subject is made compulsory for all science students and it is pre-requisites to many disciplines such as Medicine, Pharmacy, Nursing, Biochemistry, Microbiology, Science education provides a systematic understanding of nature, which comprises plants and animals.

Biology as a science subject is taught to student from SS1 to SS3. Biology is an important science subject that occupies a prominent place in the school science curriculum. The biology syllabus covers the plants, animals. The teaching methods employed for the teaching and learning of biology at the Senior Secondary School level has little or no positive effect on the Students□ academic performance in Biology. This is because majority of science teachers still teach students using the lecture method (Enesi, 2007). .Science educators such as Danjuma (2005) reported that about 80%-90% of the scientific information or principles students received from their teachers are through lecture method.

A number of activity-oriented instructional strategies have been advocated for by curriculum designers and Science educators to help improve on the failure rate among Secondary School Science Students (Eniayeju, 2001). In other word, Students are

required to pass biology at credit level in order to qualify for admission into any tertiary institutions to study pure or science education programs.

2.2 Historical Background of Concept Mapping

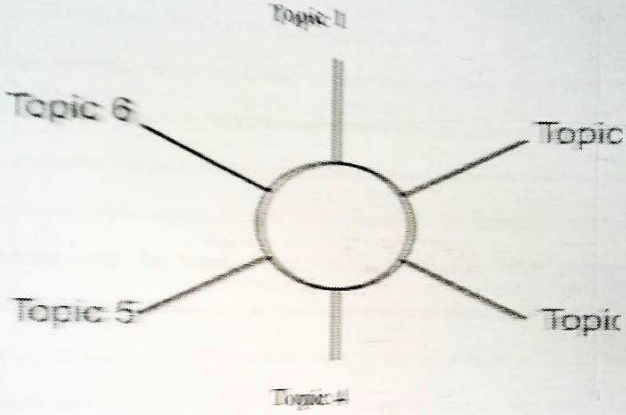
The technique of concept mapping was first developed in the 1960s and 1970s by American educator and research scientist Joseph D. Novak (1930) while at Cornell University, in Ithaca, New York. During this time, Novak, a professor of education and biological sciences, developed an effective way to strengthen the process for his students performing research. Novak discovered that representing thoughts visually often helped students to effectively associate ideas without being inconvenienced by writing them down in lengthy formats. Novak and his student found that they could represent newly learned information by first defining a concept, adding related topics, and linking similar ideas. Such an arrangement helped to organize research information and formulate educational theses.

Novak□s work was based on the cognitive learning theory first developed by educational psychologist David Ausubel in the 1960s. Also known as the theory of meaningful learning and assimilation theory, Ausubel□s theory became a tool for structuring information in an easy-to-recognize way. He found that students learned new material based on prior knowledge. According to Ausubel, by visualizing past knowledge, students were better able to control the learning process and, consequently, learned new information faster and more efficiently.

2.3 Types of Concept Mapping

According to the University of Illinois, US (2002), there are seven kinds of concept mapping which include.

1. A Spider concept mapping is a kind of mapping that is used to investigate and enumerate various aspects of a single theme or topic. It helps student to organize their thoughts. Outwardly radiating sub-themes surround the center of the map. It looks a bit like a spider's web, as its name suggests.



2. The hierarchy concept mapping presents information in a descending order of importance. Step by step the student noted down the relevant context in the given boxes/circles. It helps to understand and co-relate the subjects.

3. Multi-dimensional (3D dimensional) concept map describes the flow or state of information or resources which are too complicated for a simple two-dimensional mapping.

4. The flowchart concept map organizes information in a linear format.

2.4 Uses of Concept Mapping in Teaching and Learning of Science

Concept mapping is designed to help students and others clear up ambiguities and clarify misconceptions in information which often arise in the learning process, along with strengthening the memory and retention process after the learning is accomplished (Canas& Novak, 2008). Further explain that such improvements in education with the use of concept maps have been proven by scientific studies.

Concept mapping has been shown to help learners learn, researchers create new knowledge, administrators to better structure and manage organizations, writers to write, and evaluators assess learning (Larbi,2011).Concept maps are used to stimulate the generation of ideas, and are believed to aid creativity. For example, concept mapping is sometimes used for brainstorming. Although they are often personalized and idiosyncratic, concept mapping can be used to communicate complex ideas (Larbi, 2011). One big advantage of using concept maps is that it provides a visual image of the concepts under study in a tangible form which can be focused very easily. They can be readily revised any time when necessary. During the formulation process it consolidates a concrete and precise understanding of the meanings and inter-relation of concepts. Thus concept mapping makes learning an active process, rather than a passive one.

Concept maps used by teachers: Concept maps are used to clarify and arrange difficult concepts in a systematic order. Concept maps used as Ausubelian advance organizers also provide an initial conceptual frame for subsequent information and learning (Novak and Canas, 2008). Using concept maps to teach help teachers to be more aware of the key concepts and relationships among them. Teachers are able to convey a clear and general picture of the concepts and their relationship to students. Using concept maps reduce the

likely hood of teachers missing or misinterpreting any important concepts. In presenting concepts to students, teachers should never ask students to memorize prepared concept mapping. This could merely promote rote learning and so defeat the purpose of encouraging active meaningful learning on that part of the learner.

Concept maps use by students: Using concept maps reinforces students understanding and learning. This enables visualization of the concepts and summarizes their relationship. Many students have difficulty in identifying the important concepts in a text, lecture or other form of presentation. Part of the problem stems from a pattern of learning, that simply requires memorization of information, and no evaluation of the information is required. Such students fail to construct powerful concept and propositional frameworks, leading them to see learning as a blur of myriad facts, dates, names, equations, or procedural rules to be memorized. For these students, the subject matter of most disciplines, and especially science, mathematics, and history, is a cacophony of information to memorize, and they usually find this boring. Many feel they cannot master knowledge in the field. If concept maps are used in planning instruction and students are required to construct concept maps as they are learning, previously unsuccessful students can become successful in making sense out of science and any other discipline, acquiring a feeling of control over the subject matter (Bascones& Novak, 2000; Novak, 2004, 2005cited in Novak &Canas, 2008). Concept map is a strong tool for organization and consolidation of students□ knowledge base; and also for promotion of cooperative learning among students.

2.5 Methods of Teaching Science (Biology)

There are many methods and techniques for effective teaching. These different methods and techniques should be used skillfully in the class by the teachers in order to teach his students effectively. The skillful and competent teacher uses as many methods and techniques as possible because, there is no single method which is regarded as the best for every teaching situation. In a single lesson therefore, the teacher can employ as many methods as possible. The success or failure of any educational endeavor depends ultimately upon the method adopted by the teacher.

According to Mbah (2012) method can be defined as a practical application of teaching principles based on the nature of learner, the nature of the subject and the learning needs of the pupils/students (Vin-Mbah, 2012).

Basically, teaching methods can generally be classified into two broad categories, namely:

- Child-centered methods

- Teacher-centered methods

Child-Centered Methods include: Activity methods, assignment supervised study, discussion method, field trip Project method, Play and games method etc.

Teacher-Centered methods: The teacher centered methods as the name implies means that the principal actor in the lesson is the teacher while the learners are passive listeners. At the end of the lesson, the learner may ask one or two questions or be required to answer some questions or pass some comments or jot down some points. They are clear negation of the accepted view that learning is an active rather than a passive process that the best and most applicable learning is learning by doing. Lecture methods, questioning method and demonstration method are some of the teaching methods in this category

2.6 Concept Mapping Teaching Strategy

Concept mapping is the technique used by individuals and groups to organize, represent, and visualize knowledge and ideas in graphical formats. . Concept map according to Novak and Gowin (2008) is a schematic device for representing a set of concept meanings embedded in a framework of propositions. It is a two-dimensional hierarchical diagram that illustrates the interconnection between and among individual concepts. To Jonassen (2000), a concept map is a visual representation of concepts and their interrelationship. It is used to develop a structured framework in order to plan or evaluate various types and sizes of projects. Sometimes called knowledge maps, the graphical technique is based on graphically describing topics within one concept and/or relationships found among different concepts (Canas& Novak,2008). Concept mapping is one of the constructivists methods used in teaching science in most Western countries and it has been proved to be robust and versatile (Novak &Canas, 2008). Novak and Canas (2008) further explained that Concept maps are graphical tools used for organizing and representing knowledge. This includes concepts, usually enclosed in circles or boxes of some type, and the relationship between concepts indicated by a connecting line linking to concepts. Words on the line referred to as linking words or linking phrases specify the relationship between the two concepts.

Concept maps are generally, but not always, created so they are read from the top downward. Some concept maps are simple designs that examine one central theme and only a few associated topics. Other concept maps contain complex structures that describe multiple themes and relationships. Concept mapping has been reported to provide a very effective strategy to help students learn meaningfully by making explicit

the links between scientific concepts (Novak &Gowin, 2004 ;Adamczyk, Wilson & Williams, 2013; Fisher, Wandersee, & Moody).

2.7 Lecture Method of Teaching (Biology)

According to Brown (2012), the term lecture was derived from the Medieval Latin "Lecture" to read aloud. So, Lecture consisted of an oral reading of a text followed by a commentary. This is the oldest and the most common method in use at the tertiary level of our institutions. It is the process whereby the teacher verbally delivers a pre-planned body of knowledge to his students. The teacher talks while the students listen and jot down essential points. This method is teacher-centered. The teacher is the most active while students are passive. It is therefore used to teach a large group of students who are usually passive listeners with little or no opportunity to ask questions. Some researchers have compared the traditional method to other methods of teaching in students achievement. They found out that students normally taught with other methods do perform better than those taught with the traditional method. For instance, Apafo (as cited by Wood, 2007) conducted a study in Cape Coast using 45 males in Senior Secondary School on the topic excretion. The experimental group performed better and scores higher than the control group.

2.8 Academic Performance in Biology in Secondary School

In spite of the central and important position of biology among others science and related disciplines, studies revealed that, academic achievement of students in Biology at Senior Secondary School Certificate Examination (SSSCE) has consistently been very poor and unimpressive (Njoku, 2005).

Many factors have been suggested as contributing to the poor academic performance of students in particular and science in general. Some of these factors include: inadequate laboratory equipments poor teaching methods; among others. In summary, the problems militating against the advancement of science education have been well documented (Okoye, 2002) these are;

- Lack of adequate textbooks
- Lack of fund to purchase equipment
- Overcrowded classroom, laboratory, timetable
- Lack of cooperation by school administrators
- The pressure of external certificate examination
- Lack of proper monitoring and feedback mechanism
- Poor preparation of teachers who teach new programmed
- Lack of motivation among teachers
- Rapid rate at which teachers are transferred from one school to another or out of the profession.
- Overwhelming number of activities demanded by the new curricula and
- Shortage of qualified teachers.
- Inappropriate teaching method.

2.9 Implications of Literature Reviewed on Present Study

The review of literature made the researcher to discover that very little studies were conducted on outside the country. And from literature reviewed most of the studies on concept mapping did not cater more especially in biology which this study fill the gap. Literatures have revealed that series of researches were carried out on concept-mapping

strategy. For example Larbi (2011), Jack (2014), Cheema and Mirza (2013), Willerman and Harg (2006),Adloen(2013),Otor (2013) and many more investigated on the effects of concept-mapping strategy on students academic performance. While some researchers worked on student's perception, anxiety and interest from all the studies however, the researchers were either trying to find out students academic performance, anxiety, interest, attitude and perception when taught using concept mapping strategy.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This study investigated the effects of concept mapping on student's academic performance in excretion among secondary school biology students in Funtua education zone, Katsina State, Nigeria. The chapter is presented under the following sub-headings;

3.2 Research Design

3.3 Population of the Study

3.4 Sample and Sampling Technique

3.5 Instrumentation

3.6 Validation of the Instruments

3.6.1Pilot testing

3.7 Reliability of the Instruments

3.8 Procedure for data Collection

3.9 Procedure for data Analysis

3.2 Research Design

This study adopted pre-test, post-test quasi-experimental-control group design as proposed by (Kerlinger, 1973). The study involved two groups; experimental and control groups consisting of both male and female students. Pretest was administered to the two groups, before the treatment, to determine the groups equivalence based on the ability of the students. The experimental group students were taught excretion using concept

mapping strategy while the control group students were taught the same concept using the lecture method. At the end of the treatment period (two weeks), a posttest was administered to both groups of students in order to determine the effectiveness of the treatment on the students. The scores collected were analyzed using t-test and Pearson Product Moment Correlation. The design of the study is represented as follows;

EG→01→X1→02

CG→01→XO→02

Fig.1. Research design illustration

Source: (Adopted from sambo,2008 &Mamman, 2013)

Key:

EG= Experimental Group

01= Pre-test administered

02= Post test administered

X1= Treatment (Influence of concept mapping)

X0= No treatment

CG= Control Group

3.3 Population of the study

The population of the study covered all co-educational public senior secondary schools two (SS2) offering biology in Funtua education zone, Katsina state, Nigeria. There are fourteen co-educational public senior secondary schools with a population of seven hundred and fifty nine (759) senior secondary two students (SS 2) in the study area according to the Zonal Inspectorate of education Funtua (ZIEF, 2016). Public schools

were used because their organizational structure, condition of teaching and learning and mode of operation are relatively the same. From these, Five hundred and twenty (520) were male and two hundred and thirty nine (239) were female of average age of 17 years. The schools are operating as day schools. The detail of the summary of the used population is as shown in Table 3.1

Table 3.1: Population of the Study

S/N	Schools	Male	Female	Total
1	GDPSS Bakori	46	24	70
2	GDSSS Barde	26	09	35
3	GDSSS Dabai	46	12	58
4	GDSSS Dikke	22	18	40
5	GDSSS Makera	37	17	54
6	GDSS Kakumi	27	10	37
7	GDSS Kahutu	31	17	48
8	GDSS Tandama	33	16	49
9	GDSS Funtua	44	26	70
10	GSSS Goya	49	11	60
11	GSSS Kurami	22	13	35
12	GSSS Maska	37	08	45
13	GSSS Tuduniya	48	28	76
14	GSS Tsiga	52	28	80
Total		**520**	**239**	**759**

Source: Zonal inspectorate of Education Funtua. (ZIEF, 2016).

3.4 Sample and sampling technique

The sample consisted of 43 senior secondary two (SS2) Biology students that were selected through simple random sampling technique from two co-educational public schools of Funtua education zone. Two intact classes were used for the study from the two schools, one experimental class from GSSS Maska, and one control class from GDSSS Makera. The choice of 43 students as sample of this study is in line with sambo (2008) and the central limit theorem which recommended a minimum of thirty sample size viable for experimental research. The sample was divided into two groups namely the experimental and the control. Pre-test was administered by the researcher to 5 secondary schools to ensure selection of samples that are not significantly different in terms of academic achievement. Analysis of variance t-test was used for the analysis of results, the results was further subjected to Scheffe's test for final selection of schools with equal performance, based on this results, two schools were chosen i.e. GDSSS Maska and GDSSS Makera for the study. The detail of the sample of the study is presented in Table 3. 2.

Table 3. 2: Sample of the study

Schools	Group	Male	Female	Total
GSSS Maska	EG1	13	7	20
GDSSS Makera	CG	12	11	23
Total		**25**	**18**	**43**

3.5 Instrumentation

The instrument to be used for this study is Excretion Concept Mapping Performance Test (ECPT). The ECPT would consist of 30 multiple choice test questions that would be developed by the researcher based on excretion concepts which include excretory system, excretory mechanism in some organisms, excretion in mammals, and excretion in flowering plants. In construction of the test items, the researcher would develop a test blue print of Blooms Taxonomy. ECPT would be used on two different occasions, first as pretest to determine the current knowledge of the subjects at the beginning of the study, secondly, as a posttest to find out what the students would gain on the concept of excretion.

3.6 Validation of the Instrument

The Excretion concept performance Test (ECPT) to be used for data collection in this study it will be submitted to one senior teacher of biology who is vice academy in GDSSS Makera Funtua. Two science educators who are well experienced in concept mapping construction from Department of Science Education in Federal University Gusau for comment on the validity and correctness of the questions. All of these educators are senior lecturers with the minimum qualification of PhD.

3.6.1 Pilot testing

The essence of pilot testing is to find out how respondent the students would react to the instruments. The Excretion Concept Performance Test (ECPT) will be pilot tested on a sample of students having all the characteristics of the group in different school not

included in the selected sampled schools but part of the population of the study. The school that would be selected for pilot testing is GDSSS Makera.

3.7 Reliability of the Instrument

The split-half method (odd and even serial numbers) was used to test the reliability of the test scores on 43 students who did not form the sample of the study. The test was administered once to 43 science students from GDSSS Makera Funtua, Katsina state. The test scores were then split into two equivalent halves. The scores of the two halves were correlated and Pearson Product Moment Correlation Coefficient was used to determine the reliability of the instrument. From the result obtained, result was calculated and found to be 0.89, indicating a strong positive relationship. Thus, the instrument is reliable to measure the academic performance of the study subjects.

3.8 Procedure for Data Collection

During the familiarization, the experimental group and the control group were pretest. The test comprised items on the topic excretion. The pretest was to ascertain the homogeneity of the experimental and control groups, the researcher would administer the instrument ECPT to the treatment and no treatment groups. At the end of the two weeks teaching all the students would be given post test to measure the student's performance in excretion.

3.9 Procedure for Data Analysis

The data collect from the field will be analyzed using descriptive and inferential statistics, mean and standard deviation for research question will independent t-test will be used to

test the significance between the variables of all the null hypotheses at 0.05 level of significance.

CHAPTER FOUR

DATA ANALYSIS, RESULTS AND DISCUSSION

4.1 Introduction

In this chapter the result of data collected during the research and their discussions were presented. The data collected were analyzed using the Statistical Package for Social Sciences (SPSS) version 21.0 and the level of significance for retaining or rejecting the stated hypothesis was 0.05 at 95% significance level. The chapter also contain summary of the findings obtained from the results.

4.2 Data Analysis and Results

Three types of data were collected from the study which includes:

1. Performance scores from the pretest
2. Performance scores obtained from the posttest
3. Students□ scores from concept mapping construction after treatment.

The two groups of students that were used for data collection are the experimental group and the control group. The instrument were used for data collection is Excretion concept performance test (ECPT).

4.3 Answering Research Questions and Testing Null Hypotheses

Research Question One: What is the difference between mean scores of biology students taught using concept mapping strategy and those taught using lecture method?

To provide an answer to this research question, the mean standard deviation scores of students taught using concept-mapping strategy and those taught using lecture method of teaching in Excretion Concept Performance Test (ECPT) was used. The analysis is as shown in Table 4.1 bellow.

Table 4.1 Posttest Mean Scores of the Experimental and Control Group Based on Performance.

Group	N	Mean	Std. Deviation	Mean difference
Experimental	20	67.36	14.17	10.97
Control	23	56.39	12.37	

From Table 4.1, it can be seen that the mean score of experimental group students taught using concept- mapping strategy is higher than the mean score of the control group students taught using lecture method with a mean difference of 10.97. Therefore there is a difference in the performance of experiment group exposed to concept-mapping strategy and the control group taught using lecture method. This means that concept mapping enhance students' academic performance in biology. To find out how significant the difference is, t-test statistics was used in analyzing the scores.

Null Hypothesis One (HO_1): There is no significant difference between the mean scores of students taught using concept mapping strategy and those taught using lecture method.

To test this hypothesis, the posttest mean scores of experimental and control groups students were analyzed using the t-test statistics. The result of the t-test analysis is shown in Table 4.2 below.

Table 4.2 Posttest t-test of Experimental and Control Group Based on Academic Performance

Group	N	Mean	Std. devt	Std. Error mean	df	t. cal	t. crit	p- value
Experimental	20	67.36	14.17	2.16				
					2.06	4.20	2.00	0.02*
Control	23	56.39	12.37	2.06				

*Significant at $p<0.05$ level

Table 4.2 Shows that the tcal of 4.2 is greater than the t.crit of 2.0 and the p- value observed was 0.02 at the degree of freedom of 74 and 0.05 level of significance. The p-value of 0.02 is less than the alpha value of 0.05 which is an indication that there is significant difference in the performance of students taught biology using concept-mapping strategy and those taught using lecture method. The mean score of the experimental group as shown in Table 4 is 67.36 which is higher than 56.39 mean score of the control group. This indicates that the experimental group students taught using concept-mapping strategy performed better than the control group students taught using lecture method.

Based on the result of Table 4.2 the hypothesis which states that there is no significant difference in the academic performance of students taught using concept-mapping and those taught using lecture method is therefore rejected. There is significant difference in

the performance of students taught using concept-mapping and those taught using lecture method in favor of those taught using concept-mapping strategy. Therefore, concept-mapping strategy is found to be more influence in improving student's performance than the lecture method.

Research Question Two: What is the difference between the academic performance mean scores of male and female students exposed to concept mapping strategy?

Table 4.3 Posttest Mean and Standard Deviation of Students' Performance According to Gender in the Experimental Group

Gender	N	Mean	std. deviation	Mean difference
Male	11	37.71	2.34	
				0.35
Female	9	38.06	2.37	

From Table 4.3, the mean scores of the male and female students are (37.71 and 38.06) respectively with a mean difference of 0.35. The female students achieved higher than the male students. To find out if the value is significant, t-test statistics was used.

Null Hypothesis Two (HO_2): There is no significant difference between the mean performance scores of male and female Biology students taught the concept of excretion using concept mapping.

Table 4.4 show Posttest t-test of the Performance of Experimental Group According to Gender

Gender	N	Mean	S.D	Std. error means	df	t-cal	t-crit	p-value
Male	11	37.71	2.34	1.16				
					35	0.54	2.04	0.93
Female	9	38.06	2.37	1.19				

Not Significant at p>0.05

From Table 4.4 the calculated t value of 0.54 is less than the critical value of 2.04 at the degree of freedom of 35 at 95% confidence level. The obtained p-value of 0.93 is greater than 0.05 significant level. This result indicates that there is no significant difference in the performance of male and female students when taught biology using concept-mapping strategy. By implication male and female students performed equally the same when exposed to concept mapping strategy. The null hypothesis is therefore retained.

4.4 Summaries of Major Findings

The summaries of the findings from the results are as follows:

i) Students in experimental group taught using concept- mapping strategy achieved significantly higher than the subjects in the control group taught using lecture method.

ii) There was no significant difference between male and female students ability to construct concept mapping.

4.5 Discussion of the Results

The Objective of this study was to investigate the effect of concept mapping strategy and academic performance in biology among secondary school students in Funtua Katsina state, Nigeria. The results are discussed as follows:

The result from the research question and testing of hypothesis one indicated that the experimental group who were taught using Concept mapping strategy achieved significantly better than those in the control group who were taught same concepts using Lecture method. The significant difference in performance is in favour of the students in the experimental group which suggested a greater effectiveness of Concept mapping strategy over the Lecture method of teaching.

This finding is in conformity with that of Appaw (2011), Otor (2013), Jack (2014) who reported that students exposed to Concept mapping strategy significantly outperformed students exposed to traditional method of teaching. In similar works by Cheema and Mirza (2013), students taught using concept mapping had significantly achieved higher than their counterparts taught with the traditional method. Students improved performance might be that the instructional strategy provides opportunity for students to link concepts learned. Concept mapping strategy enable students to establish a relationship between concepts learned thereby increasing performance. The students in the experimental group were able to see links among concepts and this boosted their comprehension on topics which they were taught

The result of the students in the control group showed that lecture method is not very effective in promoting meaningful learning and increasing academic performance. As

students in lecture method are engaged as passive learners. This is in line with the argument of Stein horst and Keeler, 1995 that traditional Lecture method has a tendency to view students as passive learners because it does not engage them actively. The finding from this study indicated that Concept mapping strategy can enhance academic performance among students and yield better result than Lecture method. Students in the concept mapping group might have learnt meaningfully because of the hierarchical, logical and sequential presentation of concepts. Ausubel (as cited in Novak &Canas, 2008) asserted that, for meaningful learning to occur the new ideas must have potential meaning and the learner must possess relevant concepts that can anchor new ideas. The learner must also consciously relate the new ideas or verbal propositions to relevant aspects of their current knowledge structure in a conscious manner. According to Ausubel (1984) meaningful learning occurs by the process of subsumption when potentially meaningful propositions are subsumed.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

In this chapter the summary of the study were presented. The summary of the findings, conclusion from the findings and recommendations arising from the study were discussed. The limitation of the study and suggestions for further studies were also outlined.

5.2 Summary

The study was conducted to determine effect of Concept mapping strategy and academic performance in excretion among secondary school students in Funtua education zone, Katsina state. To achieve these, two groups of students were formed; one of the groups the experimental group was exposed to Concept mapping strategy and the other group the control group was exposed to lecture method. The effect of the methods in academic performance was deduced.

The sample size for the study comprised a total of 43 Senior Secondary two (SSII) Students drawn from two Secondary Schools in Funtua, Katsina State. The Government Senior Secondary School Maska served as the experimental group and the students were taught Excretion using concept mapping and Government Day Senior Secondary School Makera was used as control group and the students were taught the same concept using lecture method.

Three instruments were used; Excretion Concept Performance Test, a 30 item multiple choice instrument and Excretion Concept Construction Test. One null hypothesis was tested to answer the stated research questions. The study adopted a pretest – posttest Quasi Experimental-Control Group design. The treatment for the study involved teaching the experimental groups excretion concepts in biology using Concept mapping strategy and teaching the control groups same excretion concepts using Lecture method.

A pretest was administered to the experimental group and the control group before commencement of treatment. The treatment lasted for two weeks after which a posttest was administered to both the experimental group and the control group. The data generated were analyzed according to the stated hypotheses. The data was analyzed using t-test statistics, Mann-Whitney and Spearman Rank Correlation Coefficient with the help of SPSS Statistical version 21.0. The confidence level of $p<0.05$ was adopted for retaining or rejecting the hypotheses.

5.3 Conclusion

1. When students were taught excretion concept using Concept -mapping strategy, it was found to improve the performance of Senior Secondary School Students in Biology.
2. Concept Mapping Strategy is more effecting in increasing the performance of Senior Secondary School Students in biology than the Lecture Method.

5.4 Contributions to Knowledge

The concern of this study was to investigate the effect of concept-mapping strategy and academic performance in excretion among secondary school students .The findings of this study have significant contribution and great implications for educational practices.

The following contributions to knowledge were made:

1. The researcher was able to establish that students taught excretion using Concept mapping strategy had significant academic performance mean scores regardless of gender.
2. The researcher developed mole concept performance test which could be used by other researchers in future.

5.5 Recommendations

The following recommendations were made:

1. Lecture method in this research study has been found to be less effective in improving the academic performance of students. Therefore science teachers should look for alternative and more influence means of instruction to avoid poor performance of their students.

2. Concept mapping strategy has been shown to improve academic performance for both sexes; therefore teachers should be advised to adopt the approach in teaching.

3. The Federal and State Ministries of Education through Nigerian Educational Research and Development Council (NERDC) Katsina branch should provide adequate- funds for training of science teachers in-form of seminars, workshops and conferences that focuses

on Concept mapping strategy and other teaching strategies that are more influence in promoting academic performance.

4. Organizations such as Science Teachers Association of Nigeria (STAN), Nigerian Educational Research and Development Council and others should incorporate Concept mapping strategy in Science curricula at Senior Secondary School level to encourage use of the strategy among science teachers.

5. There is a need for curriculum planners and textbook publishers to take into cognizance Concept mapping strategy in developing the curriculum and the textbooks as context for each unit of learning must be identified. This will simplify adoption of the method for use by teachers.

5.6 Limitations of the Study

1. The schools used for this study were two Government Secondary Schools of Katsina State which narrow the scope of generalizations of findings. The generalization could not be extended to other schools in the State like Private Schools, Military Schools and Federal Government Schools.

2. The conclusions reached in this study are restricted to the effect of Concept mapping strategy on the teaching of excretion at Senior Secondary Schools of Katsina State.

3. The major weakness lies in some extraneous factors such as age, ability, maturation and previous learning experiences which were not controlled in this study.

5.7 Suggestions for Further Studies

1. The study should be replicated in other States of Nigeria and other Science Subjects to increase the scope of generalization.

2. The study can be extended to other levels of education to see if level is a factor in the Approach

REFERENCES

Abayomi, B.F.(1988). The influence of concept mapping and cognitive style on science achievement.*Dissertation Abstract International, 45*(6), 1420-1430.

Achino, C.(2002).The Importance of class motivation to learning achievement. *Journal of Curriculum Studies 7(1) 62-66.*

Adamcyzyk, P., Willison, M., & Williams, D. (1994). Concept mapping: A multi-level and multi-purpose tool. *School Science Review, 76*(275), 116-124.

Adesoji, F.A; Ige, T.A; Iroesbu, T.O; &Olagunju, A.M. (2003).*Innovation for Science Teaching for New Millennium*.Macmillan Publishers.

Ahiakwo, M.O.G. (2000). Mathematics achievement and academic performance in chemistry.*The Nigerian Teacher Today,* 8(1&2),.17-83.

Aiyedun J.O. (2000) Influence of sex difference of students in their achievement in secondary school mathematics. *The Journal of the Mathematics Association of Nigeria.*2 (5), 91-102.

Akpinar, E., &Ergin, O. (2008). Fostering primary school students□ understanding of cells and other related concepts with interactive computer animation instruction accompanied by teacher and student prepared concept maps. *Asia Pacific Forum on Science Learning and Technology, 9*(1), 1-15.

Asan, A. (2007). Concept mapping in science class: A case study of fifth grade students. *Education Technology and Society, 10*(1), 186-195.

Ausubel, D. P., Novak, J. D., &Hanesian, H. (1978). *Educational Psychology: A cognitive view* (2nd ed.). New York, NY: Holt, Rinehart and Winston.

Ausubel, D.P. (1963). *The Psychology of Meaningful Verbal Learning*. New York: Grine&Estratton.

Adloen,B.R.(2012). AssessingEffectiveness of Concept Map as Instructional Tool in High School Biology.LouisianaState University.

Ausubel, D.P. (1968). *Educational Psychology.A Cognitive View*. New York. Holt, Rinehart and Winston Inc.

Ausubel, D.P; Novak, J.D. &Hanesian, H. (1978).*Educational Psychology.A Cognitive View*. New York. Holt, Rinehart & Winston.

Bamidele, E.F; Adetunji, A.A; Awodele, B.A &Irinoye, J. (2013).Attitudes of Nigerian Secondary School Chemistry Students towards Concept Mapping Strategies in

Learning the Mole Concept.*Academic Journal of Interdisciplinary Studies*, Sapienza University of Rome 2(2), 89-94.

Bascones, J., & Novak, J. D. (1985).Alternative instructional systems and the development of problem solving skills in physics.*European Journal of Science Education*, 7(3), 253-261.

Bello, G. (1997). Comparative effect of two forms of concept mapping instructional strategies on senior secondary school students' achievement in biology. Unpublished Doctoral thesis, Department of Curriculum Studies and Educational Technology, University of Ilorin.

Bello, G., &Abimbola, I. O. (1997). Gender influence on biology students concept mapping ability and achievement in evolution. *Journal of Science Teaching and Learning*, 3(2), 8 – 17.

Dawn Marie Trehan (2015) the impact of concept mapping as a learning tool on student perceptions of and experiences with introductory statistics.

Ferry, B.,Hedberg, J. and Harper, B. (1998). How to Pre-service Teachers Use Concept map to Organize their Curriculum Content Knowledge? *Journal of Interactive Learning Research*, 9(1), 83-84.

Fisher, K.M., Wandersee, J. H., & Moody D. L. (2000).*Mapping Biology knowledge*.Dordrecht: Kluwer.

Heinze-Fry, J. A., & Novak, J. D. (1990). Concept Mapping brings Long-Term Movement towards meaningful learning. *Science Education, 74*, 461-472.

Hemelo A, Ferrari M.(1997) Inquiry based-approach in Education, Accessed 15November 2008. Available: http//:www.csuasedu/turner/papers/harthticc2005doc.

Jack,G.U.(2014).The effect of individual and collaborative concept mapping learning strategies on chemistry students anxiety and academic achievement.*International Journal of Innovative Education Research 2 (3),19-28,*

James T. (2000).Effectiveness of Inquiry Verses Lecture Methods of Teaching in Secondary Schools InNiger State.UnpublishedM.ED. Thesis,Ahmadu Bello University Zaria.

Jegede, O. J., &Okebukola, P. A. O. (1988). An Educology of Socio-Cultural Factors in Science Classrooms. *International Journal of Educology. 2*(2), 93-107.

Jegede, O. J., Alaiyemola, F. F., &Okebukola, P. A. O. (1990).The effect of concept mapping on students anxiety and achievement in biology.*Journal of Research in Science Teaching, 27*(10), 951-960.

Jonassen, D. H. (2000).*Computers as MindTools for schools: Engaging critical thinking*. New Jersey: Prentice Hall Inc.

Karakuyu,Y.(2010). The effect of concept mapping on attitude andachievement in a physics course.*International Journal of the Physical Sciences 5(6), 724-737.*

Kaur,G.(2011).Study and Analysis of Lecture Model of Teaching . *International Journal of Educational Planning and Administration. (1)1.*

Kember, D., Leung, D., Jones, A. &Loke, A. Y. (2000) Development of a Questionnaireto measure the Level of Reflective Thinking.*Assessment and Evaluation in HigherEducation*, 25, 380-395.

APPENDIX A

Excretion Concept Performance Test (ECPT)

There are thirty (30) multiple choice questions with options lettered a-d, choose the correct answer by circling. You should also provide the information below:

Name:- .....

School:-.....

Gender:- .....

Age:- .....

(Q1) Excretion is the ..... of metabolic waste products from the body of a living organism.

(a) Removal (b) bodies (c) produce (d)process

(Q2) All parts of a unicellular ..... are in close contact with the external environment

(a) Body (b) fluid (c) excretion (d) organism

(Q3) Digested food substances undergo in the ..... of the body.

(a) Cells (b) intestine (c) stomach (d) mouth

(Q4) The excretion organs are the ..... tubules

(a) Malpighi an (b) Urinary tubule (c) Kidney (d) bladder

(Q5) ..... Is the one of the excretion system

(a) Liver (b) kidney (c) lung (d) heart

(Q6) Excretions in plants are ..... and stationary

(a) Leaf (b)root (c) autotrophic (d) water

(Q7) The following are some part of excretory system except

(a) Kidney (b) bladder (c) mouth (d) urethra

(Q8) These are the following mechanisms that is involved in the formation of urine except

(a) Active transport (b) passive diffusion and osmosis (c) hormonal control (d) urine

(Q9) The organelle which eliminates water from the body of a protozoan is

(a) Plasma membrane (b) contractile vacuole (c) cell wall (d) protoplasm

(Q10) Which of the following parts of the mammalian skin is involved in excretion?

(a) sebaceous gland (b) sweat gland (c) hair follicle (d) malpighian layer

(Q11) In which of the following group of organisms does excretion take place only by simple diffusion through the body surface?

(a) Worms, toad and amoeba (b) paramecium, grasshopper and snake (c) grasshopper, toad and euglena (d) paramecium, amoeba and euglena

(Q12) less nitrogenous wastes, salts and water as a result of .....

(a) Temperature (b) sweat (c) excretion (d) urine

(Q13) The fluid that filters into the bowman's capsule is known as .....

(a) Henle's loop (b) hydrogen (c) protein (d) glomerular filtrate

(Q14) less oxygen and glucose, and more carbon dioxide, as result of .....

(a) Lung (b) cellular respiration (c) breath (d) inhalation

(Q15) The urine formed trickles down the urethra and collects in the .....

(a) Bladder (b) kidney (c) urethra (d) aorta

(Q16) Urine is stored in the .....

(a) Urethra (b) artery (c) urinary bladder (d) kidney

(Q17) The kidney has two distinct regions an outer cortex and .....

(a) An inner layer (b) an inner medulla (c) an outer medulla (d) an inner cortex

(Q18) Insects are found in the ..... And driest places on earth

(a) Hottest (b) cool place (c) tropical region (d) warm place

(Q19) The amoeba lives in freshwater which is hypotonic to the contents of it's .....

(a) Water (b) reproduce (c) cell wall (d) cell

(Q20) The amoeba over comes this by having a .....

(a) Cell membrane (b) cellular (c) cell wall (d) cytoplasm

(Q21) Excretion systems vary according to the degree of complexity of the .....

(a) Plants (b) organism (c) elephant (d) insects

(Q22) Flatworms may be free-living or .....

(a) Parasitic (b) parasitology (c) paramecium (d) organism

(Q23) An earthworm has a segmented body, each segment has a pair of tubes called .....

(a) Hairy body (b) nephridia (c) motor nephridia (d) nephridiatic

(Q24) The urinary tubule is the functional unit of the .....

(a) Urethra (b) bladder (c) kidney (d) aoter

(Q25) The blood entering the kidney is already at .....

(a) Low pressure (b) high pressure (c) temperature (d) at liver

(Q26) The paired kidneys are ..... of humans

(a) Excretion (b) two organs (c) left and right (d) excretory organs

(Q27) Nitrogenous waste products and water which are liberated into the .....

(a) Liver (b) kidney (c) haemocoel (d) haemodialysis

(Q28) The processes involved in the formation of urine except

(a) Ultra filtration (b) selective reabsorption (c) tubular secretion (d) capillaries

(Q29) Water is lost continuously from all parts of a plant above the .....

- (a) Soil (b) branches (c) root (d) stem

(Q30) ..... do not have special excretory organs

(a) Plants (b) insects (c) earth worm (d) fungi

APPENDIX B

MARKING SCHEME FOR (ECPT)

(1) A

(2) D

(3) A

(4) A

(5) B

(6) C

(7) C

(8) D

(9) A

(10) D

(11) A

(12) C

(13) D

(14) B

(15) A

(16) C

(17) B

(18) A

(19) D

(20) A

(21) B

(22) A

(23) B

(24) C

(25) B

(26) D

(27) C

(28) D

(29) A

(30) A