EFFECTS OF CONCEPT MAPPING TECHNIQUES ON STUDENTS ACHIEVEMENT AND ATTITUDE IN BASIC SCIENCE IN SECONDARY SCHOOLS IN DELTA CENTRAL SENATORIAL DISTRICT

ERAVWOKE Onomrerhino
PG/13/14/223160

DELTA STATE UNIVERSITY, ABRAKA

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ERAVWOKE Onomrerhino
PG/13/14/223160
B.Sc (Ed) Integrated science (DELSU)

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF CURRICULUM AND INTEGRATED SCIENCE, FACULTY OF EDUCATION IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF DEGREE OF MASTER IN EDUCATION (M.Ed) IN INTEGRATED SCIENCE, DELTA STATE UNIVERSITY, ABRAKA

OCTOBER., 2017.

CERTIFICATION

This is to certify that this work was carried out by Eravwoke Onomrerhino in the Department of Science Education, Delta State University, Abraka.

---------- ----------
PROF. O.P AJAJA **DATE**
(SUPERVISOR)

---------- ----------
PROF. O.P AJAJA **DATE**
(Head of Department)

_____ _____
Prof. E.P. OGHUVBU **DATE**
Dean, Faculty of Education

DECLARATION

I hereby declare that this thesis was carried out by me and has not been previously submitted to this or any other institution for the purpose of the award of any degree. All citation and source of information are clearly acknowledged by means of reference.

_____ _____

ERAVWOKE Onomrerhino **Date**

DEDICATION

This dissertation work is dedicated to God Almighty, the giver and keeper of life.

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ABSTRACT

The major purpose of this study was to determine the effects of concept-mapping instructional strategy on students' achievement and attitude towards basic science.. Fifteen research questions were raised and their corresponding hypotheses were formulated and tested at alpha value of 0.05. The design adopted for the study was the 2x2x2x2 factorial non-randomized pre-test post-test non equivalent control group quasi -experimental design. The sample for the study consisted of 214 students and six teachers from six secondary schools sampled from Delta Central senatorial district. The instrument used for data collection were Basic Science achievement test (BSAT) and students' attitude questionnaire (SAQ). The instruments were properly validated and reliability give their psychometetric properties determined before they were used. Data collected were analyzed using mean, paired sample t-test, student independent sample t-test and ANOVA statistics. The major findings of the study included the following: (i) the use of concept mapping had a positive effect on students' achievement. (ii) a significant difference in the performance of students in both the experimental and control groups (iii) a significant difference in the performance of students in both single sex and mixed schools of the experimental groups (iv) no significant difference in the performance of the experimental group students with varying abilities (v) no significant interaction effect between method and sex on achievement (vi) no significant interaction effect among method, sex and ability on basic science students achievement (v) no significant interaction effect among method sex and ability on attitude . It was concluded that concept mapping technique will be a suitable method for teaching basic science in schools and it is recommended that teachers and students should be properly trained to acquire the skills of usage of concept mapping and be encouraged to apply it in the teaching –learning process.

CHAPTER ONE

INTRODUCTION

Background to the Study

Basic science formerly known as Integrated Science is a body of knowledge that is taught at both primary and junior secondary schools levels of education in Nigeria. From the lower basic to the middle basic levels, it is made compulsory for all students. The aims and objectives for teaching basic science include the following: to enable the learners develop interest in Science and Technology; acquire basic knowledge and skills in science and technology; apply scientific and technological knowledge and skills to meet contemporary societal needs; take advantage of the numerous career opportunities provided by science and technology; avoid drug abuse and related vices; be safety and security conscious and become prepared for further studies of science and technology (Basic Science and Technology Curriculum (BSTC), 2012).

The revision of the secondary school science curriculum in 2008 led to the introduction of basic science as subject. Basic science prepares students at the Junior Secondary School level for the study of core science subjects (physics, chemistry, biology) at the Senior Secondary School level (Olarewaju, 1994). This implies that for a student to be able to study science subjects at the Senior Secondary School level successfully, such student must have been well grounded in basic science at both the primary and Junior Secondary School levels. In view of this, basic science is given great emphasis in the Junior Secondary School curriculum (Oludipe, 2012). The revised 9-Year basic education curriculum has basic science and technology as a component of clustered key subjects prepared with the aim of catching the young learner to love science, learn science and create change in their environment.

As important as the subject is, observation and experience have shown that lecture method has been the most commonly used method in its teaching instead of the activity based instructional strategies. According to Agboghoroma (n.d), for integrated science to be taught effectively, there must be an activity that will promote productive and beneficial learning experience for students, and enhance development of the learners. To him, the effective teaching of Integrated Science goes beyond knowledge impartation; it should involve an activity carried out by a teacher with a specialized knowledge in the subject in a skillful way to enhance cognitive, affective and psychomotor development of the students. This effective way of teaching basic science is absent at the junior secondary school level in Nigeria classrooms, since lecture method is the commonly used methodology in teaching basic science in our schools.

Lecture method is probably the oldest and most common teaching method considered to be an effective way of presenting materials in a manner in which students' learning is mediated by the teacher. This method has been described as “a gross inefficient way of engaging students with academic knowledge” (Laurillard, 2002). Nevertheless, it provides an opportunity for a very large number of students to be exposed simultaneously to a large amount of information. This enables teachers to cover large content area of scheme in a short period. This is because, the content area covered is the most important thing to educational inspectors who are on supervision tour. In this traditional method, the level of students’ involvement in the process of learning can be quite low, and a major limitation with the method is that students assume a passive, non-thinking, information receiving role (McKeachie, 1994).

The use of lecture method is one of the factors responsible for poor performances in basic science as shown by the work of Adetayo (2008) and Delta State Ministry of Education Chief Examiners Report (2008) .To buttress this, AbdulRahaman (2014) identified this teaching methodology as one of the problems of teaching and learning science at the junior secondary level. When an analysis of integrated science results of some public junior secondary schools were carried out in Jos Nigeria for consecutive

years, the result showed a poor performance outcomes with students scoring less than 50.0% (Ozogi & Mangut; 2015). With this poor performance, there is need for the use of new approach for teaching basic science. This new approach should foster students' active participation in the classrooms. One of such teaching approach that is capable of this, is the concept mapping teaching learning technique.

Concept mapping teaching learning technique has features that could be the alternative to the lecture method used in the past. Concept mapping teaching learning technique characteristics are in line with the modern idea of learning, which emphasized that learning should be students centered whether infrastructure are available or lacking in the schools. It can be seen as a teaching -learning technique in which ideas that contains two or more concepts are connected with other words to form a meaningful statement represented diagrammatically. Concept mapping teaching learning technique could be seen as a technique for representing the structure of information visually. Creating a graphic representation of a topic often helps in visualizing key concept and organize ones' knowledge more clearly than other methods of study. At a first glance, a concept map looks like a flow chat in which the key words are placed in boxes connected by directional arrows (Ajaja, 2007). Based on educational psychology theories on how we organize information, concept maps are hierarchical with broader general ideas at the top and more specific topics arranged in a cascade below them. They are meta- cognitive tools that empowers the learner to take charge of their own learning in a highly and meaningful manner. When concept mapping teaching learning technique is used in the classrooms, students' will be made to represent their ideas graphically. This enables the teacher to visualize students understanding and the organization of their knowledge about those particular concepts represented.

Available literature has showed that most of the work done on the effect of concept-mapping, which were found to improve on students achievement were carried out using senior secondary school sciences like chemistry and Biology. For instance, Eravwoke and Omoifo (2014) looked at effect of concept

mapping teaching-learning techniques on students achievement in chemistry and found the methodology effective in improving students achievement in chemistry. In the same vein, Okafor (2004), studied effect of concept mapping on students achievement in genetics in secondary school, and also found a positive effect of concept mapping on students achievement. In addition, Peter (1999) carried out a study on the relative effectiveness of concept mapping instructional method and lecture method in the teaching of chemistry to senior secondary school students. He discovered that concept mapping has positive effects on students achievement.

The findings of these studies buttress the fact that for students to acquire basic knowledge and skills in science and technology, the teaching methodologies should foster the process of inquiry, encourage curiosity and active participation of students in the teaching process. This suggests that active participation of students in the classroom can encourage students to learn science effectively with positive attitude, which is another factor that could be responsible for poor performances.

Attitude is an expression of favour or disfavour towards a person, place, thing, or event (the *attitude* object). It could be negative or positive. Once one has a negative or positive attitude towards a subject, it influences the performances, either positively or negatively. However, the intention in an attitude is not discerned only through behaviour but encompasses general knowledge, and comprises of the cognitive, emotions and actions of the individual. For students to perform well in basic science, they must have positive attitude towards it. From available literature it has been found that concept mapping has positive influence on attitude. For example, Eravwoke (2010) determined the effect of concept-mapping on chemistry teachers attitude towards the teaching of chemistry and found a positive result. This connote that positive attitude is needed for better performances irrespective of gender and varying abilities. Gender is a state of being a male or female. The classroom is made of students of different gender. Available literature have shown that the use of concept mapping teaching learning technique on

students performances at senior secondary school based on gender has mix results. For example, Bello & Abimbola (n.d) carried out a study on gender influence on biology students' concept-mapping ability and achievement in evolution. They found out that the methodology is not gender biased whereas Eravwoke and Omoifo (2014) found out that females performed better than their male counterparts.

In addition, Miller (2001) discovered that the classroom is made up of students with varying abilities and as a result of these differences, they process information differently which bring about different learning requirements. Different people have different perception about information and process this information differently; this in turn influences their performances. In order to improve students' performance having various learning styles, there is often the need to explore various learning opportunities which can address the complexity of learners in the classroom to capture pupils' interest, purpose and this should be for fast, average and slow learners (Ediger & Rao, 2000). Udeani and Okafor (2012) carried out a study to determine the effect of concept mapping instructional strategy on biology achievement of senior secondary school slow learners. The results showed that the concept mapping classroom is beneficial to the students, especially the low-ability ones.

From the foregoing, an attempt has been made to clearly discuss the meaning of concept mapping teaching learning technique, the relevance of concept mapping teaching learning -technique in teaching and learning process, steps of how to use concept mapping teaching- learning technique, as well as highlight of research findings on the effects of the use of concept mapping teaching learning technique on students achievement and attitude in basic science and the rationale for the study. Considering the relevance of concept mapping teaching learning -technique in enhancing students' achievement and attitude as shown by the results of studies conducted in senior secondary schools, this study examined

the effect of the use of concept mapping teaching- learning technique on achievement and attitude of basic science students irrespective of their gender and varying abilities in Delta Central Senatorial District.

Statement of the Problem

Concept mapping is a teaching -learning strategy in which ideas that contains two or more concept are connected with other words to form a meaningful statements represented diagrammatically. It could be seen as a technique for representing the structure of information visually. Concept mapping teaching learning technique has features that could be the alternative to the lecture method used in the past. Concept mapping teaching learning technique characteristics are in line with the modern idea of learning, which emphasized that learning should be students centered whether infrastructure are available or lacking in the schools. It can be seen as a teaching -learning technique in which ideas that contains two or more concepts are connected with other words to form a meaningful statement represented diagrammatically. Concept mapping teaching learning technique could be seen as a technique for representing the structure of information visually. Creating a graphic representation of a topic often helps in visualizing key concept and organize ones' knowledge more clearly than other methods of study. At a first glance, a concept map looks like a flow chat in which the key words are placed in boxes connected by directional arrows (Ajaja, 2007). Based on educational psychology theories on how we organize information, concept maps are hierarchical with broader general ideas at the top and more specific topics arranged in a cascade below them. They are meta- cognitive tools that empowers the learner to take charge of their own learning in a highly and meaningful manner. When concept mapping teaching learning technique is used in the classrooms, students' will be made to represent their ideas graphically. This enables the teacher to visualize students understanding and the organization of their knowledge about those particular concepts represented. Hence, this study is designed to investigate the effect of concept

mapping teaching learning technique on basic science student's achievement and attitude towards basic science irrespective of their varying abilities and gender?

Research Question

Based on the identified problems, the following research questions were raised to guide the study

1. Is there any difference in achievement mean scores in basic Science between students in classrooms where concept mapping teaching learning technique is used and those in classroom where lecture method is used?
2. Is there any difference in the achievement mean scores in basic science between male and female students who learned basic science using concept mapping instructional strategy?
3. Is there any difference in the achievement mean scores in basic science between students who learned basic science using concept mapping teaching learning technique in single sex and mix schools?
4. Is there any the difference in achievement test mean scores between high and low ability students taught with concept mapping teaching learning technique?
5. Is there any difference in attitude mean scores of students taught with concept mapping teaching learning technique and those taught with lecture method towards basic science?
6. Is there any difference in the attitude mean scores between high and low ability students taught with concept mapping teaching learning technique?
7. Is there any interaction effect among method, sex and ability of students on achievement?
8. Is there any interaction effect among method, sex and ability of students on attitude in Basic Science?

Hypotheses

From the stated research questions, the following hypotheses were formulated

Ho_1: There is no significant difference in achievement mean scores in basic Science between students in classrooms where concept mapping teaching learning technique is used and those in classroom where lecture method is used.

Ho_2: There is no significant difference in achievement mean scores in basic science between male and female students who learned basic science using concept mapping teaching learning technique.

Ho_3: There is no significant difference in achievement mean scores in basic science between students who learned basic science using concept mapping teaching learning technique in single sex and mix schools.

Ho_4: There is no significant difference in achievement mean scores between high and low ability students taught with concept mapping teaching learning technique.

Ho_5: There is no significant difference in the attitude mean scores of students taught with concept mapping teaching learning technique between those taught with lecture method towards basic science.

Ho_6: There is no significant difference in the attitude mean scores between high and low ability students taught with concept mapping teaching learning technique.

Ho_7: There is no significant interaction effect among method, sex and ability of students on achievement in basic science.

Ho_8: There is significant interaction effect among method, sex and ability of students on attitude in basic science.

Purpose of the Study

The major purpose of this study was to determine the effects of concept-mapping instructional strategy on students' achievement and attitude towards basic science on students' achievement in Basic Science.

The specific purposes of the study was designed to investigate if there there is a difference in

- achievement mean scores in basic Science between students in classrooms where concept mapping teaching learning technique is used and those in classroom where lecture method is used;
- achievement mean scores in basic science between male and female students who learned basic science using concept mapping teaching learning technique
- mean achievement scores in basic science between students who learned basic science using concept mapping teaching learning technique in single sex and mix schools;
- achievement mean scores between high and low ability students taught with concept mapping teaching learning technique;
- attitude of students taught with concept mapping teaching learning technique and those taught with lecture method towards basic science;.
- To determine any interaction effect among method, sex and ability of students on achievement in basic Science; and
- To determine any interaction effect among method, sex and ability of students on attitude in basic Science.

Significance of the Study

The findings of the study is significant in the following ways:

To the basic science teacher, this study will generally help them acquire skills in concept mapping and popularize its use in basic science and other science subjects teaching. Specifically, the finding of the study may demonstrate to the teachers how to present content materials to students for effective learning. The finding of the study has demonstrated to the teachers the importance of teaching methodology in improving students' attitude towards basic science.

To the basic science students, the study is of immense value to them since they were taught basic science with a method which emphasize critical thinking and thus learn and retain what is learnt better.

To the curriculum planner, the findings of this study makes it necessary now than before to specify appropriate instructional strategies for teaching concepts in basic science. This will in turn help teachers and students develop positive attitudes towards science teaching and learning.

To future researchers, the findings of this study may be a source of method, materials and reference for studies on similar topics.

Scope and Delimitation of the Study

The scope of this study is the concept of habitat and its types. The study was delimited to public secondary schools in Delta Central Senatorial District. Specifically only Junior Secondary Class two (JSS II) students were used for the study.

Operational Definition of Terms

The following concepts were defined based on how they were used in the study

Attitude: This is an expression of favor or disfavor towards basic science

Achievement: Scores obtained by students in basic science

Concept mapping strategy: Is a teaching -learning strategy in which students are made to construct concepts making use of ideas that contains two or more concept that are connected with other words to form a meaningful statement represented diagrammatically**.**

Gender: A state of being a male or female.

Non-concept mapping strategy: This refers to all the teaching methods which do not use concept mapping teaching technique.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

This chapter was organized under the following headings:

- Theoretical Framework of the Study
- Concept of Basic Science
- The Structure and objectives of Basic Science and Technology Curriculum
- Lecture Method of Teaching

  Concept Mapping Instructional Strategy

- Characteristics Of Concept Mapping
- Construction of concept maps.

- Uses of Concept Map and its Application in Educational Settings.
- Students attitude towards science
- Empirical studies on the effects of concept mapping teaching learning technique on students achievement in school science
- Empirical studies on the effects of concept mapping teaching learning technique on students attitude towards school science
- Empirical studies on the effects of concept mapping teaching learning technique on students achievement based on gender
- Effect on concept mapping instructional strategy on students' achievement based on learning abilities
- Summary of Reviewed Literature

Theoretical Framework of the Study

This study is hinged on Vygostky (1978) Active theory of learning. Vygostky (1978) believed that students' development in learning is facilitated through social interaction with more learned peers who provide guidance during the learning process in times of difficulty. He emphasized that children learn best if placed in an environment that fosters thinking which is likely above their developmental level. To him, many developments in such environment are facilitated by social interaction among peers and between teachers and learners. This implies that teacher's skilful intervention during the teaching learning process

can elevate the students' level of thinking and learning. From the theoretical framework, it is seen that meaningful learning takes place when a child actively participates in the teaching and learning process. As learners engage in activities with adults or more capable peers, they exchange ideas and ways of thinking about a concept. Students internalize these co-created ideas for future use. The structure of this theory agrees with the principle of concept mapping teaching learning techniques because of the existence of social interaction among students themselves and between students and teachers during the construction of the maps. As students construct these maps, they make use of their thinking faculties at every level thereby interacting with themselves in order for them to represents their ideas diagrammatically in such a way that these ideas make sense to their teachers and their fellow students.

The concept of Basic Science

Basic science which is formerly known as Integrated Science is a body of knowledge that is taught at both primary and junior secondary schools levels of Education in Nigeria. From the lower Basic to middle basic level it is made compulsory for all students.

According to Igbokwe (2015) Basic Science and Technology Curriculum (BSTC) is a typical case of a composite subject in the Revised 9-Year Basic Education Curriculum (BEC). The BSTC (revised, 2012) is a product of the restructuring and integration of our Primary and Junior Secondary School (JSS) BEC, namely: Basic Science, Basic Technology, Physical and Health Education, and Computer Science/Information Technology (IT). The integration of these science curricula became necessary for the following reasons:

1. Recommendations of the Presidential Summit on Education (2010) to reduce the number of subjects offered in Primary and Junior Secondary Schools;

2. Feedback from the implementation of the curricula in schools that identified repetition and duplication of concepts as the major cause of curriculum overload;

3. Need to encourage innovative teaching and learning approaches and techniques that promote creativity and critical thinking in learners;

4. Need to promote the holistic view of science at the Basic Education level for better understanding of contemporary and changing world; and 5. Need to infuse emergent issues that are of national and global concern such as gender sensitivity, globalization, disaster risk reduction, consumer education, climate change and entrepreneurship.

The objectives and Structure of Basic Science and Technology Curriculum

The objectives of Basic Science and Technology Curriculum is that its study will enable the learners: Develop interest in Science and Technology;

- Acquire basic knowledge and skills in science and technology;
- Apply scientific and technological knowledge and skills to meet contemporary societal needs;
- Take advantage of the numerous career opportunities provided by science and technology;
- Become prepared for further studies in science and technology;
- Avoid drug abuse and related vices; (BSTC, 2012) Be safety and security conscious.

The thematic approach to content organization was adopted in developing the BSTC in order to achieve a holistic presentation of scientific and technological concepts and skills to learners. The themes and sub-themes that formed the integrating threads for the Basic Science and Technology Curriculum are shown in the figure below:

Theme	**Sub-theme** For primary	**Sub-theme** For Junior secondary school

Basic Science	• Exploring our environment • Living and Non-Living things	• Learning about our Environment • You and Energy • Science and Development
Basic Technology	• Understanding Basic Technology • You and Energy	Understanding Basic Technology • Materials and Processing • Drawing Practice • Tools, Machines and Processes • Safety
Physical and Health Education	• Fundamental Movements • Basic Movements • Athletics • Games and Sports • Health Education • Pathogens, Diseases and Prevention • Drug Eradication • Responsible Parenthood	Basic Human Movement • Sports and Games • Health Education • Moving our Body Parts • Athletics • Contact and Non-Contact Games
Information Technology (IT)	• Basic Computer Operations and Concepts • Basic Concepts of Information Technology	• Basic Computer Operations and Concepts • Computer Ethics • Computer Application Packages • Basic knowledge of Information Technology

Source: NERDC (2012).

Lecture Method of Teaching

This is the oldest method of teaching used in our schools and it is the most widely used method of presentation in our schools. A lecture is an oral presentation intended to present information or

teaches people about a particular subject. It is used to covey critical information, history, background, theories and equations to the learners. In using lecture method, the lecturer stands in front of the lecture halls and recite information relevant to the lecture content to the students while the students listen to him or her. This method of teaching is a convenient way of teaching a large group of students. This method has been described as "a grossly inefficient way of engaging students with academic knowledge" (Laurillard, 2002). Nevertheless, it provides opportunity for a very large number of students to be exposed simultaneously to a large amount of information which enables teachers cover large content area of scheme in a short period. This is because, the content area covered is the most important thing to educational inspector who are on supervision tour. In this traditional method, the level of students' involvement in the process of learning can be quite low, and "a major limitation with the method is that students assume a passive, non-thinking, information receiving role" (McKeachie, 1994).

Meaning Concept Mapping

Ossai (2004) sees concept mapping "as a graphical arrangement of key concept to show meaningful relationship among the selected concept or ideas been studied". According to Ajaja (2007) "concept mapping is a learning strategy which helps students in understanding complex ideas and clarifies ambiguous relationships". Also, concept mapping may be seen as a teaching -learning strategy in which ideas that contains two or more concept are connected with other words to form a meaningful statements represented diagrammatically. It could be seen as a technique for representing the structure of information visually. Concept maps are tools for organizing and representing knowledge, they include concept which are generally enclosed in circles or boxes of some types and relationship between concept and preposition between two concepts. (Propositions are statement about some object or statement in the universe either naturally occurring or constructed.) They contain two or more concepts connected with other words to form a meaningful statement. A concept map is also a graphical representation where

links (point or vertices) represent concepts and cross links (arcs or lines) represents the relationships between concepts. The links between the concepts can be one way, two ways or non directional. The concepts and the links may be categorized and the concepts may show temporary or causal relationship between concepts. Concept map can also been seen as a visual representation of linkages/connections between a major concept and other knowledge students has learned.

Novak (1998) define a concept as perceived regularities in event or object or record of events or objects designated by a label. The label for most concept is a word, sometimes a symbol such as + or % may be used. According to the Chambers twentieth century dictionary, a concept is a thing conceived a general motion. Okabukola (1999) , defines a concept as perceived regularity in event or object designated by an arbitrary label.). Novak and Gowin (1984) sees concept map as a schematic representation of a set of concept whose meaning is embedded in a frame work of proposition. To Novak, concept map is a tool that promotes meaningful learning as opposed to rote learning.

A concept map is a two dimensional representation of the relationship between key ideas. It shows us how we think and suggest affinities and association that might not other wise be obvious. At a first glance, a concept map looks like a flow chat in which the key words are placed in boxes connected by directional arrows (Ajaja, 2007). Concept maps are excellent tools which provide instructors with diagnostic pre-assessment prior to beginning a unit and formative assessment during learning activities.

Based on educational psychology theories of how we organize information, concept maps are hierarchical with broader more general items at the top and more specific topics arranged in a cascade below them. They are meta cognitive tools that empower the learner to take charge of his/her own learning in a highly and meaningful manner. According to Novak (1996), “meaningful learning involves the assimilation of new concept and proposition into cognitive structure.” The most important factor influencing learning is what the learner has already known. Novak’s work on concept mapping is based on

the cognitive theory of David Ausubel (assimilation theory) who stresses the importance of prior knowledge in been able to learn new concept.

Concept maps have their origin in the learning movement called constructivism. Constructivists are of the view that learners construct knowledge from their existing knowledge.

Concept mapping is a teaching technique

Concept mapping is a teaching technique which was discovered by Joseph D. Novak and his term in 1970 as a means of representing science knowledge of students. Concept mapping is also a learning strategy that many students find useful in understanding complex ideas and clarifying ambiguous relationships. Creating a graphic representation of a topic often help in visualizing key concept and organized ones knowledge more clearly than other method of study. Novak's work on concept mapping was based on the learning psychology theory of David Ausubel (1968, 1978). The fundamental idea in Asubel's cognitive psychology theory is that learning takes place by the assimilation of new concept and preposition into existing concept and propositional frame work held by the learner. Concept mapping has consequently been used as a tool to increase meaningful learning in the sciences and other subject areas as well as to represent the expert knowledge of individuals and themes in education, government and business. Concept mapping as an instructional strategy extends the elements of observation, inferring and classification, hierarchical structuring and construction (Inomiesa and Unuero 2003).

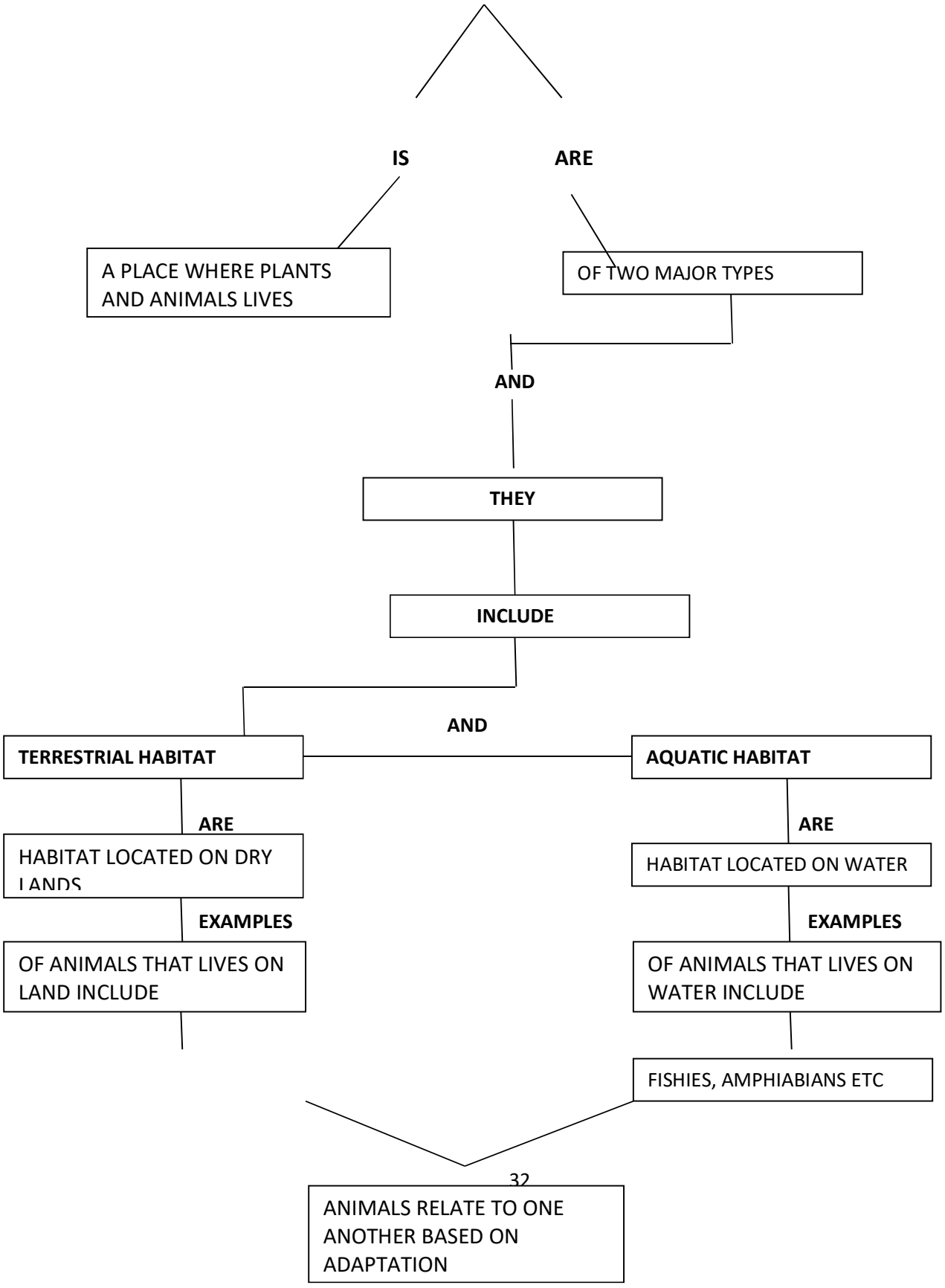
Types of Concept Maps

The following are the types of concept map

1. **Hierarchy Concept Map**

Hierarchy concept map represent information in a descending order of importance. The most important information is placed on the top. According to Novak and Gowin (1984), the hierarchical

structure arises as a result of new information that is often related to and subsumable under more general or more inclusive concept. However, the hierarchy expands according to the principle of progressive differentiation. New concept and new links are added to the hierarchy either by creating new branches or by differentiating existing ones even further. Meaning increase for students as they recognize new links between set of concept or proposition at the same level in the hierarchy. E.g of a concept map of on habitat is shown below:


IS
ARE
A PLACE WHERE PLANTS AND ANIMALS LIVES
OF TWO MAJOR TYPES
AND
THEY
INCLUDE
AND
TERRESTRIAL HABITAT
AQUATIC HABITAT
ARE
ARE
HABITAT LOCATED ON DRY LANDS
HABITAT LOCATED ON WATER
EXAMPLES
EXAMPLES
OF ANIMALS THAT LIVES ON LAND INCLUDE
OF ANIMALS THAT LIVES ON WATER INCLUDE
FISHIES, AMPHIABIANS ETC
ANIMALS RELATE TO ONE ANOTHER BASED ON ADAPTATION

THESE

MAN,GOATS,SNAKE,DOgG ETC

2. Spider Concept Map

In spider concept map, the central team or unifying factor is placed on the center of the map. Outwardly, radiating sub teams surrounds the centre of the map.

3. Flow Chat Concept Map

In this concept map information are organized in a linear form.

4. System Concept Map

In this type of map, information is organized in a similar way like that of a flow chart with the addition of 'INPUT and OUTPUT'.

Adamczykl and Wilson, (1996) as quoted by peter (1999) described five different types of concept maps and they include:

1. **Free Range:** In this type of map, students are given the opportunity to demonstrate what they know. The teacher provides the list of prime descriptors which may be defined by the teacher or provided by an initial brainstorming session with student.
2. **Object Only:** The teacher provides the concepts and the students are to supply the propositions and the direction of arrows.
3. **Link Only:** The students are to supply the description only.
4. **Proposition:** descriptors and proposals are provided and the students are expected to choose appropriate connections in order to build the pre defined concepts.
5. **Picture Map:** The students work in groups and like pictures representing the prime descriptors either verbally or by various written or pictorial methods.

Other special concept maps include the following types:

1. **Picture Landscape Concept Map:** These maps present information in a landscape format.
2. **Multidimensional/3-D Concept Map:** These maps describe the flow or state of information or resources which are too complicated for a simple two-dimensional map.
3. **Mandala/Mandala Concept Map:** In this map, information is presented within a format of interlocking geometric shapes. A "telescoping" fact creates compelling visual effects which focus on the attention and thought processes of the viewer.

Features of a Concept Map

There are two features of concept map that are important in the facilitation of creative thinking and they are:

- The hierarchical structure that is represented in a good map and the ability to search for and characterize cross links. In a concept map, the concept will be represented in a hierarchical fashion with the most inclusive, most general concept at the top of the map and the more specific less general concept arranged hierarchically below. The hierarchical structure of a particular domain is been applied or considered. It is best to construct concept map with reference to some particular question will seek to answer or situation or event that we are trying to understands through the organization of knowledge in form of a concept map.
- The second importance of concept map is the inclusion of "cross links". These are relationships between concepts in different domains of the concept map. The cross links in the concept map shows how some domains of knowledge represented in the map are related to each other. Cross links often represent creative leaps on the part of the knowledge procedures in the creation of new knowledge. Final features that will be added to concept maps are specific examples or actual images of event or object that helps clarify the meaning of a given concept.

Characteristics of Concept Mapping

The following are the characteristics of concept mapping:

1. **Underlying Theory:** It is grounded on Ausubel's assimilation theory which shows that new knowledge can be learned effectively by relating it to previously existing knowledge. Concept map may be viewed as a methodological tool of assimilation theory that displays fundamental element of the theory such as subsumption, integrative reconciliation and progressive differentiation.
2. **Semi-Hierarchical Organization:** The basic motivation for the hierarchical arrangement of concept in concept map is from Ausubel's notion of subsumption, that more general, super ordinate concept subsume more specific detailed concept. This theoretical notion translates to an arrangement of concept from those that are more general towards the top of the page, with those that are more specific or detailed distributed beneath. In practice, the concept in concept map are not arrange in a semi-hierarchical manner. Concept map allow for the representation of un-hierarchical relationship or cross links as well as other types of non-hierarchical arrangement.
3. **Links:** This is another defining factor of concept map. Novak and Gowin (1984) stated that a link phrase should join concept to form meaningful proposition which is a basic unit of knowledge according to the theory of meaningful learning and Ausubel's assimilation theory. Researchers using other types of graphing method have prescribed a limited number of linking phrases that can be used universally.
4. **Label:** A label for most concepts is a word. It could be a symbol such as + or %. Concept mapping theory does not constrain the label that can be used. This allows map makers more freedom and precision in describing the relationship among concepts.
5. **Definition of Nodes:** One of the defining characteristics of concept map is the limiting node content to concepts which allows for a more explicit representation of the interrelationships

among concepts. Numerous mapping systems have been developed that enables graphical depiction of ideas and concept e.g. knowledge maps, mind maps, cognitive maps and semantic networks. Concept maps differ from these other types of maps due to the above characteristics.

Underlying Theory of Concept Mapping

Concept mapping is base on cognitive theory of David Ausubel's (Assimilation Theory) who stress the importance of prior knowledge in been able to learn new concept. The fundamental idea in the Ausubel's cognitive psychology theory of learning is that learning takes place by the assimilation of new concepts and propositions into existing conceptual frame work held by the learner. The first concepts are acquired by students during the ages of birth to three years, when they recognize regularities (Mac namara, 1982). This is a phenomenal ability that is part of the evolutionary heritage of all normal human beings. After age 3,new concepts and propositional learning is mediated heavily by language and takes place primarily by a reception learning process where new meanings are obtained by asking questions and getting clarifications of relationships between old concepts and propositions and new concepts and propositions. This acquisition is mediated in a very important way when concrete experiences or props are available; hence the importance of "hands on" activity for science learning with young children, but this is also true with learners of any age and in any subject matter domain.

In addition to the distinction between the discovery learning process where the attributes of concepts are identified autonomously by the learner and the reception learning process where attributes of concepts are described using language and transmitted to the learners, Ausubel made a very important distinction between rote learning and meaningful learning. For meaningful learning to take place, three conditions must be met;

- The material to be learned must be conceptually clear and presented with language and examples relatable to the learners prior knowledge. Concept maps can be helpful to meet this conditions both by identifying large general concepts prior to instruction in more specific concepts and by assisting the sequencing of learning tasks through progressively more explicit knowledge that can be anchored in developing conceptual framework.
- The learner must posses' relevant prior knowledge. This condition is easily met after age 3 for virtually any domain of subject matter, but it is necessary to be careful and explicit in building conceptual framework if one hopes to present detailed specific knowledge in any field in subsequent lessons.
- The learner must choose to learn meaningfully. The teacher or mentor only has indirect control over learners by motivating them to choose to learn by attempting to incorporate new meanings into their prior knowledge rather than simply memorizing concept definitions or propositional statement or computational procedures.

Construction of Concept Maps

Different methods can be used in the construction of concept maps. The method one decides to use depends on the purpose of map construction. Concept maps can be constructed either by hand or with the assistance of software supports specific tasks or general diagramming. It could also be constructed by individuals or groups either with or without facilitation. According to Novak and Gowin (1984), a standard concept map construction methods include the following series of steps;

1. Define the topic. Concept map that attempt to cover more than one question may be difficult to manage.
2. Identify and list the most important or 'general' concepts that are associated with the topic.
3. Arrange concept hierarchically or morphologically from the most general and inclusive to the most specific, in action that fosters the explicit representation of subsumption relationship.
4. Once the key concept as been identified and ordered, links are added to form a preliminary concept map.
5. Linking phrases are added to describe the relationship among concepts.
6. After building preliminary concept map, look for cross links which links together concepts that are in different areas of sub-domains on the maps. Cross links help to elaborate how concepts are interrelated.
7. Review the map and make any necessary changes to structure or content. Below is an example of a concept map on Basic science

Variation of Standard Map Construction Method

This method of concept map construction is preferred because it allows the creator freedom in the representation of knowledge. Other methods of map construction have been used to serve a variety of goals including ease of computer implementation and ease of construction by students. It was suggested by Ruiz-Primo , Schultz, Li. and Shavelson (2001) that the degree of control or directedness in map construction differs in different mapping tasks. Map builders can be given the structure of the knowledge map, lists of concepts and linking phrase to use to fill in the slots in the graph (a fill task). At the opposite

extremes, the creator may be required to provide all the concepts and the linking phrases (a graph from scratch task).Apart from encouraging the semi-hierarchical format, the method proposed in Novak and Gowin (1984) is a low –directedness mapping task. It was suggested by Ruizo –Primo et al (2001) that graph construction tasks that are low in directedness may provide clearer insights into differences among students knowledge. Other concept mapping construction methods includes variations designed to address specific tasks or setting. Concept maps can be constructed by individuals or by collaborative groups either in the same location or in remote locations facilitated by computer network. Concept map could be constructed with or without the use of facilitation, either within a group or individual setting. In any of the above setting, the facilitator may simply play the role of transcriptionist or actively promote elaboration or clarification of ideas in the concept map and improvement of the map structure. Concept mapping software has been designed to provide different types of facilitation for map construction. This includes online scoring and assessment of maps or suggestion about improvement that may be made on the concept map.

Collaboration in the Construction of Concept Map

In many cases, concept maps can be constructed as part of a collaborative group process. Although the standard method of mapping presumes that a concept map can be made to represent individuals' current knowledge and understanding. Concept mapping can facilitate the exchange of information in group and can make the view point of an individual's collaboration clearer and encourage participation in collaborative process.

In educational setting, collaboration concept maps have been used in group projects and have been compared with other types of group projects such as posters (e.g Van Voxtel,Vander Linder and Kanselear 1997,2000). Collaborative creation of map may be conducted face to face or at a distance. It may be synchronous (all participants working concurrently) or asynchronous (e.g one collaborator completes the map and another edits) Collaborations in the construction of maps in any context described previously can be performed locally or at a distance either synchronously or asynchronously.

As in the case of individual map construction, a well defined focus question must be formulated. One method of collaborative concept map construction entails group identification of concept and their relationship. One means of improving efficiency in a group creation is to identify a group moderator and a recorder or 'drive' who actually records the concepts and build the concept map. It should be noted that participants might have irreconcilably different opinions that are made evident by the process. Such differences can cause the mapping process to stall. In such cases, it is probably best to separate out the conflicting ideas into two concepts maps and continue in separate groups. An attempt to reconcile differences can be made when both positions are clearly mapped.

Another form of collaboration in concept map construction is allowing the user access to related maps in development by others. There are multiple ways to provide this capability; this includes searching for related maps on public servers and collaboration capabilities provided by software. Canas, Hill,Garandos,Perze and Perze (2003) described the extensive networking provided by the concept map tools software in support of synchronous and synchronous collaboration and sharing during concept map construction. Canas et al proposed a different form of collaboration in which knowledge soup stored in server allows students from distant schools to share claims(propositions) derived from their concept maps regarding any knowledge domain been studied.

Facilitation of Concept Map Construction: Human Facilitation and Computer Support.

Facilitations can take several forms in the creation of concept map. It could be human facilitation or computer software facilitation. A distinction can be made between assistance that is provided by human facilitators and that which is provided by computer software that is used to construct concept map. Also, the nature of facilitation to be used depends on the goal of mapping effort. If the goal is to use concept mapping in an educational setting to help students learn meaningfully or for the assessment of structural knowledge, than the facilitator is essentially a teacher who must help the students learn how to make concept maps. Guiding students through the steps in the standard method described earlier and presenting examples of good concept maps are effective strategies to pursue this end. Secondly, if concept mapping is use as a vehicle for knowledge elicitation, the facilitator plays a different role. In this case, the expertise resides within the expert and the facilitator's role is to help create, co-create, with the expert been an explicit representation of that knowledge in a concept map. In this setting, a facilitator may perform several function including that of a knowledge editor, an interviewer who simultaneously create a concept map reflecting the ideas that emerge from the interview, a 'cheer leader' who encouraged the effort to achieve clarity, consistency, completes and even a monitor to encourage all the various group members to become involved in the mapping process.

When constructing a group concept map, it is desirable to allow the emerging concept map to be viewed by all participants using computer software and a projector or by creating a presentation on the white board. Facilitation can be done by any of the group members in as much as they contribute to attempt to refine the concept map. The role of the designated facilitator is to assist in the elucidation of knowledge and ideas of group members and to assist in construction of a concept map representation that adequately represents the necessary information in a well designed and readable concept map. Another source of support can come from the software itself. Ideally, electronic facilitation might provide an individual with information about good concept mapping form and process (for example ,hierarchical structure in maps, definitions of focus questions ,adequate distinction between concepts and linking

phrases, clear specification of linking phrases etc). Although this level of support may seem to be relatively providing feedback in a very difficult task to automate. In addition, concept map systems might provide online access to word net, the web or other related information directories which may provide access to concepts and relationships that could or should be incorporated within a given concept map on a given topic .A course authority system in which manual linking of course topics in a concept map which can be aided by automatic linking of topics based on keywords defined in the course material was described by Cristea and Okamoto (2001). The teacher or course designer is than asked to verify the corrections. Leake et al (2001) presented a mechanism that suggests linking phrases and related concept map tools and suggested topic for new concept maps related to the ones under construction. Concept map tools also provide access to definitions synonyms and other terms related to a word in a concept maps or linking phrase (Canas and Velerio 2003). Concept map creation can be facilitated in a verity of ways that involves human and machine assistance.

Uses of Concept Map and its Application in Educational Settings

The following are the uses of concept maps;

1. **Concept map as 'Advance Organizer':** They are regarded as global overview of what is to be learnt. Ausubel,Novak and Hanessian ,(1978) advocated the use of "Advance organizers to foster meaningful learning. He suggested that the advance organizers foster meaningful learning by;
    a. Promoting the learner pre-existing super –ordinate concepts that are already in the students' cognitive structure.
    b. Providing a context of the most general concepts into which students can in corporate progressively differentiated details.

Advance organizers are most effective if they make explicit the relationship among learned concepts that are already known, thus providing structure into which the new concept can be integrated

(Canas,Coffey,Carnot,Feltovich,Hoffam,Feltovich and Novak 2003). Advance organizer concept map can be constructed by the teacher or other experts. The constructed concept map advance organizers can be used in various ways as part of the classroom experience. They can be presented at the beginning of a text book chapter or other instructional unit or used as a guide for a lecture that is presented in the class. They can also be used to present an overview multimedia with links to instructional materials associated with different topics.

2. As a tool for supporting learning: The concept map created by students can be used in several ways to facilitate meaningful learning. It was pointed out by Novak and Gowin (1984) that concept map is some kind of schematic summary of what students know. It (concept map) can be used to display students prior knowledge about a given topic or they can be used to summaries what has been learned by students after reading or completing class work. In this regard, it is often used for note taking or as a study aid. The art of map creation 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 and understanding, providing a kind of feedback that helps students monitor their learning and perhaps with the assistance of teachers or peers to focus attention on learning needs. As a creative activity, concept mapping can also be used as a planning alternative to easy writing. Most reviewed literature shows that the prevalent use of concept mapping is for teaching and learning.

3. Identification of Current Understanding, Misconception and Conceptual change; Concept maps have been used to examine students prior knowledge and to track a student's progression of knowledge throughout a course, compare students at different levels of knowledge and so forth (Admaczyk&willison,1996; Cho, 1980; ,Hoz, Boroman &kozmiasky, 2001 ;Parsall, Skipper &Mintzes ,1997; Songer & Mintzes ,1994). The level of conceptual understanding students achieve in a new learning activity is highly dependent on their prior knowledge. Concept maps have also been used to identify

specific misconception in knowledge (e.g Gonzalez 1997; Regis and Albertazzi, 1996; Trowbridge and Wandersee 1994) and to identify alternative educational approaches to address misconceptions (Kinchin, 1998; Mc Naught and Kennedy 1997; Passmore 1998). Teachers and students are often able to more clearly identify misconceptions within the context of a concept map.

According to Lavoie (1997) using a reflective writing exercise with concept mapping reveals additional misconceptions and provides more information about students' understanding than concept map alone. Edmondson and Smith (1996) used concept maps in several different ways in a veterinarian curriculum where faculty members are able to identify students' misconceptions and adjust teaching to address them.

4. **Concept Map as an Assessment Tool:** It can be used as formative or summative assessment procedures. In the formative assessment, learners may be asked to make a concept map at various points in the learning process to show their understanding and the teachers can use these maps both to assess the learners understanding and to modify the curriculum. In summative assessments, it can be used at the end of an instructional unit to determine a learners understanding of that unit and to assign grade.

How to Use Concept Mapping Strategy in the Classroom

In using the concept mapping strategy in the classroom, the teacher has to follow the steps below:

Step I: for each topic to be taught the teacher will identify a focus questions or define the key topic.

Step II: After the identification of focus question or topic, the teacher list the most important or general concepts that are associated with that topic

Step III: The teacher places the listed concepts from the most general and inclusive to the most specific. This action fosters the explicit representation of subsumption relationship i.e. hierarchical arrangement.

Step IV: The teacher adds links to form a preliminary concept map.

Step V: The teacher adds linking phrases to describe the relationship among concepts.

Step VI: After building the preliminary concept map, the teacher looks for cross links which will link together concepts that are in different areas or sub domains on the map. Cross links help the teacher to elaborate how concepts are interrelated.

Step VII: The map will be reviewed by the teacher in order to make any necessary changes in structure or content.

Method of Scoring Concept Maps

According to Canas et al (2003), there are three methods of scoring concept map and they include:

1. Traditional method
2. Automated scoring method
3. Traditional base scoring combine with methods based on comparison to criterion map

Traditional Method: This method of scoring concept map was proposed by Novak and Gowin (1984). The method is based on the component and structure of the concept map. They assign point in the following ways:

- For valid proposition 1 point each
- For each level of hierarchy 5 points
- For each number of branching 1 point

- For each valid cross-links 10 points
- For specific example 1 point each

The number of hierarchical levels addresses the degree of subsumption. The number of branching indicates progressive differentiation and the number of cross links indicates the degree of integration of knowledge. The scoring technique has proven to be time consuming but it gives a great deal of information about the creator's knowledge structure. Some scoring techniques have been developed as an extension or variations of Novak and Gowins' system. E.g Mintzes and colleagues, Pearsall, Skipper and Mintzes (1977) scored the same components of the map but weigh them differently. Some researchers are pursuing the possibility of providing automated assessment for the structural component of concept map (Luckie 2001, NAF Proposal).

Automated Scoring System: This method involves the comparison of a students' map with that of an expert. Expert maps may be constructed by a teacher or by a group of domain experts. Comparison procedures can range from prepositional comparison to holistic comparison of maps and this procedure has to be well defined. This automated scoring system is typically based on propositional matching within limited sets of concepts and linking phrases. Holistic or structural comparisons are more difficult to automated scoring method as they often require human judgment.

Traditional base scoring combine with methods based on comparison to criterion map: This method of scoring involves the use of traditional base component scoring combine with some comparison to a criterion map by assigning more weight to propositions that were considered to be critical by experts. Rye and Rubba (2002) reported such a concept map scoring system that was based on component but which used an expert map to weigh composition in the students map.

Two major issues are of great concern in the method used for scoring concept maps. One of them is that the traditional method are time consuming and it requires the input of an expert either in terms of

judging the validity and the importance of map components or in the creation of a criterion map. The second issue of great concern is the psychometric properties of concept map scores. The first issue was addressed by the development of simplified map scoring techniques. An example of a simplified concept map scoring technique was provided by Shake and Bitner (1996). It uses Novak and Gowins' (1984) scoring techniques as the starting point but provided simplified analysis of important map characteristics. In their approach, several map properties including propositions, branches, hierarchies, examples, cross links etc are given a rating from 0 to 4 rather than being counted or characterized. This kind of simplification in scoring is probably typical of those utilized in concept map assessment. According to Kinchin, Hay and Adams (2000), concept maps should be analyzed in terms of their overall structure rather than in terms of a detailed analysis of concept, links and proposition as another alternative.

Students' Attitude Towards Science

According to business dictionary .com, attitude is a predisposition or a tendency to respond positively or negatively towards a certain idea, object, person, or situation. Attitude influences an individual's choice of action, and responses to challenges, incentives, and rewards (together called stimuli). Four major components of attitude are (1) Affective: emotions or feelings. (2) Cognitive: belief or opinions held consciously. (3) Conative: inclination for action. (4) Evaluative: positive or negative response to stimuli.

The oxford advanced learners' dictionary defines Attitude "as the way you think and feel about something or someone." The concept of Attitude arises from attempts to account for observed regularities in the behavior of individuals. Ones Attitude is judged from observable, evaluative responses he or she tends to make. Scholla (2002) sees Attitude as a mental predisposition to act that is expressed by evaluating a particular entity with some degree of favour or disfavour. In continuation, he said that

individuals generally have Attitude that focus on objects, people or institution. Attitude itself cannot be observed, it is inferred from behaviors' observation.

One of the major aim of introducing basic science into the curriculum was with the aim of catching the young learner to love science. This is one of the indicators that students have positive attitude towards science. This was why Osborne (2003) argued that the continuing decline in numbers choosing to study science at the point of choice requires a research focus on students' attitudes to science if the nature of the problem is to be understood and remediated.

Suzanna &Marcos (1998) as cited by oghenejabor (2005) noted that lack of commitment towards teaching and learning makes teachers develop negative attitude towards teaching and learning situation. Anders and Berg (2005) from their research work discovered that teachers attitude towards teaching of chemistry goes along way to affect the students either positively or negatively .Students appreciate the teacher more if he/she shows them respect in their chemistry learning. Mattaga and Abdullahi (2003) are of the view that teaching and learning are opposite side of a coin. According to them, a good teacher is one who understands what his/her students need to learn and also has a good understanding of their capabilities for learning.

Many factors affect the attitude of student s towards the teaching and learning of science. The conditions under which the teacher work affects the attitude of the teacher either positively or negatively and this will in turn affect the student's attitude . Examples of such conditions according to Cedrez (1993) are school infrastructure, poor library, ill equipped laboratories, safety conditions and classroom environment. Aron as cited by Oghenejabor (2005) is of the view that a teacher should have enough time to prepare for his or her lesson as this goes a long way to affect his or her thinking skills, communication skills, problem-solving abilities and data interpretation. Any teacher lacking in these aspects ends up

having a negative attitude towards the subject he or she is teaching and this in turn affects the student's attitudes and performance.

Empirical Studies on the use of Concept Mapping on students achievement in school science.

Ajaja (2011) carried out a study titled " Concept Mapping As a S tudy Skill: Effects on Students Achievement in Biology". The purpose of the study was to determine if the use of concept mapping as study skill could influence students' achievement in biology. The design of the study was quasi experimental Pretest Posttest control group design. The population consisted of 280 SSII students from where 120 students were selected. 100 students were used for analysis while 20 students dropped out of the study. To guide this study five research questions were raised and three hypotheses stated and tested at 0.05 level of significance. The major instrument used for data collection was biology achievement test. Another instrument used for data collection was an interview schedule to determine the students' perception of the usefulness of concept mapping in their studies. The major findings of this study include: a non significant difference in immediate Post achievement test scores between students who used concept mapping as a study skill and those who reviewed and summarized in their studies; a steady, consistent and significant increase in test scores of students who used concept mapping as study skill across achievement tests 1-6; a significant difference in estimated retention between students who used concept mapping as study skill and those who summarized after review , and all the students interviewed agreed that concept maps helped them to determine relationships among concepts, sharpened their understandings and increased their critical thinking.

Jegede, Alaiyemola and Okebukola (1990) carried out a study on the effect of concept mapping on students' anxiety and achievement in biology. The study sought to find out if the metacognitive strategy of concept mapping reduces anxiety and thereby enhances achievement in

biology. A total of 51 (30 boys, 21 girls) senior secondary one (grade 10) students participated in this experiment. Two instruments—the Zuckerman Affect Adjective Checklist and the Biology Achievement Test—were used in pre- and posttest administrations to measure the treatment effect on anxiety and achievement, respectively. Findings support the stand that concept mapping is significantly more effective than the traditional/expository teaching strategy in enhancing learning in biology. In addition, it apparently reduces students' anxiety towards the learning of biology. A significant reduction of anxiety was noticed for male subjects.

Cheema and Mirza (2013) carried out a study titled "Effect of Concept Mapping On Students' Academic Achievement". The study aimed to analyze effect of concept mapping, a constructivism based learning strategy, on academic performance of 7th grade students in the subject of general science. The quasi experimental research, based on 2x2 factorial research design, involved 167 students from two single sex schools. Major objectives of the study were to; (i) find out the effect of concept mapping as a learning strategy on the academic achievement of students (ii) study differential effect of concept mapping on academic achievement of male and female students (iii) to find out the interaction effect of concept mapping as a learning strategy and gender on students' academic achievement. Researcher's developed achievement test was used as pre test and post test. During the treatment of five months, experimental group was trained to develop concept maps for three weeks. Subsequently students developed concept maps of general science content individually, shared those in groups and were compared by teacher with scientifically accepted concept maps for possible correction and improvement. Data on gain achievement scores were analyzed through 2-way ANOVA. Results showed that the male and female students taught through concept mapping performed better than the students taught through traditional teaching method. However male students taught through concept mapping performed significantly better than the female students

Adeneye (2011) carried a study titled " Effect of Concept Mapping Strategy on Students' Achievement in Junior Secondary School Mathematics". The study investigated the effect of concept mapping strategy on achievement in mathematics of 88 junior secondary year three Nigerian students. The study adopted a pre-test, post-test non-equivalent control group quasi-experimental design and data collected for the study were analysed using the t-test statistic. The experimental group, taught with concept mapping strategy obtained mean post-test score which was significantly higher than the mean post-test score of the control group. Results

showed that concept mapping is an effective strategy for teaching and learning mathematics. The strategy is also capable of improving students' mastery of content at the higher-order levels of cognition.

Sakiyo and Waziri (2015) carried out study titled " Concept Mapping Strategy: An Effective Tool for Improving Students' Academic Achievement in Biology". The study investigated the use of concept mapping teaching method on secondary school students' academic achievement in biology. Two hypotheses tested at 0.05 level of significance guided the study. The design of the study was quasi-experimental design with 122 Senior Secondary students selected purposively from two senior secondary schools in Adamawa state. Instrument used for data collection was an achievement test tagged Biology Students' Achievement Test (BSAT) adapted from WAEC tests 2005 to 2010. The instrument was content validated by three experts and Cronbach alpha formula was used for testing its reliability. The reliability coefficient of 0.78 was obtained. The treatment lasted for six weeks and data were analyzed using one-way Analysis of Covariance (ANCOVA). The result revealed that, concept mapping method enhanced students' academic achievement in biology. Furthermore, there was no significant difference between male and female students in the experimental group.

Singh & Moono (2015) carried out a study titled " The Effect of using Concept Maps on Student Achievement in Selected Topics in Chemistry at Tertiary Level". The study investigated the effectiveness

of composite use of concept maps and traditional method on student achievement in selected topics in chemistry. The study was conducted in view of determining the method which is more effective in enhancing student understanding in chemistry. There were three groups involved in the study i.e. Control, experimental group1 and experimental group 2. The pre-test, post –test true experimental research design was used for the study. The sample of the study consisted of thirty nine (39) first year students at Mufulira College of education. Each of the three groups was randomly assigned 13 students. The treatment took four weeks using the topics “atomic structure” and “chemical bonding”. The control group was treated using the traditional method, the experimental group 1 was treated using the conceptmap method while experimental group 2 used composite of both the traditional and concept map methods. One way ANOVA at an alpha (α) = .05 was conducted to analyze the results of the pre- test and post test scores. The means of the pre-test scores were; control group = 6.46, Experimental group 1 = 7.07 and experimental group 2 = 6.61. These results show that there was no significant difference in the performance of the students in all groups. This result implied that the entry level performance for all the groups was not significantly different. The means of the post-test results(control group = 4.53,experimental group1 = 5.46, experimental group 2 = 6.61) showed that there was a significant effect on the use of both traditional teaching method and concept map teaching method at $p < .05$ level for the three groups at $F(2,36) = 17.156$, $p = 0.00$. The experimental group 2

performed better than both control group and experimental group 1 in the post test scores. Post hoc comparisons using the Turkey HSD test indicated that the mean scores were significantly different. The results strongly support that when students are taught using both the concept map teaching strategy and traditional teaching strategy, they achieve the best scores. This study therefore offers an encouraging solution towards improvement of student performance in Chemistry at tertiary level.

BouJaoude and Attieh (2008) carried out a study titled " The Effect of Using Concept Maps as Study Tools on Achievement in Chemistry". The purposes of this study were to: (1) examine whether or not the construction of concept maps by students improves their achievement and ability to solve higher order questions in chemistry, (2) investigate the differential effect of the treatment by gender and achievement level, and (3) explore the relationships between performance on concept maps and chemistry achievement. Participants were 60 tenth-grade students randomly divided into two groups. The study spanned six weeks in a class that met five times a week. The material covered was acid-base titration and equilibrium in weak acids. The students were pre- and post-tested using a teacher-constructed chemistry test. Results showed that while there were no significant differences on the achievement total score, there were significant differences favoring the experimental group for scores on the knowledge level questions. Moreover, there were sex-achievement interactions at the knowledge and comprehension level questions favoring females and achievement level –achievement interactions favoring low achievers. Finally, there were significant

correlations between students' scores on high level questions and the convergence and total concept map scores

Nicoll, Francisco and Nkhleh (2001) carried out a study to investigate the value of choosing concept mapping in general chemistry and more particularly to see if concept mapping will produce a more interconnected knowledge base in students when compared with ordinary instruction. The result showed that the concept mapping group knew more concept, more linking relationship and had no more erroneous linking relationships than the non concept mapping students. Despite some design flaws (eg non random assignment etc), this findings are very impressive for concept mapping as it relates to the development of an interconnected knowledge base.

Chang, Sung and Chen (2001) carried out a study to determine the benefit of learning on three different kinds of uses of concept maps. The design involved four conditions, one control and three experimental, a pre-test and a post-test. Twice per week for four weeks, students read one of the science articles and study it under one of the four conditions. In the map generation group, students constructed a concept map for the material from scratch. In the other group (map connection group) students were given an expert generated concept map for the material in which some errors has been introduced. Students were to find and correct these errors. In the scaffold-fading group, students were progressively weaned from constructed maps. The control group received no adjuncts at all, just the original text to read and study. The result showed that the map corrective group did better on the (comprehension) post-test than the map generation and the control group. The differences among scaffold-fading, map generation and control groups were not significant.

Effect of the use concept mapping instructional strategy on students attitude towards school science

Eravwoke (2010) carried out a study titled "Effect of Concept-Mapping Teaching Learning Technique on teachers attitude and students achievement in chemistry. The major purpose of this study was to find out if concept mapping teaching -learning technique will improve teachers and students' attitude towards chemistry. To guide this study four research questions and their corresponding hypotheses were raised, answered and tested at 0.05 alpha level of significance. The design of the study was a pre-test post- test non-equivalent control group quasi- experimental design. The samples of the study consist of six secondary schools (two boys, two girls and two mixed), 112 students and six chemistry teachers. The major findings of this study included: concept mapping experience increased both teachers and students attitude towards chemistry and students achievement in chemistry.

Effect on Concept Mapping Instructional strategy on students' achievement based on gender

Eravwoke and Omoifo (2014) carried out a study on effect of concept-mapping teaching and learning techniques on senior secondary school students' achievement in chemistry. The purpose of their study was to find out if concept mapping teaching learning techniques will improve students' achievement in chemistry. Based on the identified problem, they raised two research questions and corresponding hypotheses will raised and formulated, answered and tested at 0.05 alpha levels of significance. The design for the study was a pretest-post-test non-equivalent control group quasi experimental design. Six secondary schools (2 boys,2 girls, 2 mixed) consisting of 112 students and six chemistry teachers became the same for the study. The major findings of the study include: (i) students in the experimental group perform better than those in the control groups (ii) female students performed better than their male counterparts in the experimental group.

Bello & Abimbola (n.d) carried out a study on gender influence on biology students" concept-mapping ability and achievement in evolution. The study mainly sought to investigate gender influence on students' concept-mapping ability and achievement in evolution. It attempted to provide answers to the following questions on how do male and female students compare in constructing concept maps? And if there any gender influence on achievement in evolution when students are taught evolution through concept-mapping instructional strategy . Four research questions were raised for the study. The one-group pretest posttest quasi-experimental design was adopted in conducting the study. The main data-gathering instrument employed for the study was the slightly modified form of the Evolution Theory Tests developed by Bello (1997). 48 biology students in the selected school became the sample for the study. The findings of the study revealed the following (i) it was shown clearly reveal that concept-mapping ability is not significantly influenced by students' gender (ii) Results of the study indicate that while most high-scoring students constructed good concept maps, a few of this group of students constructed poor maps Conversely, while few low-scoring students constructed good concept maps, many of them constructed poor concept maps (iii) significant difference does not exist between the achievement in

evolution of male and female students generally, when taught through concept-mapping instructional strategy.

Nekang and Agwagah (2010) studied effect of concept mapping on students' achievement and interest in elementary probability in Cameroon . This study investigated the effect of concept mapping on two groups of form five (final year secondary school) students' achievement and interest in elementary probability. It also sought to find out the effects of concept mapping on the achievement of male and female students in probability. A 17 item essay type Achievement Test in Elementary Probability (ATEP) and a 13 item Probability and Statistics Interest Inventory (PSII) were administered on 154 subjects before and after teaching. The internal consistency of ATEP ($\alpha = 0.70$) and the reliability coefficient of PSII ($\alpha = 0.64$) were computed using the Cronbach Alpha (α) formula. The subjects were randomly drawn from two schools in Bui Division, in the North West Region of Cameroon. The study lasted for two weeks. Data were analyzed using means and analysis of covariance (ANCOVA), to test the two hypotheses stated at $p \leq .05$ level of significance. Results showed that concept mapping enhances students' achievement and interest in probability and statistics in Bui Division in Cameroon

Otor (2013) carried out a study titled "Effects of concept mapping strategy on students' achievement in difficult chemistry concepts". The study investigated the effects of concept mapping strategy on secondary school students' achievement on difficult chemistry concepts. It also examined the differential effect on the achievement of male and female chemistry students. Two research questions and two hypotheses were formulated to guide the research. The study used a quasi-experimental pretest-posttest on group design. Data were collected from 1,357 SS2 chemistry students using a stratified random sampling procedure from two schools in two local government Areas of Benue State of Nigeria. One instrument for data collection developed by the researcher and validated by experts was Chemistry Achievement Test (CAT), on structure of matter and energy changes. The research questions were

answered using mean and standard deviation scores, while the hypotheses were tested at 0.05 significance level using Analysis of Covariance (ANCOVA). Students taught using concept mapping strategy achieved higher and significantly better than those taught using conventional method. There was also a better performance in favour of female students compared to their male counterparts using this method.

Effect on concept mapping instructional strategy on students' achievement based on learning abilities

Udeani and Okafor (2012) carried out a study titled "The Effect of Concept Mapping Instructional Strategy on the Biology Achievement of Senior Secondary School Slow Learners". The study investigated the comparative effectiveness of the expository and concept mapping instructional strategy of presenting secondary school biology concepts to slow learners. One hundred and twenty four biology slow learners were identified and randomly assigned to the expository group (n=62) and concept mapping group (n=62) and respectively taught the concept of photosynthesis. The groups were post-tested after two weeks of teaching for any significant differences in their biology achievement. Analysis of post-test scores indicated that the group taught by the concept mapping instructional strategy performed significantly ($p<0.05$) better than their expository group counterparts. Specifically, female slow learners taught with the concept mapping instructional strategy performed significantly ($p<0.05$) better than their male counterparts taught by the same method.

Appraisal of the Reviewed Literature

From the theoretical framework, it was found that meaningful learning takes place when a child actively participates in the teaching and learning process. As learners engage in activities with adults or more capable peers, they exchange ideas and modify of thinking about concepts.

A review of majority of past researches showed that several empirical studies have been carried out to determine the effect of concept mapping teaching learning techniques on students achievement

in school science at senior secondary levels (Jegede, Alaiyemola & Okebukola, 1990; BouJaoude & Attieh ,2008, Nekang & Agwagah ,2010; Ajaja, 2011; Udeani & Okafor, 2012; Otor ,2013; Eravwoke & Omoifo, 2014; Sakiyo & Waziri , 2015),) and at junior secondary school level, only one study was done on the effect of concept mapping instructional strategy in mathematics (Adeneye , 2011). From the literature reviewed within the reach of the researcher, it was discovered that there is a dearth in literature on effect of concept mapping teaching learning technique on basic Science students achievement and attitude in Delta Central Senatorial District, as such, this became the gap that this study investigated and filled.

CHAPTER THREE

RESEARCH METHOD AND PROCEDURE

This chapter describes the following sub-headings:

- Research design
- Population of the study
- Sample and sampling technique
- Research Instrument
- Validity of the instruments
- Reliability of instrument
- Treatment procedure
- Method of data analysis.

Research Design

The design that was used for this study is the 2x2x2x2 factorial non-randomized pre-test post-test non equivalent control group quasi -experimental design. The design consists of two instructional methods, two ability levels (high and low), sex (male and female) and attitude (positive and negative). In this design, there was no randomization of subjects into groups but rather, intact classes were used. The variables for this study included: concept-mapping instructional strategy and lecture method of teaching (independent variables), achievement and attitude (dependent variables), sex and ability (intervening variables).

Graphical Representation of the Design

Groups	Design
Experimental Group	O_1----------X_1---------- O_2
Control Group	O_3 ----------X---------- O_4

Key: ***O_1&O_3 are pre-test while $O_2$and O_4post test.***

---------- ***No randomization of subjects to groups.***

X_1 treatment with concept mapping instructional strategy.

X control group using lecture instructional strategy.

Population of the Study

The population of the study consisted of all public Junior Secondary School 11 basic science students in Delta Central Senatorial District. There are 160 secondary schools and about 7200 students in the senatorial district (Source: Post Primary Board, Asaba. 2011, Appendix v)

Sample and Sampling Technique

The sample for the study consisted of two hundred and fourteen students from six secondary schools randomly selected from two Local Government Areas. Three schools each were selected from each of the Local Government Areas. Six junior secondary schools, six basic science teachers and six intact classes made up the sample for the study. Of the six schools, three schools (i.e. one boy, one girl and one mix school) were used as the experimental group while the other three schools, (one boy one girl and one mix school) were used as the control. Three teachers each were also used for the experimental and control groups as shown in the table below:

Experimental group schools	Control group schools
ABRAKA GRAMMAR SCHOOL, ABRAKA	ETHIOPE MIXED SECONDARY SCHOOL 1, SAPELE
EKU GIRL'S SECONDARY SCHOOL, EKU	ST. ITAS GIRL'S MODEL SECONDARY SCHOOL, SAPELE
OKPARA BOY'S SECONDARY SCHOOL, OKPARA	OKPE GRAMMAR SCHOOL, SAPELE

In the selection of local governments, schools and classes, two sampling techniques were used as follows:

For the selection of Local Government Areas, simple random sampling technique (Balloting) using the withdrawal with replacement strategy was used. In doing this , all the local governments in the senatorial district was listed..

Also, the sampling technique that was used for the selection of schools was stratified random sampling. The schools were grouped into two strata based on their characteristics (single sex and mix schools) and from there; the samples were selected using balloting. The classes were still selected using simple random sampling technique (Balloting). In doing this, all the arms of the selected classes were listed. The arms were also written on pieces of paper, folded and poured into a blind bag. Using withdrawal with replacement method of balloting, the required numbers of classes were selected

Research Instruments

The following instruments were used for the study:

1. Basic Science Scholastic Ability Test (BSSAT)
2. Basic Science Achievement Test (BSAT)
3. Students Attitude Questionnaire (SAQ)

Intervention package

4. Concept mapping instructional strategy was the intervention package.

Basic Science scholastic ability test (BSSAT)

The Basic Science scholastic ability test used for this study was designed by the exams and Standard Division of the Delta State Ministry of Education 2015 (Appendix 11). The instrument consisted of fifty multiple choice items .It test students' knowledge of Basic Science at the end of the coverage of JSS 1 Basic Science syllabus. The test items were drawn from all the major concepts in JSS1 Basic Science syllabus.

The instrument was adopted whole for the study and no fresh input was made to the instrument. The instrument was developed by Exams and standards, Ministry of Education Asaba and has a reliability value of 0.75 . On the strength of this, no fresh validation was done on the instrument since the instrument was constructed in the state and used on the students in Delta state where this study was conducted.

Basic Science Achievement Test (BSAT)

The Basic Science Achievement Test (Appendix I) is made up of two sections. Section A contained questions on students bio-data while section B contained 20 items with one correct answer and four distracters (Option A-E) on the concepts of habitat, terrestrial and aquatic habitats.

Students Attitude Questionnaire (SAQ)

The students' attitude questionnaire a four point modified scale of Strongly Agree (SA), Agree (A) Strongly Disagree (SD) and Disagree (D) designed by the researcher. The students' attitude questionnaire is made up of two sections. Sections A and B, Section A consisted of questions on student's bio-data while section B consisted of twenty items on student's attitude towards Basic science (Appendix 111).

Concept Mapping Instructional Strategy Intervention Package

This is made up of two sections, section A is teachers training manual which include: the specific step to be followed in constructing a concept map. Section A defined concept maps, types of concept maps, characteristics of concept maps and scoring of concept map. Section B shows the specific steps to be

followed in using it as instructional strategy in the classroom. It shows topic to be taught, objectives to be achieved, teachers and students activities, aim of the activities, instructional materials to be used and evaluation questions. (Appendiv iv)

Validity of the instruments

a. Basic Science Achievement Test (BSAT)

The content validity was done using a table of specification as shown in the table below;

Table of specification

Objectives

Content	Knowledge 15%	Comprehension 25%	Application 25%	Synthesis 35%	Total % of items
Habitat 20%	1	1	1	1	4
Terrestrial Habitat 50%	1	3	3	3	10
Aquatic Habitat 30%	1	1	2	2	6
Total Items	3	5	6	6	20

The face and content validities of the BSAT were determined by the supervisor, three experts in Basic Science and one expert in measurement and evaluation. They specifically looked at the research questions and the hypotheses with the intention of establishing if the instrument could generate data to answer the research questions and test the hypotheses.

b. Students Attitude Questionnaire (SAQ)

The content validity of the instrument was done by given it to three experts in measurement and Evaluation and the supervisor of the work. The experts determined if the content of the questionnaire was able to generate data to answer the research questions raised for the study. Their suggestions were that some of the items should be rephrased and this was done.

Reliability of the Instruments

An instrument validation exercise was conducted to determine the reliability of the BSAT and SAQ t to be used for the main study. A mix school which was not part of the main study was purposively selected for the pilot study. In doing this, the instruments were administered to the students after they have been taught the topic Habitat. The data collected were analyzed using Kuder-Richardson formula to determine the reliability value of the BSAT and it was found to have a reliability value of 0.79 (Appendix VI). The Kuder- Richardson (k21) was used because the instrument was an achievement test, Crobanch Alpha formula was used to determine the reliability of the SAQ because it is four lickert scale instrument and it was found to have an r-value of 0.80. With the r values above 0.70, the instruments were considered reliable. This is because according to Wiseman (1999) any instrument with a reliability value of 0.70 and above is reliable. The computation is shown in AppendixV11.

Treatment Procedure

(a) **Training of the experimental and control group teachers**

The experimental group teachers were trained by the researcher on how to use concept mapping instructional strategy. Each teacher was trained individually in a 1hr-30mins session, followed by a practice. In training the teachers on the skills of concept mapping, they were exposed to the following:-

a) Meaning of concept maps
b) Characteristics of concept maps
c) Key terms used in concept map (cross links main concepts, linking phrases, hierarchies etc)
d) Construction of concept maps
e) Scoring of concept maps following Novak and Godwin's guide lines

In course of the training, the researcher made use of the concept map intervention package (Appendix iv)

Ability Testing

A week before the treatment, all the sampled students were subjected to a scholastic ability test in basic science.. The ability test responses were scored and the record of the results for each student was kept. This test served as a means of better defining the sampled JSS11 basic science students as high, middle and low ability students. Students, who scored 44% and below were regarded as low ability students, while those who scored 60% and above were regarded as high ability students. The students who score between 45 to 59% (average ability) were not used in determining the effect of concept mapping instructional strategy students' achievement in Basic science. The reason for leaving out students who scored between 45-59% in the analysis is because members of this group are very unstable. At one time some members became high achievers while at another time some become low achievers.

c. **Lesson treatment**

During the treatment which lasted for Eight (8) weeks, for each lesson taught, the experimental group students were asked to read and produce their concept maps on each topic to be studied before the lesson. During the lesson, the students were also asked to look at their concept maps as the teacher explains. The students were made to provide the linking words and phrases appropriate for the concept maps.

The specific steps adopted in teaching the selected topics using concept mapping and lecture methods are shown in appendices.

At the end of the treatment duration, both the experimental and control groups were given a post test. Also the post attitude questionnaire was administered on both experimental and control group.

Steps followed in teaching Basic Science by teachers using concept mapping instructional strategy and lecture method for the control group.

(a) Teaching with Concept mapping instructional Strategy : In teaching the concepts of habitat and its types using Concept mapping instructional Strategy, the following steps were taken.

Step1: Introduction of the concepts: students were asked to explain the concept to be studied. The aim of this was to determine their prior knowledge about the concept to be taught.

Step 11: Production of concept maps: Students were asked to read their study material on the topic to be taught and summarized what they have read with a concept map. The aim was to foster active participation

Step 111: Explanation of the map: Students were asked to explain the concept using their constructed maps. The aim was to foster active participation and critical reasoning.

Step 1V: Evaluation of the map: Teachers and students identified the relevant features of the map making use of the prepositions and linking phrases. The aim was to fostered active participation and critical reasoning

Step V: Comparison of maps: Teachers and students compared their maps and made corrections were necessary. The aim of this was to further strengthening understanding

Step VI: Drawing of Conclusion: Teacher explains the concepts taught putting into consideration all the students' contribution. Teacher asks questions, answered students' questions to ascertain students understanding and summarized the lessons.

(b). **Teaching the Basic science by the teacher using lecture method for the control group.**

In teaching the concepts of habitat and its types using lecture method, the following steps were taken for each of the concept taught.

Step 1: Teacher asked questions to elicit students knowledge about the concept to be taught

Step II: Teacher explained the concepts to be taught

Step III: Teacher asked students questions to find out their levels of understanding

Step IV: Teacher answered students' questions

Step V: Teacher summarized the lesson.

The specific lessons taught to both groups included:

Week 3

Lessons I & II: Teaching of Habitat and General characteristics

Week 4: Teaching of the types of habitat

Lessons 1&11- Teaching of Terrestrial habitat

Week 5:

Lessons 1 & 11 - Teaching of characteristics of terrestrial habitat

Week 6

Lessons I & II - Teaching of Aquatic habitat

Week 7

Lessons 1&11- Teaching of characteristics of Aquatic habitat

Week 8

Step IV: Post testing

At the end of the treatment, a post-test was administered on the students The Basic science achievement test questions and students attitude questionnaire were given to both the experimental and the control group students to respond to by the researcher.

Step VI

The researcher collected the completed students attitude questionnaire and Basic science achievement test questions from both the experimental and control group students respectively. The

attitudinal and achievement test score of both experimental and control group students were averaged to a single test score in Basic science.

The data were analysed to determine if there was any significant difference in performance of both experimental and control groups. The students' attitude questionnaire score was also be analysed to determine if there was any effect on the students Attitude before and after the treatment.

Method of Data Analysis

Each correct answer given by the students in section B of the Basic science students was scored as 5. At the end, the mark obtained was converted to percentage. The scoring of items in section B of the students' attitude questionnaire followed this pattern. For positively worded answer, SA = 4, A = 3, D = 2, SD = 1. For negatively worded answers, SA = 1, A = 2, D = 3, SD = 4.

To analyze the data collected were analyzed according to hypotheses stated.

All research questions were answered using descriptive statistics of the mean..

H_{01-6} were tested using independent sample t-test at 0.05 alpha level of significance while H_{07-8} was tested using Analysis of variance (ANOVA).

CHAPTER FOUR

PRESENTATION OF RESULT AND DISCUSSION

In this chapter, data collected from this study which looked at the effect of concept mapping technique on students' achievement and attitude in basic science, among junior secondary school students in delta central senatorial district were analysed and presented in tables and discussed

Answering of research questions and testing of hypotheses

Research question 1: Is there any difference in achievement mean scores in basic Science between students in classrooms where concept mapping technique was used and those in classroom where lecture method was used?

Having taught the experimental group students with concept mapping instructional strategy and the control group students with lecture method, the mean scores are represented in table 1 below

Table 1: Descriptive statistics showing the difference in post achievement mean scores in basic Science between students in classrooms where concept mapping instructional strategy is used and those in classroom where lecture method is used.

Group	N	Mean	Mean Difference	SD
Experimental	104	42.24		9.75
			6.85	
Control	110	35.39		8.24

Table 1 shows that students in experimental group have a mean score of 42.24 and the students in the control group had a mean score of 35.39. This shows that students in the concept mapping teaching technique group outscored the students in the group taught with lecture method with a mean difference of 6.85, which implies that concept mapping teaching learning techniques was responsible for the observed differences in the set of scores between the two groups.

H_{01}: There is no significant difference in post achievement mean scores in basic science between students taught with concept mapping technique and those who learned basic science using lecture method.

To test the hypotheses, the mean scores of students taught with concept mapping instructional strategy and lecture methods were compared using t-test statistics as shown in table 2

Table 2: students' independent sample t-test statistics showing differences in mean score between students taught with concept mapping instructional strategy and those taught with lecture method at post test.

Group	N	Mean	Mean diff	SD	d.f	t.cal	t. cri	Sig(2-tailed)
Exp.	104	42.24	6.85		7.75			
						212	5.56	1.96	0.00
Control	110	35.39			8.24			

Table 2 above showed that there is a significant difference in mean scores between students taught with concept mapping technique and those taught with lecture method in achievement in basic science. This is because the t-calculated value of 5.56 is higher than the t. critical value of 1.96.This means that there is significant difference in their in achievement. As such, H_{02} which says that There is no significant difference in post achievement mean scores in basic science between students taught with concept mapping technique and those who learned basic science using lecture method was rejected.

Research question 2: Is there any difference in the achievement mean scores in basic science between male and female students who learned basic science using concept mapping technique?

Having taught the male and female experimental group students with concept mapping instructional strategy the mean scores are represented in table 3

Table 3:Descriptive statistics showing the difference in post achievement mean scores in basic science between male and female students who learned basic science using concept mapping instructional strategy .

Gender	**N**	**Mean**	**Mean Difference**	**SD**
Male	56	43.79		9.98
			3.35	

Female	48	40.44	9.26

Table 3 shows that the male students had a mean score of 43.9 while the female students with low ability had a mean score of 40.44. This shows that the male students outscored the female students with a mean difference of 3.35. To determine if the observed difference in table 3 is significant, H_{03} was tested as shown below.

H_{02}: There is no significant difference in achievement mean scores in basic science between male and female students who learned basic science using concept mapping technique. To test the hypothesis, the mean scores of male and female students taught using concept mapping instructional strategy were compared using t-test statistics a

To test the hypotheses, the mean scores of students taught with concept mapping instructional strategy and lecture methods were compared using t-test statistics as shown in table 4

Table 4: students independent sample t-test statistics showing difference in mean scores of male and female students taught with concept mapping instructional strategy at post-test

Gender	N	Mean	Mean diff	df	t.cal	t.Cri	significance (2-tailed)
Male	56	43.79					
			3.35	102	1.76	1.96	0.81
Female	48	40.44					

Table 4 showed that the observed difference in table 3 between the male and the female students is not significant because t- cal value of 1.76 is less than t-cri value of 1.96 at 0.05 alpha level of significant, since the observed difference is not significant, H_{03} which states that there is no significant difference in achievement mean scores in basic science between male and female students who learned basic science using concept mapping technique is therefore retained.

Research question 3: Is there any difference in the in post achievement mean scores in basic science between students who learned basic science using concept mapping technique in single sex and mix schools?

Having taught the experimental group students with concept mapping instructional strategy in single sex and mix schools, their mean scores are represented in table 5

Table 5:Descriptive statistics showing difference in the post achievement mean scores in basic science between students who learned basic science using concept mapping instructional strategy in single sex and mix schools

School type	N	Mean	Mean Difference	SD
Single sex school	42	39.19		8.25
			8.12	
Mix schools	62	44.31		8.24

Table 5 shows that the single sex school students had a mean score of 39.19 while mean score of mix school students is 44.3. This shows that students in the mix school performed better than students in the single sex school with a mean difference of 8.12. To determine if the difference observed in table 4 is significant, student independent sample t-test was used to test hypotheses four as shown below.

H_{03}: There is no significant difference in post achievement mean scores in basic science between students who learned basic science using concept mapping technique in single sex and mix schools.

To test the hypotheses, the mean scores of students taught with concept mapping instructional strategy in single sex and mix schools were subjected to t-test statistics as shown in table 6

Table 6: Students' independent sample t-test statistics showing difference in students' achievement between students who learned Basic science using concept mapping instructional strategy in single sex and mix schools.

School type	N	Mean	Mean x	df	t.cal	t.cri	Sig(2-tailed)
Single sex sch	42	39.19					
			8.12	102	2.70	1.97	0.08
Mix schools	62	44.31					

Table 6 above showed that the t-cal value of 2.70 is higher than that of the t. cri. Value of 1.97. This shows that the observed difference in mean score as shown in table 5 is significant. Therefore H_{04} which says that there is no significant difference in post achievement means scores of students in single sex and mix schools is rejected.

Research question 4: Is there any the difference in achievement means scores between high and low ability students taught with concept mapping technique?

Having taught the low and high ability students of the experimental group with concept mapping instructional strategy and the control group students with lecture method, the mean scores are represented in table 7 below

Table7 :Descriptive statistics showing the difference in post achievement test mean scores between high and low ability students taught with concept mapping instructional strategy

Ability	N	Mean	Mean Difference	SD
High ability	39	42.64		9.42
			2.52	
Low ability	42	40.12		8.72

Table 7 shows that students' with high ability level has a mean score of 42.64 while the low ability students had a mean score of 40.12. This shows that students with high ability level outscored the students with low ability level with a mean difference of 2.52. To determine if the observed difference in table 7 is significant, hypotheses five was tested as shown below.

H_{04}: There is no significant difference in post achievement mean scores between high and low ability students taught with concept mapping technique.

To test the hypotheses, the mean scores of high and low ability students taught with concept mapping instructional strategy thods were compared using t-test statistics as shown in table 8

Table 8. Students independent sample t-test statistics showing difference in mean of students between high and low ability students taught with concept mapping instructional strategy

Ability level	N	Mean	Mean diff	t.cal	t.Cri	Sig (2-tailed)
High	39	42.64				
			2.52	1.25	1.96	0.22
Low	42	40.12				

Table 8 above showed that the t-cal value of 1.25 is less than the t. Cri. value of 1.96, this shows that the observed difference in table 11 is not significant. Therefore H_{05} which says that there is no significant difference between high and low ability students taught with concept mapping teaching learning technique is retained.

Research question 5: Is there any difference in attitude mean scores of students taught with concept mapping technique and those taught with lecture method towards basic science?

Having taught the experimental group students with concept mapping instructional strategy and the control group students with lecture method, the attitude mean scores are represented in table 9

Table 9: Descriptive statistics showing the difference attitude mean scores of students taught with concept mapping instructional strategy and those taught with lecture method towards basic science.

Group	N	Mean	Mean Difference	SD
Experimental group	104	36.44		5.20
			15.01	
Control group	110	21.43		6.77

Table 9 shows that students from the experimental group had a mean score of 36.44 and that of students in the control group was mean score of 21.43. This shows that students in experimental group outscored the students in the control group with a mean difference

of 15.01. To determine if the observed difference in table 9 is significant, a hypothesis 6 was tested as shown below.

H_{05}: There is no significant difference in the attitude mean scores of students taught with concept mapping technique between those taught with lecture method towards basic science.

To test the hypotheses, the mean scores of students taught with concept mapping instructional strategy and lecture methods were compared using t-test statistics as shown in table 10

Table 10: students independent sample t-test showing the difference in mean attitude scores of students taught with concept mapping instructional strategy and those taught with lecture method towards basic science.

Group	N	Mean	Mean diff	d.f	t.cal	t. Critical	sig(2-tailed)
Exp.	104	36.44					
			15.01	212	18.12	1.96	0.00
Control	110	21.43					

Table 10 showed that the observed difference in table 6 is significant since the t-cal of 18.12 is higher than that of t.cri. value of 1.96. As a result of this, H_{06} which says that

there is no significant difference in the post attitude mean scores between students taught with concept mapping technique and those taught with lecture method towards basic science is rejected.

Research question 6: Is there any difference in the post attitude mean scores between high and low ability students taught with concept mapping technique?

Table 11 : Descriptive statistics showing post attitude mean scores between high and low ability students taught with concept mapping instructional strategy

Ability	**N**	**Mean**	**Mean Difference**	**SD**
High ability	39	36.92		6.09
			0.42	
Low ability	42	36.50		9.30

Table 11 shows that students with high ability level have a mean score of 36.92 and those with low ability had a mean score of 36.50. This shows that students with high ability level outscored the students with low ability level with a mean difference of 0.42. T o determine if the observed difference in table 15 is significant, hypothesis 6 was tested using students independent sample t-test statistic.

H_{06}: There is no significant difference in the post attitude mean scores between high and low ability students taught with concept mapping technique.

To test the hypotheses, the attitude mean scores of high and low ability students taught with concept mapping instructional strategy were compared using t-tes statistics as shown in table 12

Table 12: Students' independent sample t-test showing students post attitude mean scores of low and high ability students taught with concept mapping instructional strategy

Ability Level	N	Mean	Meandiff	df	t.cal	t.Critical	Sig(2-tailed)
High	39	36.92					
			0.42	79	0.35	1.96	0.73
Low	42	36.50					

Table 12 above showed that there is no significant difference in post attitude means scores of students taught with concept mapping technique of high and low abilities. As a result of this $H_{06:}$ which says that there is no significant difference in attitude mean scores between high and low ability students taught with concept mapping instructional strategy is retained.

Research question 7: Is there any interaction effect among method, sex and ability of students on achievement?

Having taught the experimental group students with concept mapping instructional strategy and the control group students with lecture method, their mean scores were analyzed and presented in table 13 to determine if there is any interaction effect among method, sex and ability of students on achievement.

Table 13:Descriptive statistics showing interaction effect among method, sex and ability on achievement.

Sex	Group	Ability	N	Mean	Mean diff	SD
	Exp	**High**	39	42.64		9.41
					2.79	
		Low	23	45.43		11.44
Method	Control	**High**	53	35.70		6.83
					0.8	
		Low	39	34.90		10.27
Sex	Group	**High**	17	42.35		
	9.22					
	Exp. Female				4.03	
		Low	8	46.38		12.20
	Control. Female	**High**	30	34.90		5.22
					2.7	
		Low	19	37.60		9.16

Exp.	Male	**High**	22	42.86		9.79
					2.07	
		Low	15	44.93		10.97
	Control.	**High**	23	36.48		8.18
					4.43	
		Low	19	35.05		10.83

Table 13 above shows that the experimental group students with high ability has an interaction mean value of 42.64 and 45.43 for low, with a mean difference of 2.79 in favour of the low. For the control group, the high ability value has a mean value of 35.70 and 34.90 for the low, with a mean difference of 0.8 in favour of the high also, the table showed that the female students with high ability level has a mean interaction mean of 42.35 and 46.38 for low, while for the control, the high female has a mean interaction score of 34.90 and low female for 37.60 with a mean interaction difference of 2.7 in favour of the low. Finally, the table also showed that the high students in the group taught with concept mapping teaching and learning technique has an interaction mean score of 42.86 and 44.93 for low. With an interaction mean difference of 2.07 in favour of the low, whereas in the control group, the high male has a male interaction mean score of 36.48 and 32.05 for the low. With an interaction mean difference of 4.43 in favour of the high. To determine if the observed effect is significant, hypothesis 7 was tested as shown below

H_{07}: There is no significant interaction effect among method, ability and sex of students on achievement in basic science .

To test the hypotheses, the mean scores of male and female students, high and low ability students taught with concept mapping instructional strategy and lecture methods were compared using ANOVA statistics as shown in table 14

Table 14:- ANOVA statistics showing interaction effect among method, sex and ability on achievement in basic science.

Source	Type 111 sum of squares	Df	Mean square	F cal.	F critical	Sig.
Corrected model	3028.383	7	432.626	5.115		0.00
Intercept	212392.338	1	212392.338	2.51103		.000
Gender	54.715	1	54.715	0.647		0.423
Ability level	36.510	1	36.510	6.432		0.512
Method	2620.318	1	2620.318	30.983		0.000
Sex ability	165.799	1	165.799	1.960		0.164
Sex and method	22.057	1	22.057	0.261		0.610
Ability level and group	135.213	1	135.213	1.599		0.206
Sex *ability* method	52.028	1	52.028	0.615	3.94	0.434
Error	12347.468	146	84.572			
Total	246113.000	154				
Corrected total	15375.851	153				

Table 14 above shows that the calculated F value of 0.615 is less than the F critical value of 3.94. This shows that there is no significant difference with this $H_{07:}$ which says there is no significant interaction effect among the variables: method, sex and ability of students on achievement in basic science hypotheses is therefore retained.

Research question 8: Is there any interaction effect among method, sex and ability of students on attitude in basic science?

Having taught the experimental group students with concept mapping instructional strategy and the control group students with lecture method, their mean scores were analyzed and presented in table 15 to determine if there is any interaction effect among method, sex and ability of students on attitude.

Table 15: Descriptive statistics showing the interaction effect among method, sex and ability on students' attitude in basic science.

Sex	**Gender**	**Ability**	**N**	**Mean**	**Mean diff**	**SD**
	Male	**High**	22	38.37		6.939
					2.7	
Exp.		Low	15	35.67		4.61
Female		**High**	17	35.06		3.13
					0.61	
		Low	8	35.67		3.24
Control	male	**High**	23	20.13		5.64

					1.34	
		Low	19	21.47		6.08
	Female	high	30	23.27		8.76
					2.75	
		Low	20	20.60		5.72
Sex	**Male**	**High**	45	29.04		11.13
					2.69	
		Low	54	27.74		8.96
	Female	high	47	27.53		9.20
					2.74	
		Low	28	24.79		8.43

Table 15 showed that male students with high ability level in experimental group have an interaction mean attitude score of 38.37 and 35.67 for low ability. With a mean difference of 2.7, the males with high ability out scored those with low ability. Also the table showed that the female students taught with concept mapping teaching learning technique with high ability have a mean score of 35.06 and 35.25 for the low, with a mean difference of 0.61 low ability female students out scored those with high ability.

The table also shows that for the control, the male students with high ability has a mean score of 20.13 and those with low ability have a mean score of 21.47, with a mean difference of 1.34, the male student with high ability outscored those with low ability. Also female students with high ability had a mean score of 23.27 while those with low ability had a mean score of 20.60, with a mean difference of 2.75, those with high ability outscored those with low ability.

Finally, male students with high ability has a mean score of 29.04 and those with low ability have a mean score of 27.53 with a mean difference of 2.9, the male students with high ability outscored those with low ability. In addition, the female students with high ability have a mean score of 27.53 and those with low ability has a mean score of 24.79, those with high ability outscored those with low ability with a mean difference of 2.74. To determine if the observed difference is significant, hypothesis 9 was tested as shown below.

H_{08}: There is no significant interaction effect among method, sex and ability of students on attitude in basic science.

To test the hypotheses, the mean scores of male and female students, high and low ability students taught with concept mapping instructional strategy and lecture methods were compared using ANOVA statistics as shown in table 16 to determine if there was any significant interaction effect among the variables

Table 16:- ANOVA statistics showing interaction effect among method sex and ability on attitude in basic science.

Source	Type 111 sum of squares	Df	Mean square	F cal.	F critical	Sig.

Corrected model	8477.564	7	1211.081	30.746		0.000
Intercept	111093.686	1	111093.686	2.82023		0.000
Ability level	30.844	1	30.844	0.783		0.378
Sex	4.477	1	4.477	0.114		0.736
Method	7289.797	1	7289.797	185.069		0.00
Ability and sex	2.647	1	2.647	0.067		0.796
Sex and group	75.325	1	75.325	1.912		0.169
Ability*sex* method	106.094	1	100.094	2.541	3.94	0.113
Error	5750.878	146	39.390			
Total	130836.000	154				
Corrected total	14228.442	153				

Table 21 above shows that F calculated value of 2.541 is less than the F critical value of 3.94. This shows that there is no significant interaction effect among method, sex and ability on basic science students' attitude. With this, H_{08} which says there is no significant interaction effect among method, sex and ability of students on attitude in basic science is therefore retained.

Discussion

This study which dealt with the effect of concept mapping teaching learning techniques on students achievement and attitude in basic science among junior secondary schools in Delta Central Senatorial District is quite timely considering the importance of the use of the knowledge of basic science at the senior secondary schools and higher institutions, since it has been observed that lecture method is the dominant methodology used in the teaching of basic science, and it has also been observed that its usage is one of the major problems of teaching sciences at the senior secondary school level. In addition to this, Delta State ministry of education chief examiners report (2008) showed that students perform poorly in basic science. With the situations of poor performance, there is need for the use of new approaches that will foster the active participation of students in the class room and this will help reverse the trend in poor performance and foster better understanding by students of the concept taught.

One finding of the study showed that the use of concept mapping had a positive effect on students' achievement. This is because there was a significant difference in the performance of students taught with concept mapping teaching and learning techniques and those taught with lecture method . This result was achieved by the series of activities the students were engaged in when using the concept mapping instructional strategy. The use of the methodology also requires students' active participation in the teaching and learning process. These activities may have positively influenced the basic science students understanding of the concept taught. This findings agreed with the views of the

theory of constructivism which is of the view that effective learning takes place when students actively participate in the teaching and learning process (Vygotsky, 1934). This finding is also in agreement with the findings of Adeneye (2011), and sakys and Waziri (2015). They both found out that the use of concept mapping enhanced students performs.

The second finding of the study showed that there was no significant difference in the performance of males and female students taught with concept mapping teaching and learning techniques.. This finding is in disagreement with the findings of Cheema and Mirza (2013) who found out that male students significantly performed better than the female students and female students performed better using concept mapping instructional strategy.

The third findings of the study showed that there was a significant difference in the performance of students in mixed and single sex schools taught with concept mapping teaching and learning technique With students in mixed schools achieving better than those in single sex schools. This could be as a result of heavily competition between the male and female students of the schools. This result disagreed with that of Eravwoke 2010, who found no significant difference in the use of concept mapping teaching learning techniques between students in single sex schools and mix schools.

The fourth findings of the study showed that there was no significant difference in the performance of students with high and low abilities taught with concept mapping teaching and learning techniques. This shows that both the high and low ability students benefited equally from the use of the methodology. This finding is in disagreement with the findings of Udeani and Oka (2012) who found significant difference in the performance of students with high and low abilities.

Also the fifth findings of the study showed a significant difference in the attitude scores between the students taught with concept mapping teaching learning techniques and those taught with lecture method; Those exposed to concept mapping instructional strategy developed positive attitude towards basic science than those exposed to lecture methods. This is because of their involvement in the lessons. This finding is in agreement with the findings of Neknag and Agwadgah (2010) who found that the use of concept mapping enhances students interest.

Going further, the findings of the study showed no significant interaction effect among method, sex and ability on basic science students achievement . This shows that the concept mapping influenced basic science students' achievement independent of sex and abilities. This agrees with the findings of Agboro (2015) who found no significant interaction effects among ability, method and sex on students' achievement in mathematics through the use of mathematics game instructional strategy.

Lastly, the findings of the study showed no significant interaction effect among method, sex and ability on basic science students attitude . This shows that the concept mapping influenced basic science students' achievement independent of sex and abilities.

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CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

Summary of the Research

The aim of the study was to determine the effects of concept mapping teaching- learning technique on students achievement and attitude towards basic science. Specifically, the variables studied included: concept mapping teaching- learning technique and lecture teaching (independent variables), achievement and attitude scores (dependent variables) and sex and ability as intervening variables.

Based on the stated problem, eight research questions were raised and their corresponding hypotheses were formulated and tested at alpha value of 0.05.The design adopted in this study was the 2x2x2x2 factorial non-randomized pre-test post-test non equivalent control group quasi -experimental design. The design consisted of two instructional groups, two ability levels (high and low), sex (male and

female) and attitude (positive and negative). The sample for the study consisted of 214 students from six secondary schools sampled from Delta Central senatorial district.

The instrument used for data collection were Basic Science achievement test (BSAT) and students' attitude questionnaire (SAQ). The instruments were properly validated and reliability determined before they were used. The duration for the study was eight weeks. Six basic science teachers were used for the study. Three of them taught the experimental groups using concept mapping teaching –learning technique while the other three teachers taught the control groups with lecture methods. The experimental group teachers were trained on how to present content materials to the students using the concept mapping teaching learning technique. To achieve this, the intervention package developed by the researcher was used.

At the end of the treatment, post- achievement test scores and post attitude scores were collected from both the experimental and control groups students. Using the collected data, the research questions were answered with the descriptive statistics of the mean and the hypotheses were tested using independent sample t-test and ANOVA. All hypotheses were tested at 0.05 alpha level of significance. The findings of the study were:

- Concept mapping had a positive effect on students' achievement;
- there was a significant difference in the performance of students concept mapping teaching learning techniques in single sex schools and mix schools with those in mix schools performing better;
- there was no significant difference in the performance of students with high and low abilities taught with concept mapping teaching learning techniques;
- there was no significant interaction effect among method , sex, method and ability levels on basic science students achievement; and

- there was no significant interaction effect among method, sex and abilities on attitude.

Conclusion

Based on the findings of the study, the following conclusions were drawn: there is no significant interaction among method, sex, ability levels on achievement and attitude towards basic science using concept mapping instructional strategy. Concept mapping instructional strategy has positive influence in enhancing achievement and attitude towards basic science and should be used in teaching in our schools. This is based on the fact that the method will make Basic science teachers to adequately plan, prepare and present lessons that will guarantee learning by students because of the activity involved.

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Concept mapping instructional strategy when used efficiently enhances students achievement irrespective of sex in basic science s above other methods currently used for teaching. This is because the method enables both male and female students are very active and creative during the lesson.

Concept mapping instructional strategy when used efficiently enhances students achievement irrespective of their attitude towards basic science students above other methods currently used for teaching. This is hinged on the fact that the methods enable both students with positive and negative attitude to be very active and creative during the lesson.

Contributions to knowledge

The findings of this study and the conclusions drawn therefore have contributed to knowledge in the following areas:

- the use of concept mapping instructional strategy had a positive effect on students' achievement and attitude towards basic science.
- the use of concept mapping had a positive effect students of both high and low abilities levels
- the use of concept mapping instructional strategy had a positive effect on both male and female students achievement
- the use of concept mapping instructional strategy has no significant interaction effect among method , sex, method and ability of students in enhancing achievement in basic science
- the use of concept mapping instructional strategy has no significant interaction effect among method, sex and abilities of students in enhancing attitude towards basic science.

Recommendations

Since the method is found to increase students post test and post attitude score, it is recommended that teachers and students should be properly trained to acquire the skills on usage of concept mapping and be encouraged to apply it when teaching and learning respectively.

Secondly, since the method guarantees effective learning even when teaching aids are not available, the use of concept mapping teaching learning technique could serve as the best alternative for teaching basic science in such schools.

Thirdly, since the method is found to enhance students' achievement scores, students should be properly trained to acquire the skills and encouraged to apply it in their learning.

Lastly, faculty of education should review their curriculum to include this methodology so that trainee teachers will acquire the skills before graduation.

Suggestions for further studies

This study should be replicated by drawing samples from the entire state and concept from all branches of basic science should be used instead limiting it to habitat.

Also, the study should be carried out to determine the effect of concept mapping teaching learning techniques and students' conceptual understanding of habitat.

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Appendix 1: Basic Science Achievement test (BSAAT)

1. What is a habitat?

A.A place where animals and plants live

B. something you do that may not be good for you (like biting your nails) C.A group of animals

2. What does it mean to migrate?

A.To look like another animal

B. To move to another place

C.To store food for winter

3. What three things do animals need to survive?

4. Name 2 or more plants you might find in a woodland forest

5. Name 2 or more animals on might find in water

6. Which animal would not live in a rain forest?

A. tree frog

B. Parrot

C. Polar bear

7. True or false. It rains a lot in the rain forest

A. True

B. False

8. Name 2 or more animals you may find in the desert

9. True or false: It is usually warm in the aquatic habitat

A. True

B. False

10. Which animal would you see in the Aquatic?

A. Rattle snake

B.Polar bear

C. Monkey

11. Which habitat would have a lot of each cacti (cactuses)

12. Which of the following is not used to collect small animals?

a. Small mammal trap

B. pooter

c. Beating tray

d. Linetransect

13. The soil in a habitat affects the organisms living in it. Which one of the following factors does not contribute to the kind soil present?

a. Soil type

b. Wind direction

c. Moisture content of the soil

d. Ph of the soil

14. A quadrat is used in studying habitat. Which one of the following statements aboutthe use of quadrats is not correct?

a. Quadrats are sometimes made of wood.

b. The quadrat is used to estimate numbers of plants and animals

c. The quadrat should be thrown behind by the person using it

d. The quadrat has a square shape

15. When studying a habitat, whichone of the following procedures is unnecessary?

a. Take a colour photograph of the habitat

b. Draw a simple map of the habitat

c. Note the environmental factor affecting the habitat

d. Identify as many plants and animals in the habitat.

16. When identifying insects found in a habitat, which one of the following is most useful?

a. Key

b. Map

c. Pooter

d. lock

17. When studying a habitat, which one of the following procedure is unnecessary?

a. Take a colour photograph of the habitat

I'. Draw a simple map of the habitat

c. Note the environmental factors affecting the habitat

d. Identify as many plants and animal in the habitat.

18. Which one of the following is not done in a habitat study?

a. Leaves of some plants are collected and studied

b. Records the wind direction and the soil temperature

c. Insects arc collected, killed humanely and later identified

d. The frequency of plants is studied using a quadrat.

19. The soil in a habitat affects the organism living in it

a. Soil type

b. Wind direction

c. Moisture content of the soil

20. Which one of the plants can be considered rare on the DAFOR scale?

a. Grass

h. Plantain

c. Daisy

d. clove

Appendix II: Basic Science scholastic ability test (BSSAT). ADAPTED FROM THE DELTA STATE MINISTRY OF EDUCATION

Section A.

Personal data

Name of school----------

Class----------

Sex ----------

Section B

BASIC SCIENCE JSS1 PROMOTION PAST QUESTION PAPER FOR JULY 2015

Instructions: Answer all questions: Choose from the options lettered A-E, the one that best answers each of the following questions and write out in your answer sheets the correctly letter only.

1. Scientists that travel to space are called……

A. Air travellers

B. Astronauts

C. Engineers

D. Fliers

E. Space travellers

2. Living things are things that have……

A. Food

B. Money

C. Life

D. Shelter

E. Water

3. Which of the following is a renewable energy source?

A. Coal

B. Kerosene

C. Petrol

D. Sun

E. Wood

4. Animals are living things that move about in search of……

A. Biro

B. Food

C. Money

D. Paper

F. Shelter

5. Wood obtained from trees in the forest for cooking can lead to……

A. A forestation

B. Deforestation

C. Rainfall

D. Solidification

E. Wind

6. One of the following is an example non biodegradable material.

A. Broken bottles

B. Faces

C. Fertilizer

D. Vegetable

E. Raw meat

7. The space outside the sun, stars, and planets is also called……

A. Atmosphere

B. Environment

C. Inner space

D. Open space

E. Outer space

8. The vector that causes malarial is called……

A. Diarrhea

B. Dysentery

C. Organism

D. Pathogen

E. Plasmodium

9. The area in which a magnet has an effect is called Field……

A. Chemical

B. Electrical

C. Gravitational

D. Magnetic

E. Mechanical

10. Which type of energy does the sun give out

A. Fire

B. Hot

C. Radial

D. Solace

E. Solar

D. Lubricants

E. Pomades

11. water can be made safe for drinking by .....

A. allowing to settle
B. boiling
C. sedimentation
D. evaporation
E. filtering

12. which form of energy can a body posses by virtue of its position?

A. electricity

B. Kinetic

C. Light

D. Heat

E. Potential

13. .....is a carbohydrate food

A. banana
B. cassava
C. egg
D. meat
E. milk

14. ..... satellite improves radio and television reception

A. communication
B. natural
C. observation
D. reconnaissance
E. weather

15. one of the following is not a living matter

A. cat
B. dog
C. lion
D. man
E. stone

16. chemical energy is used in metabolic activities in .....

A. animals
B. fertilizer

C. flowers
D. plants
E. worms

17.materials which decay are also called

A. biodegradable
B. compost
C. composition
D. non biodegradable
E. rust

18.oil and grease are.....

A. chemicals
B. detergents
C. disinfectants
D. lubricant
E. pomades

19. Living things can be classified into……

A. Matter and Money

B. Money and Animals

C. Plants and Animals

D. Living and Non Living things

B. Life and Death

20. Astronauts experience ……in outer space

A. Anointing

B. Madness

C. Obesity

D. Weightiness

E. Wickedness

21. WC Means……

A. Water cleaning

B. Water clearing

C. Water cropping

D. Water closet

E. Water crop

22. One of the following is an example of force

A. Joint

B. Ligament

C. Push

D. Tendon

E. Tension.

23. Which of the following is a type of pollution

A. Air pollution

B. Rubber pollution

C. Soap pollution

D. Salt pollution

E. Wood pollution

24 ……is a form of energy produced when an object is made to vibrate

A. Chemical

B. Electrical

C. Mechanical

D. Nuclear

E. Sound.

25. One of the main elements in carbohydrate is……

A. Carbon

B. Iron

C. Nitrogen

D. Water

E. Sodium

26. The best source of drinking water is……

A. Pipe borne water

B. Pond

C. Rain

D Stream

E. Well

27. Misuse of Non renewable energy causes one of the following

A. Absorption

B. Celebration

C. Continuity

D. Pollution

E. Solidification

28. Gravitational force is a force of……

A. Attraction

B. Friction

C. Opposition

D. Repulsion

E. Separation

29. Opposite charges……

A. Attract

B. Contract

C. Distract

D. Extract

E. Repel

30. An empty space is referred to as……

A. Air

B. Atmosphere

C. Confidential

D. Environment

E. Vacuum

31. Which of the following is an example of biodegradable soil pollutants

A. Dung

B. Manure

C. Oil spillage

D. Sewage

E. Faeces

32. Firewood is an example of energy

A. Heat

B. Light

C. Non renewable

D. Renewable

E. Sound.

33 ……promotes good health

A. Brushing the teeth after meal

B. Leaving food uncovered

C. Leaving dirty plates in the kitchen

D. Keeping long fingernails

E. Washing hair one in three months

34. Nigerian satellite launched in 2003 is called……

A. CAT1

B. CAT2

C. SAT1

D. SATI.1

C. SAT2

35. The main source of energy to the earth is……

A. Food

B. Plants

C. Sand

D. Soil

E.Sun

36. Energy is measured in……

A. Bytes

B. Joules

C. Newton

D. Power

E. Works

37 ……Is anything that has weight and can occupy space

A. Gases

B. Ice block

C. Liquid

D. Matter

E. Solid.

38. The unit force is……

A. Ampere

B. Kilogram

C. Metres per second

D. Newton

E. Watt

39. Which of these is not a water borne diseases

A. Cholera

B. Diarrheal

C. Dysentery

D. HIV AIDS

E. Typhoid

40. Which of the following forces allow all objects to fall on the ground?

A. Contact

B. Electrical

C. Gravitational

D. Magnetic

E. Mechanical

41. Petrochemical are used as raw materials for producing one of the following

A. Benze

B. Fertilizer

C. Gasoline

D. Kerosene

E. Naphtha

42 ……is useful because it allows us to walk on the ground without sliding and falling

A. canvas

B. friction

C. slippers

D. umbrella

E. walking stick

43. The attract object to itself because of the force of……

A. Gravitational pull

B. Revolves

C. Rotation

D the plant

E. Weightlessness

44. The rotation of the earth causes……

A. afternoon / evening

B. Day / night

C. evening / morning

D. morning / evening

E. noonday / night

45 is an example of air pollutant7

A. broken bottles

B. construction

C. compost

D. rust

E. smoke

46. one of the following is a water pollutant

A. fertilizer

B. flowers

C. moonlight

D. Sand

E. sunlight

47. A balance diet contains classes of food

A. 2

B.3

C.4

D.5

E.6

48. The two ends of a bar magnet has…… and ..... poles

A. North/east

B. North / south

C. North / west

D. South / north

E. South / west

49. One of the following is an artificial satellite

A. cloud

B. Moon

C. Salt

D. Star

E. rain

50. Two examples of stimulants are……..and……

A. Caffeine, cocaine

B. Fish, meat

C. Fat, bread

D. Lithium, iron

E. vitamins, worms

Appendix 111: Students Attitude Questionnaire (SAQ)

Instruction:

Kindly answer the following questions sincerely by filling out the spaces and ticking [√] were relevant.

Section A

Sex of students: [ ] Male [ ] Female

School Type: [ ] Mixed school [ ]Boys school [ ] Girls school

Section B

Key – SA (strongly agreed)

- A (agreed)
- D (disagreed)
- SD (strongly disagreed)

Please indicate how strongly you agree or disagree on the following terms. Tick [√] one appropriate response out of these four responses given to indicate your response.

S/N		SA	A	D	SD
1	Basic science is an interesting subject.				
2	Basic science is very interesting to me.				
3	Most students are afraid of Basic science and so they are afraid to take it..				
4	Most students will be happy to take more Basic science				
5	Most students enjoyed studying Basic science				
6	Most students in Basic science discussions often, and it is enjoyable.				
7	Basic science lessons are very boring				
8	Most students Basic science because of teacher.				
9	The Basic science textbook is not helpful.				
10	Basic science is enjoyable and fun.				
11	Most students have good feelings toward Basic science in general.				
12	Basic science is not usable in daily life situations, and is not important to learn				
13	Basic science knowledge is necessary in my future career				
14	Most students are comfortable with Basic science and it is not so much difficult				

15	Most students are always under a terrible stress in Basic science class.				
16	It makes me nervous to think about problem solving and making Basic science experiments.				
17	Basic science concepts and symbols of elements are unfamiliar for me.				
18	Most students don't want to take role in Basic science experiments because they are stressful				
19	Basic science makes me restless, irritable, and impatient.				
20	Basic science should not be made compulsory				

APPENDIX IV

Concept Mapping Teaching Intervention Package

Section A

Teachers Training Manual

What is Concept Map?

According to Novak (1984) a concept is a perceived regularity in event or objects designated by a label. It could also be seen as a constant idea one has about an event or object. Maps are dramatically representation of geographical regions which help to show ones bearing hence helping one to proceed to ones destination.

Concept map is a graphical arrangement of key concept or ideas being studied. A concept map presents the relationships among a set of connected concepts and ideas. The concepts is usually represented by a single words enclose in a rectangle (Box) connected to other concept boxes by arrows. A word or brief phrase, written by the arrow defines the relationship between the connected concepts. Major concept in boxes has links to and from several other concepts in boxes generating a network.

In a concept map, each word or phrase is connected to another and linked back to the original idea, word or phase. Concept maps are one way of developing logical thinking and study skills. It reveal connection and helps students see how individual idea form a large whole. Concept maps are flexible, they can be made simple, linear, branched radiating or cross linked.

Types of Concept Maps

The following are the types of concept maps:

1. **Hierarchy Concept Map**: Hierarchy concept map presents information in a descending order of importance. The most important information is placed on the top. According to Novak and Gowin, the hierarchical structure arises as a result of new information that is often related to and subsumable

under more general more inclusive concepts. However, the hierarchy expands according to the principle of progressive differentiation, new concepts and new links are added to the hierarchy either by creating new branches or by differentiating existing ones even further. Meaning increase for students as they recognize new links between sets of concepts or preparation at the same level in the hierarchy.

2. **Spider Concept Map:** In spider concept map, the central theme of unifying factor is placed in the centre of the map. Outwardly radiating sub themes surrounds the center of the map.

3. **Flow Chart Concept Map:** In this concept map, information are organized in a linear form.

4. **System Concept Map:** In this type of map, information are organized in a similar way like that of a flow chart with the addition of **INPUTS** and **OUTPUT'**

For this lesson, emphasis will be on the hierarchy concept map.

Characteristics of Concept Mapping

The following are characteristics of concept mapping.

1. **Under Laying Theory:** It is grounded on the cognitive theory of Ausubel's assimilation which shows that new knowledge can be learned most effectively by relating it to previously existing knowledge. Concept map may be viewed as methodological tool of assimilation theory that displays fundamental elements of the theory such as subsumption, integrative reconciliation and progressive differentiation.

2. **Semi-Hierarchy:** The basic motivation for the hierarchical arrangement of concepts in concept map is from Ausubel's notion of subsumption, that more general, super ordinate concept subsumes more specific, detailed concepts. This theoretical notion translates to an arrangement of concepts from those that are more general toward the top of the page, with those that are more specific or detailed distributed beneath. In practice, the concepts in concept maps are not arranged in a semi-hierarchical manner. Concept maps allows for the representation of un-hierarchical relationship or cross-links, as well as other types of non-hierarchical arrangements.

3. **Label Links:** This is another defining factor of concept maps. Novak and Gowin (1984), states that a link phrase should join concepts to form meaningful proposition, which is a basic unit of knowledge according to the theory of meaningful learning and Ausubel's Assimilation theory. Concept mapping theory does not constrain the labels that can be used, allowing map makers more freedom and precision in describing the relationships among concepts. Researchers using other types of graphing methods have prescribed a limited number of linking phases that they claim can be used universally.

4. **Definition of Nodes:** One of the defining characteristics of concept maps is the limiting node contents to concept which allows for a more explicit representation of the interrelationship among concepts. Numerous mapping systems have been developed that enables the graphical depiction of ideas and concepts e.g concept maps, knowledge maps, mind maps, cognitive maps and semantic networks. Concepts maps differ from these other superficially similar types of representation due to the above characteristics.

Constructing a Concept Map

The following steps are to be followed when constructing a concept map.

Brainstorming Phrase: Go through your note and related course material looking for facts, terms, and ideas that you think are in anyway associated with the topic. Make a list of these items and print them neatly on small post notes, one per note, in every brief form, i.e. a single word or short phrase. This is a brainstorming process, so write down everything that anybody in the group thinks is important and avoid discussing how important the item is. Your objective here is to generate the highest possible list you can. Before your group completes this step you may have more than 50 items.

Organizing Phase: Spread out your concept on a flat surface so that all can be read easily and, together create groups of related items. Try to group items to emphasize hierarchies. Identify terms that represent those higher categories and add them. Feel free to rearrange items and introduce new items that you omitted initially. Note that some concept will fall into multiple groupings. This will become important later.

Layout Phase: On a large sheet of paper, try to come up with an arrangement (layout) that best represent your collective understanding of the relationships and connections among groupings. Feel free to arrange things at any time during this phase. Use a consisted hierarchy in which the most important concept are in the centre or at the top. Within sub-groupings, place closely related items near to each other. Think in term of connecting the items in a simple sentence that shows the relationship between them. Do not expect your layout to be like that of the other groups. It is advisable to meet outside of class to work on this assignment and plan for its completion.

Linking Phase: Use lines with arrows to connect and show the relationship between connected items. Write a word or short phrase by each arrow to specify the relationship. Many arrows can originate or terminate on particularly important concepts.

Finalizing the Concept Map: After your group has agreed on the arrangement of items that conveys your understanding, you need to convert the concept map into a permanent form that others can view and discuss. Be creative in constructive way through the use of colors, fonts shapes etc to communicate your group's understanding. Give your concept map a title.

After constructing the map, check for the following for its review.

Accuracy and Thoroughness: Are the concepts and the relationships correct?

Organization: Was the concept map laid out in a way that higher order relationships are apparent and easy to follow? Does it have title?

Appearance: Was the assignment done with care showing attention to the details each as spellings? Is it neat and orderly or is it chaotic and messy?

Creativity: Are there unusual elements that aid communication or stimulate interest without being distracting?

Scoring Of Concept Map

To score the concept map, the guideline of Novak and Gowin scoring criteria for concept maps will be followed:

1. **Proposition:** Is the relationship between two concepts indicated by a connecting and linking word(s)? Is the relationship valid? For each valid point shown, score 1 point

2. **Hierarchy:** Does the map show hierarchy? Is each subordinate concept more and less general than the concepts drawn above? Is the context of the matter mapped? Score 5 points for each valid level of hierarchy.

3. **Cross Links:** Does the map show meaningful connections between one segment concept hierarchy and another segment? Is the relationship shown significant? Score 10 points for each cross link that is both valid and significant and 2 points for cross link that is valid but does not illustrate a synthesis between sets of relationship or propositions.

4. **Examples:** Specific events or objects that are valid instances of those designated concept label can be scored 1 point each.

Section B: Guideline for Concept Map Construction.

Step I: For each topic to be taught the teacher will identify a focus questions or define the key topic.

Step II: After the identification of focus question or topic, the teacher list the most important or general concepts that are associated with that topic

Step III: The teacher places the listed topics from the most general and inclusive to the most specific. This action fosters the explicit representation of subsumption relationship i.e hierarchical arrangement.

Step IV: The teacher adds links to form a preliminary concept map.

Step V: The teacher adds linking phrases to describe the relationship among concepts.

Step VI: After building the preliminary concept map, the teacher looks for cross links which will link together concepts that are in different areas or sub domains on the map. Cross links help the teacher to elaborate how concepts are interrelated.

Step VII: The map will be reviewed by the teacher in order to make any necessary changes in structure or content.

SECTION B: BASIC STEP FOR THE USAGE OF CONCEPT MAPPING TEACHING LEARNING TEACHNIQUE

SECTION B: BASIC STEPS FOR USING CONCEPT MAPPING INSTRUCTIONAL STRATEGY IN THE CLASSROOM

WEEK	TOPIC	PERFORMANCE OBJECTIVES	CONTENT	TEACHER'S ACTIVITIES	STUDENTS' ACTIVITIES	AIM	INSTRUCTIONAL MATERIALS	EVALUATION GUIDE/ ASSIGNMENT
1	Habitat	By the end of the lesson, students should be able to: 1) draw a concept on habitat 2) Explain what an habitat is with the aid of the concept map 3) List different linking words and phrases used in the explanation of the concept map	Habitat	Teacher asks students to explain the term 'habitat Teacher ask students to read their material and draw a concept map on habitat Teacher ask students to explain term habitat with the aid of the map. Teacher ask students to compare their maps	Students give explanation based on their understanding . Students read and produce their maps. Students explain the term habitat with aid of map. Students do comparison	To elicit students' prior knowledge To enhance active participation and critical reasoning To enhance active participation To enhance active participation and strengthen understanding To enhance active participation	Students and teachers concept maps	Students are given exercises to list phrases, preposition that will be used to create another map.

WEEK 2&3	Types of Habitat	By the end of the lesson, students should be able to: 1) construct a map on terrestrial habitat showing their characteristics and examples of the animals in the habitat 2) Explain the term terrestrial habitat with the aid of the map. 3)) List different linking words and phrases used in the explanation of the concept map	Terrestrial habitat	Teacher asks students to explain Terrestrial habitat Teacher ask students to produce their drawn concept map on Terrestrial habitat and explain the term Teacher and students draw a concept map of Terrestrial habitat. Teacher ask students to compare the collaborated drawn concept maps with their own	Students give explanation based on their understanding. Students explain the term habitat with aid of map Students produces linking words, phrases and preposition Students do the comparison	To elicit students' prior knowledge To enhance active participation and foster critical thinking To enhance active participation and foster critical thinking To enhance active participation and strengthening understanding	Students and teachers maps	Students are given exercises to produce linking words for the construction of maps

Week 4&5		By the end of the lesson, students should be able to: 1) construct a map on aquatic habitat showing their characteristics and examples of the animals in the habitat 2) Explain the term aquatic habitat with the aid of the map. 3)) List different linking words and phrases used in the explanation of the concept map	Aquatic habitat	Teacher asks students to explain aquatic habitat Teacher ask students to produce their drawn concept map on aquatic habitat and explain the term Teacher and students draw a concept map of aquatic habitat. Teacher ask students to compare the collaborated drawn concept	Students give explanation based on their understanding. Students explain the term habitat with aid of map Students produces linking words, phrases and preposition Students do the comparison	To elicit students' prior knowledge To enhance active participation and foster critical thinking To enhance active participation and foster critical thinking To enhance active participation and	Students and teachers maps	Students are given exercises to produce linking words for the construction of maps

				maps with their own		strengthening understanding		

APPENDIX V: MODEL LESSON NOTE FOR THE USE OF CONCEPT MAPPING TEACHING LEARNING TECHNOQUE

SECTION A:

Week One

Period one

Topic: Habitat

Duration: 45mins

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

- Explain the term habitat
- List keys words and prepositions that can be used for creation of concept map on habitat
- Provide a good cross link for the concept map on habitat
- Create a good concept maps.

Instructional materials: **classroom and a concept map showing habitat**

Step One: Introduction of the concept

Teacher asks students what habitat is and gives necessary guide when they are wrong

Aim: To determine their pre-instructional knowledge of habitat.

Step Two:

Teacher gives students ask students to read study materials on habitat, summarize what they have read and bring out linking words and prepositions.

Aim: To encourage students' participation

Step Three: Production of the concept map

Teacher asks students to produce a concept map based on what they have read using their linking words and prepositions.

Aim: To encourage students' critical thinking and active participation of students

Step Four: Explanation of the concept map

Teacher ask students to explain the what habitat is using their drawn concept map

Aim: To encourage students' critical thinking and active participation of students

Step Five: Evaluation of the concept map

Teacher asks students to identify the relevant features of the map.

Aim: To encourage students' critical thinking, active participation of students and identify errors in the map when necessary

Step Six: Drawing of conclusion

Teacher explains the concept of habitat using the textbook and gives them assignment

Week Two&Three

Period Two

Topic: Types of habitat

Sub-topic: Terrestrial Habitat

Duration: 1hr.45 mins

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

- Explain the term Terrestrial habitat
- identify it anywhere they see
- List keys words and prepositions that can be used for creation of concept map on Terrestrial habitat
- Provide a good cross link for the concept map on Terrestrial habitat
- Create a good concept map on Terrestrial habita.

Instructional materials: classroom and a concept map showing Terrestrial habitat

Step One: Introduction of the concept

Teacher asks students what Terrestrial habitat is and gives necessary guide when they are wrong

Aim: To determine their pre-instructional knowledge of Terrestrial habitat.

Step Two:

Teacher gives students ask students to read study materials on Terrestrial habitat, summarize what they have read and bring out linking words and prepositions.

Aim: To encourage students' participation

Step Three: Production of the concept map

Teacher asks students to produce a concept map based on what they have read about Terrestrial habitat using their linking words and prepositions.

Aim: To encourage students' critical thinking and active participation of students

Step Four: Explanation of the concept map

Teacher ask students to explain the what Terrestrial habitat is using their drawn concept map

Aim: To encourage students' critical thinking and active participation of students

Step Five: Evaluation of the concept map

Teacher asks students to identify the relevant features of the map.

Aim: To encourage students' critical thinking, active participation of students and identify errors in the map when necessary

Step Six: Drawing of conclusion

Teacher explains the concept of habitat using the textbook and gives them assignment

Week Four&Five

Period Two

Topic: Types of habitat

Sub-topic: Aquatic Habitat

Duration: 1hr:45 mins

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

- Explain the term Aquatic habitat
- List keys words and prepositions that can be used for creation of concept map on Aquatic habitat
- Provide a good cross link for the concept map on Aquatic habitat
- Create a good concept maps.

Instructional materials: classroom and a concept map showing Aquatic habitat

Step One: Introduction of the concept

Teacher asks students what aquatic habitat is and gives necessary guide when they are wrong

Aim: To determine their pre-instructional knowledge of habitat.

Step Two:

Teacher gives students ask students to read study materials on aquatic habitat, summarize what they have read and bring out linking words and prepositions.

Aim: To encourage students' participation

Step Three: Production of the concept map

Teacher asks students to produce a concept map based on what they have read using their linking words and prepositions.

Aim: To encourage students' critical thinking and active participation of students

Step Four: Explanation of the concept map

Teacher ask students to explain the what aquatic habitat is using their drawn concept map

Aim: To encourage students' critical thinking and active participation of students

Step Five: Evaluation of the concept map

Teacher asks students to identify the relevant features of the map.

Aim: To encourage students' critical thinking, active participation of students and identify errors in the map when necessary

Step Six: Drawing of conclusion

Teacher explains the concept of aquatic habitat using the textbook and gives them assignment

Week six.

Period Four

Topic: Characteristics of Habitat

Duration: 45mins

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

- Identify the different types of habitat on pictures
- Give least two examples of animals in both terrestrial and aquatic habitat
- List keys words and prepositions that can be used for creation of concept map on characteristics of habitat
- Provide a good cross link for the concept map on characteristics of habitat
- Create a good concept maps.

Instructional materials: **classroom and a concept map showing habitat**

Step One: Introduction of the concept

Teacher asks students list the features of both aquatic and terrestrial habitat is and gives necessary guide when they are wrong

Aim: To determine their pre-instructional knowledge of characteristics of aquatic and terrestrial habitat.

Step Two:

Teacher gives students ask students to read study materials on aquatic and terrestrial habitat, summarize what they have read and bring out linking words and prepositions.

Aim: To encourage students' participation

Step Three: Production of the concept map

Teacher asks students to produce a concept map based on what they have read using their linking words and prepositions.

Aim: To encourage students' critical thinking and active participation of students

Step Four: Explanation of the concept map

Teacher ask students to explain the characteristics of aquatic and terrestrial is using their drawn concept map

Aim: To encourage students' critical thinking and active participation of students

Step Five: Evaluation of the concept map

Teacher asks students to identify the relevant features of the map.

Aim: To encourage students' critical thinking, active participation of students and identify errors in the map when necessary

Step Six: Drawing of conclusion

Teacher explains the concept of habitat using the textbook and gives them assignment

APPENDIX V1: MODEL LESSON NOTE FOR THE USE OF LECTURE METHOD

INSTRUCTIONAL STARTEGY

Week One

Period one

Topic: Habitat

Duration: 45 mins

Objectives: At the end of the lesson, students should be able to explain the term habitat

Instructional materials: **classroom and a concept map showing habitat**

Step One: Introduction of the concept

Teacher asks students what habitat is and gives necessary guide when they are wrong

Aim: To determine their pre-instructional knowledge of habitat

Step Two:

Teacher draws students' attention to the meaning of habitat written on the board

Step Three:

Teachers explain the term habitat

Step Four:

Teacher asks students to explain the term habitat

Step Five: Drawing of conclusion

Students ask questions when necessary; teacher answers the questions and summarizes the work done and gives them assignment to do.

Period Two

Topic: Types of Habitat

Sub-topic: Terrestrial Habitat

Duration: 45 mins

Objectives: At the end of the lesson, students should be able to explain the term Terrestrial Habitat and be able to identify it anywhere they see

Objectives: At the end of the lesson, students should be able to explain the term Terrestrial habitat

Instructional materials: **classroom and a concept map showing Terrestrial habitat**

Step One: Introduction of the concept

Teacher asks students what Terrestrial habitat is and gives necessary guide when they are wrong

Aim: To determine their pre-instructional knowledge of Terrestrial habitat.

Step Two:

Teacher draws students' attention to the meaning of Terrestrial habitat written on the board

Step Three:

Teachers explain the term Terrestrial habitat

Step Four:

Teacher asks students to explain the term Terrestrial habitat

Step Five: Drawing of conclusion

Students ask questions when necessary; teacher answers the questions and summarizes the work done and gives them assignment to do

Period Three

Topic: Types of Habitat

Sub-topic: Aquatic Habitat

Duration: 45 mins

Objectives: At the end of the lesson, students should be able to explain the term aquatic Habitat and be able to identify it anywhere they see

Objectives: At the end of the lesson, students should be able to explain the term aquatic habitat

Instructional materials: classroom and a concept map showing aquatic habitat

Step One: Introduction of the concept

Teacher asks students what aquatic habitat is and gives necessary guide when they are wrong

Aim: To determine their pre-instructional knowledge of aquatic habitat.

Step Two:

Teacher draws students' attention to the meaning of aquatic habitat written on the board

Step Three:

Teachers explain the term aquatic habitat

Step Four:

Teacher asks students to explain the term aquatic habitat

Step Five: Drawing of conclusion

Students ask questions when necessary; teacher answers the questions and summarizes the work done and gives them assignment to do

Period Four

Topic: characteristics of Habitat

Duration: 45 mins

Objectives: At the end of the lesson, students should be able to explain the characteristics of Habitat and be able to identify them anywhere they see

Instructional materials: classroom and a concept map showing aquatic and terrestrial habitat

Step One: Introduction of the concept

Teacher asks students what characteristics of habitat is and gives necessary guide when they are wrong

Aim: To determine their pre-instructional knowledge of characteristics of habitat.

Step Two:

Teacher draws students' attention to the meaning of characteristics of habitat written on the board

Step Three:

Teachers explain the term characteristics of habitat

Step Four:

Teacher asks students to explain the term characteristics of habitat

Step Five: Drawing of conclusion

Students ask questions when necessary; teacher answers the questions and summarizes the work done and gives them assignment to do

APPENDIX V11

COMPUTATION OF RELIABILITY FOR BASIC SCIENCE ACHIEVEMENT TEST

Get

Data for reliability.sav.

DATASET NAME DataSet0 WINDOW=FRONT.

RELIABILITY /VARIABLES=Item1 Item2 Item3 Item4 Item5 Item6 Item7 Item8 Item9 Item10 item11 Item 12 Item13 Item14 Item15 Item16 Item17 Item18 It

em19 Item20

/SCALE('ALL VARIABLES') ALL

/MODEL=kuder-Richardson 21

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Kuder-Richardson 21(k21)	N of Items
0.78	20

APPENDIX V111

COMPUTATION OF RELIABILITY FOR STUDENTS ATTITUDE QUESTIONNAIRE

GET

Data for reliability.sav.

DATASET NAME DataSet0 WINDOW=FRONT.

RELIABILITY /VARIABLES=Item1 Item2 Item3 Item4 Item5 Item6 Item7 Item8 Item9 Item10

/SCALE('ALL VARIABLES') ALL

/MODEL= Crobanch Alpha

Reliability

Scale: ALL VARIABLES

Case Processing Summary

		N	%
Cases	Valid	20	100.0
	Excluded[a]	0	.0
	Total	20	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics

Crobanch Alpha	N of Items
0.80	20