CHAPTER ONE

INTRODUCTION

1.1   Background to the Study

Science education is a very essential tool for sustainable development. It has greatly affected the lives of the average citizen that to be ignorant on the basis of this development is to live an empty, meaningless and hence unrealistic life. The importance of science and technology education on the overall development of any nation is acknowledged worldwide. It is due to this importance that the Federal Republic of Nigeria (FRN, 2013) in the National Policy on Education emphasized the teaching of science and technology subjects at all levels of Education. Jibrin (2014) also acknowledged that science and technology education can help individuals to participate fully and intelligently in education sector.

The valuable role of science in the technological development of any nation is never in dispute. Fafunwa (2013) opined that we are living in a world where science and technology have become an integral part of the world's culture, and any country that over looked this significant statement does so at its own peril. Hence, a solid background in the basic sciences is very crucial if Nigeria has to attain the required science and technological development height. One of such basic sciences is Computer science. At secondary levels of education, Computer Science as a school subject is called Computer Studies.

Computer studies is not about learning how to use the computer, and it is much more than computer programming. It is the study of ways of representing objects and processes. It involves defining problems; analyzing problems; designing solutions; and developing, testing, and maintaining programmes.

Computer studies, according to Edhuze (2013) involves teaching and inculcating in the learner the basic skills required to independently manipulate the computer to achieve educational goals. Edhuze added that, computer studies as a subject is aimed at making students acquire skills and competencies required in this digital word of competitiveness. Such basic skills and competencies upon graduation make them conversant with term and practices embedded in the world of computer. Computer studies are therefore a subject organized to enable people understand the function, uses and limitations of the computer and to provide an opportunity for the study of the modern methods of information processing.

Computer studies is relevant to all students because it incorporates a broad range of transferable problem-solving skills and techniques, including logical thinking, creative design, synthesis, and evaluation. It also teaches generically, useful skills in such areas as communication, time management, organization, and teamwork. Students live in a technologically rich world, and computer studies will provide them with the knowledge and skills to understand the underpinnings of current computer technology and prepare them for

emerging technologies. A foundation in this discipline will introduce students to the excitement and opportunities afforded by this dynamic field and will begin to prepare them for a range of rewarding careers.

The intention of Nigeria to include computer studies in the secondary school curriculum dates back to 1988 when the National Policy on Computer Education was enacted and launched (Abimbade, 2014). The policy on computer education suggested the following as some of the computer curriculum content at the secondary school level: A basic appreciation of how the computer works, an understanding of the basic principle of operating the computer, hands-on experience using the pre-programmed packages which are relevant to the interest of the students as teaching aids in different subjects. According to the National Policy on Computer Education (NPCE, 2014), it is expected that by the end of secondary education, the child has acquired reasonable competence in software such as word processing, spreadsheet, database, analyzing programmes that allow learners interact with the computer the way they desire. One of the major merits of the NPCE, is that it recommended the introduction of computer studies at all secondary schools in Nigeria. The committee on the policy recommended a total lifting of restriction on computer studies in a way that computer literacy programme can begin right from primary school. According to the committee, computer studies should be introduced at any level provided the necessary facilities and resources are adequately provided for effective implementation. Since then, effort has been

made to include computer studies in the primary and secondary school curriculum.

No educational programme for primary and secondary school across the world that is devoid of computer studies, is complete (Azuka, 2013). With the introduction of computer studies, in Nigerian secondary schools, its implementation has been faced with so many difficulties ranging from (resources, computer experts, computers and computer systems) to equipment necessary for teaching computer studies. With the launching of the National Policy on Information and Communication Technology (ICT) in 2001, the Federal Government began a spirited campaign to make computers available to different strata of the society, beginning from the federal and state owned schools. According to Sloan in Agwagah (2013), the need for computer literate teachers can lead to improved students' performance in thinking logically, formulating problem, solving procedures and understanding relationships.

Report by the Chief Examiner, West African Senior School Certificate Examination (WASSCE, May/June 2014-2017) on candidates performance in Computer studies showed that the performance of the candidates at credit pass level decreases gradually as the failure rate increases correspondingly in 2014 and 2016. In 2015 and 2017, the pass rate at credit level fluctuates below average (50%) as the failure rate increases and fluctuates below average respectively also. This shows poor trend of performance. The pass rate at credit

level in 2014 and 2016 were 50.74% and 50.63% respectively while their corresponding failure rate (grade 9) were 26.10% and 27.58%. Therefore, the students' pass rate at credit level was on the average in 2014 and 2016. This also shows a poor trend of performance. Also, Opara (2017) had earlier reported a poor trend of performance in Computer studies from 2014 to 2017 respectively. (The WASSCE May/June 2014-2017 Results is attached as Appendix A on page 90).

Ifegbo (2014) attributed the low achievement in secondary school Computer studies to teachers' non utilization of appropriate teaching methods. The author specifically noted that the use of ineffective teacher centered – strategies like conventional teaching method account for the highest poor performance. In addition, Ayogu (2014) remarked that most teachers in Nigerian secondary schools still believe that the most effective means of communicating to students' is through the conventional "talk and chalk" method of teaching.

The conventional lecture method is a method in which the teacher presents a verbal discourse mainly on a particular subject, theme or concept to the learners. The teacher delivers preplanned lessons to the students with little or no instructional aid that involves students' activity (Okoli, 2016). Secondary school teachers very often teach subjects by conventional lecture method (CLM).This may be because the method is the easiest way to deliver and large

contents are usually covered within a short time by the teacher using the method. This may be why majority of teachers often use this method without recourse to constructive teaching methods that promote the acquisition of scientific and technological skills in learners. The use of CLM, sometimes involves questions and answers, practicals and practices and showing of teaching aids may be involved but, hands on activities of the teacher and students are seldom involved. According to Opara (2017), Computer studies teachers have been teaching their students using CLM over the years (2010-2016). Opara further opined that WAEC annual reports for the slated years revealed that students' pass rate at credit level in computer studies were poor as earlier reported. This is an indication that the use of CLM in teaching computer studies has not delivered effectively. The situation therefore calls for exploration of other teaching methods found effective in some other fields and countries.

Opara (2017) proposed that teachers should use teaching strategies that are helpful in nature and which should involve learners' active participation and encourage skill acquisition. Such strategies could be able to generate interest among students in the learning process. This is because it is expected that students' learning of Computer Studies through using realistic instructional techniques should enhance the inculcation of the generic skills of inquiry, reasoning, conceptualizing, problem-solving and communicating. By applying these skills, students are not only expected to construct their knowledge of

computer studies but also to establish confidence and positive attitudes toward computer studies. One way of achieving this may be through the adoption of student-centered, activity-based and minds-on approaches that cater for individual needs and differences, learning styles, interests and abilities. One such student-centered, inquiry-based approach to organize learning is mind mapping.

Mind mapping is a teaching method which is visual and non-linear representation of ideas and their relationship (Buzan, 2010). The method is student-centered as described by Luepruti (2012) who pointed out that it allows learners to be active rather than passive listeners and emphasized deep learning and understanding. Mind mapping method is a beneficial learning method to help students brainstorm any topic and think creatively. Mind mapping are particularly helpful in the writing process and provide students with a natural way of thinking and building thoughts on a story plot or theme. The Mind Mapping, which represents and classifies the knowledge is a powerful graphic technique for uncovering the potential of the brain (Ayogu, 2014). Generally, a Mind mapping provides an organized knowledge and information by means of hierarchies and categories. Along with this, those hierarchies and correlations in Mind mapping spread around meaningfully from a central image without a certain order (Budd, 2015). That is to say, Mind mapping are the expression of the radiant thinking on a piece of paper. The radiant thinking is about the associated thinking processes which connect to a central point or originate and

advance from a central point. This phenomenon takes place naturally and spontaneously in the brain functions of all people (Gardner 2012). Mind mapping can be used to increase the performance of humans in all areas of life.

Teachers can understand if students understood the subject and if they could construct an appropriate structure for the new information by examining their Mind mapping (Zhao 2013). In addition, the mind mapping teaching strategy helps students assimilate new information, to think and to develop their conceptual schema. To Lumbsdaine (2015), mind mapping is a strategy which enhances creativity and promotes individuals' learning. They assure individuals to recall knowledge and to show the relations between different thoughts and concepts. Mind mapping teaching strategy could provide teacher with a feedback about students' mental structure and development of their mental structure, could facilitate students' recalling the knowledge by the assistance of using visual elements and could be used as an activity that makes the students participate in the lesson. When the features of Mind mapping are taken into consideration, it is proposed that using Mind mapping in the constructivist science and technology education is efficient.

Mind mapping has also been described as one of the teaching strategies that promote creative thinking, ability and high retention in learners. It is a powerful tool that teachers can use to enhance learning as it is evident in brainstorming, note taking, problem solving, memory learning and visual

thinking technique used by psychologist, educationist and other professionals (Yusuf, 2012). Yusuf added that mind mapping enhances the development of certain skills in learners such as thinking skills, reasoning skills and ability to make decision, taking action, information gathering and generating skills. Types of Mind mapping are (1) reference Mind mapping which is used for keeping document (2) planning Mind mapping used in making plans (3) institutions and presentation Mind mapping used for training in schools. The institutions and presentation Mind mapping will be relevant in the course of this study because it is relatively important in education. According to Buzan (2010), Mind mapping can be used in teaching in the following ways: place an image or topic in the centre at least using three colours, use image symbol codes and dimension throughout your mind maps, select key word and print using upper or lowercase letters and each word is alone and sitting on its line.

Buzan (2016) stated that mind mapping teaching strategy (MMTS) is a constructive and classification graphic organizer of ideas which uses the cortical skills to unlock the brain potentials. Buzan added that a Mind mapping is a powerful graphic organizer of ideas, which provides a universal key to unlock the potential of the individual brain. It harnesses the full range of cortical skills, words, image, number, logic, rhythm, colour and spatial awareness in a single uniquely powerful manner. In doing so it gives the learner the freedom to roam the vast expanse of his or her brain. From time to time, students have difficulty understanding the topics in Computer studies courses. Using visual teaching

materials can attract students' attention to those topics and it is very important in uncovering how students organize knowledge and how they realize learning. One of these visual-mental materials is Mind mapping. Mind mapping is useful in discovering and correlating the concepts on a subject like Computer studies teaching and being able to express them visually. Mind mapping encourages divergent thinking and makes it easier for students to start from a central thought and reach further ideas and create associations with those ideas (Lumbsdaine, 2015). It is believed that applying activities with Mind mapping in lessons is useful in that it increases the interest in the computer science courses and makes lessons more attractive.

Achievement is the feeling of getting things done as we desired or getting things that we expected (Budd, 2015). It is not only reaching greater heights but also getting something after a bit of struggle. Academic achievement is the extent to which a student, teacher or institution has achieved their short or long-term educational goals (Ifegbo, 2014). Its achievement is commonly measured through examinations or continuous assessments but there is no general agreement on how it is best evaluated or which aspects are most important— procedural knowledge such as skills or declarative knowledge such as facts. Anaekwe (2012) used interaction patterns to evaluate students' achievement in Computer studies. He found out that there was significant difference in the mean achievement scores of boys and girls in computer studies in favour of boys. Similarly Ifegbo (2014) used peer assessment to evaluate mean

achievement scores of students in computer studies. Ifegbo added that there was significant difference in mean achievement score of males and females in favour of males. Conversely Njoku (2005) reported that there was no significant difference in the mean achievement scores of males and females in secondary school computer studies. Therefore, research findings have shown contradictory evidence in the influence of gender on achievement, interest and retention of students in computer studies.

Interest is a feeling or emotion that causes attention to focus on an object, event, or process. It is used as a general concept that may encompass other more specific psychological terms, such as curiosity and to a much lesser degree surprise. According to Ezeudu (2015), Interest could be defined as an activity one enjoys and devotes his/her time in studying or doing. It can also be seen as a feeling one has in the cause of wanting to know or learn more about something or somebody. Interest differs from ones personal attitude which refers to the manner of behaving towards somebody or something. Chauhan (2007) described interest as an activity that drives or motivates the individual for action. Unfortunately there are strong indications of gender biases that pervade Science and Technology curricula used in Nigerian secondary schools (Olagunju, 2011). Ezeudu (2015) reported that influence of gender on interest in Computer studies was not significant. This finding is in support of Obodo (2011) who reported that the experimental and control groups had equal changes in interest in science and mathematics. However, the findings were in

disagreement with that of Chidolue (2013) who reported that females showed more interest than males in Computer Studies while Balogun (2015) reported that more boys than girls tend to opt for all the basic sciences at SSCE examinations. Therefore, the status of students' interest in computer studies is inconclusive. Teaching with MMTS may contribute effectively to the inconclusive findings on students' interest in their learning. Interest in learning could help to boost the achievement of students in Computer studies and enhance retention.

Retention can be seen as the ability to absorb, hold or keep in memory what has been learned and hence remember or utilize the already acquired knowledge or skills over an extended period of time. Retention plays a pertinent role when it comes to the effective or correct application of whatever a student has learnt. This is because a student retrieves the information he/she has retained in his/her memory when the need arises (may be during a test or examination). So what has been learnt and assimilated by the students can be measured by their ability to answer questions given to them in either test or examination. Retention according to Chauham (2009) is a direct correlate of positive transfer of learning. This means that a student who has high retention ability should invariably achieve highly when achievement test is given. Ugwuanyi, (2010) maintained that the ability of the students to retain and hence remember what they have been taught by the teacher depends heavily on the appropriateness of the method of instruction. Okwo (2012) observed that the

ability to remember takes place more effectively when experiences are passed to the learner through an appropriate instructional method. For a student to retain or hold back something, the student must have good memory where what he has learnt can be stored and hence retrieved when the need arises.

In Computer studies teaching and learning, the ability to remember computer concepts takes place more effectively when the concepts are presented to the students through an appropriate instructional method. Chukwu (2010) asserts that failure to provide enough application to real life activities, social usage cum poor teaching techniques are strong limiting factors to students' retention in Computer Studies. In support of this, Nneji (2013) states that retention depends mainly on teaching strategy adopted by the teacher and made case for adoption of instructional methods that promotes students involvement and activity in the teaching of secondary school Computer Studies so as to enhance students' retentiveness. Many researchers used different strategies in teaching their students science and yet found divergent retention status by gender in their studies. Hence, there is yet no consensus report on the retention of students in sciences, so also on the achievement and interest. Therefore, it is worthwhile to evaluate the effect of mind mapping teaching strategy (MMTS) on secondary school students' academic achievement, interest and retention in Computer Studies.

1.2   Statement of the Problem

There is a growing concern about which strategy or method of teaching in our secondary schools should be able to reverse deteriorating trends in students' poor achievement in Computer Studies. Some suggestions have been made regarding the identification of science teaching methods and strategies which motivate students better to learn and achieve superior results in their study of Computer Studies. Research results reveal that the methods presently in use by teachers of Computer Studies are the traditional, talk or lecture rather than the strategies that involve students' participation. Probably, the non-use of innovative methods that are learner-centred and problem solving oriented such as Concept maps, Mind mapping and so on could be the main cause of deteriorating students' achievement and low interest in Computer Studies.

Mind mapping however, has been used as an effective strategy in enhancing students' achievement both in Computer Studies and other subjects outside Nigeria and may produce the desired effective teaching of senior secondary Computer Studies such that students' interest, achievement and retention improve. There is no evidence in literature on the use of Mind mapping in the teaching of secondary school Computer Studies here in Nigeria. Therefore, the problem of this study is: 'What is the effect of MMTS on achievement, interest and retention of senior secondary school students in Computer Studies?'

1.3 Purpose of the Study

The purpose of this study was to determine the effect of Mind mapping teaching strategy (MMTS) on academic achievement, interest and retention of senior secondary school students in Computer Studies. Specifically, the study determined the:

i. Difference between the mean achievement scores of students taught Computer Studies using MMTS and those taught using conventional lecture method (CLM).

ii. Difference between the mean interest rating scores of students taught Computer Studies using MMTS and those taught using CLM.

iii. Difference between the mean retention scores of students taught Computer Studies using MMTS and those taught using CLM.

iv. Difference in the mean achievement scores of male and female students taught Computer Studies using MMTS.

v. Difference in the mean interest rating scores of male and female students taught Computer Studies using MMTS.

vi. Difference in the mean retention scores of male and female students taught Computer Studies using MMTS.

vii. Interaction effect of gender and teaching methods on academic achievement of students in Computer Studies.

viii.   Interaction effect of gender and teaching methods on interest of students in Computer Studies.

ix.   Interaction effect of gender and teaching methods on retention of students in Computer Studies.

1.4   Significance of the Study

The findings from this study would be beneficial to many groups of people through improving the poor performance of computer studies in secondary school students. These people include; teachers, secondary school students, curriculum planners, textbook writers, government and the society at large.

The study will help the teacher in proper implementation of the curriculum. From the advantages of mind-mapping strategy, their use in classroom will motivate the teachers in handling the subject well by directing the students on how to use computer in their day-to-day activities. This is because the strategy could help the teacher when published in journals, proceedings, presented in workshops, conferences and seminars to boost the students' achievement, interest as well as retention.

The findings of this study would help secondary school students to remove some of the social anxiety towards computer studies and that their achievement depends on their own active participation. Thus, the students will appreciate the need for their involvement in computer activities in their

classroom and this may help them to acquire both computer skills and knowledge which will enhance capacity building and sustainable development. In other words, the students will be enabled towards achievement of national goals for computer education.

The knowledge of the use of mind-mapping strategy will help the curriculum planners to apply the strategy when reviewing computer studies curriculum. Thus, the curriculum should be organized in such a way that it will enhance capacity building and sustainable development. Also, the goals of the curriculum planners will be re-directed towards more on acquisition of performance skills in computer than on acquisition of knowledge.

It is expected that the results of this study would be helpful to computer studies textbook writers to design and apply the use of mind-mapping strategy in structuring their textbooks. In this way, the teachers will use them when seen in the teacher's guide to improve their knowledge of the strategy. The textual materials would gain an appeal and efficacy if adequate number of suitably structured mind-mapping strategies are used by the textbook writers at strategic positions in their texts. Government and other education authorities will realize the importance of organizing seminars and regular workshops on computer studies to educate the in-service teachers on this need.

Finally, the society would benefit from the study because if the study helps to improve students' achievement, retention and interest in computer

studies, then the subject will be studied by many students in institutions of higher learning. If students study computer science our dream in the use of ICTs for capacity building and sustainable development will be fully realized.

1.5   Scope of the Study

The study investigated the effect of Mind Mapping Teaching Strategy (MMTS) on academic achievement, interest and retention of senior secondary school students in Computer Studies in Owerri Municipal Council of Imo State. It was carried out with SS2 Computer studies students in the area. The selected units: Networking, Network topology, World Wide Web and Network and Computer cables were taught to SS2 students during the period of the study. The units were selected as the content of instruction because they form part of SS2 Computer Studies curriculum.

1.6   Research Questions

The following research questions guided the study:

1. What is the difference between the mean achievement scores of students taught Computer Studies using MMTS and those taught using CLM?

2. What is the difference between the mean interest rating scores of students taught Computer Studies using MMTS and those taught using CLM?

3. What is the difference between the mean retention scores of students taught Computer Studies using MMTS and those taught using CLM?

4. What is the difference in the mean achievement scores of male and female students taught Computer Studies using Mind mapping teaching strategy (MMTS)?

5. What is the difference in the mean interest rating scores of male and female students taught Computer Studies using MMTS?

6. What is the difference in the mean retention scores of male and female students taught Computer Studies using MMTS?

1.7 Hypotheses

The following null hypotheses were tested at 0.05 level of significance:

1. There is no significant difference between the mean achievement scores of students taught Computer Studies using Mind mapping teaching strategy (MMTS) and those taught using conventional lecture method (CLM).

2. There is no significant difference between the mean interest rating scores of students taught Computer Studies using MMTS and those taught using CLM.

3. There is no significant difference between the mean retention scores of students taught Computer Studies using MMTS and those taught using CLM.

4. The difference in the mean achievement scores of male and female students taught Computer Studies using Mind mapping teaching strategy (MMTS) is not significant.

5. The difference in the mean interest rating scores of male and female students taught Computer Studies using MMTS is not significant.

6. The difference in the mean retention scores of male and female students taught Computer Studies using MMTS is not significant.

7. There is no significant interaction effect of gender and teaching methods on academic achievement of students in Computer Studies.

8. There is no significant interaction effect of gender and teaching methods on interest of students in Computer Studies.

9. There is no significant interaction effect of gender and teaching methods on retention of students in Computer Studies.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.0 Introduction

In this chapter, literature relating to the present study are reviewed and organized under the following subheadings:

2.1 Conceptual Framework

2.2 Theoretical Framework

Ausubel's Learning Theory

2.3 Theoretical Studies

Mind Mapping Teaching Strategy (MMTS)

Academic Achievement of Students

Interest in School Subjects

Academic and Knowledge Retention

Gender and student's interest in Computer Studies

2.4 Empirical Studies

Effect of Mind Mapping Teaching Strategy On Students' Achievement, Interest and Retention

Effect of other Teaching Strategies On Students' Achievement, Interest and Retention in Computer Studies

Gender, Achievement and Retention of Students in Computer Studies

2.5   Summary of Review of Related Literature

2.1   Conceptual Framework

The conceptual framework showing relationship between the variables of interest in the study on effect of Mind Mapping Teaching Strategy on secondary school students' achievement, interest and retention in Computer Studies is shown in Figure 1.
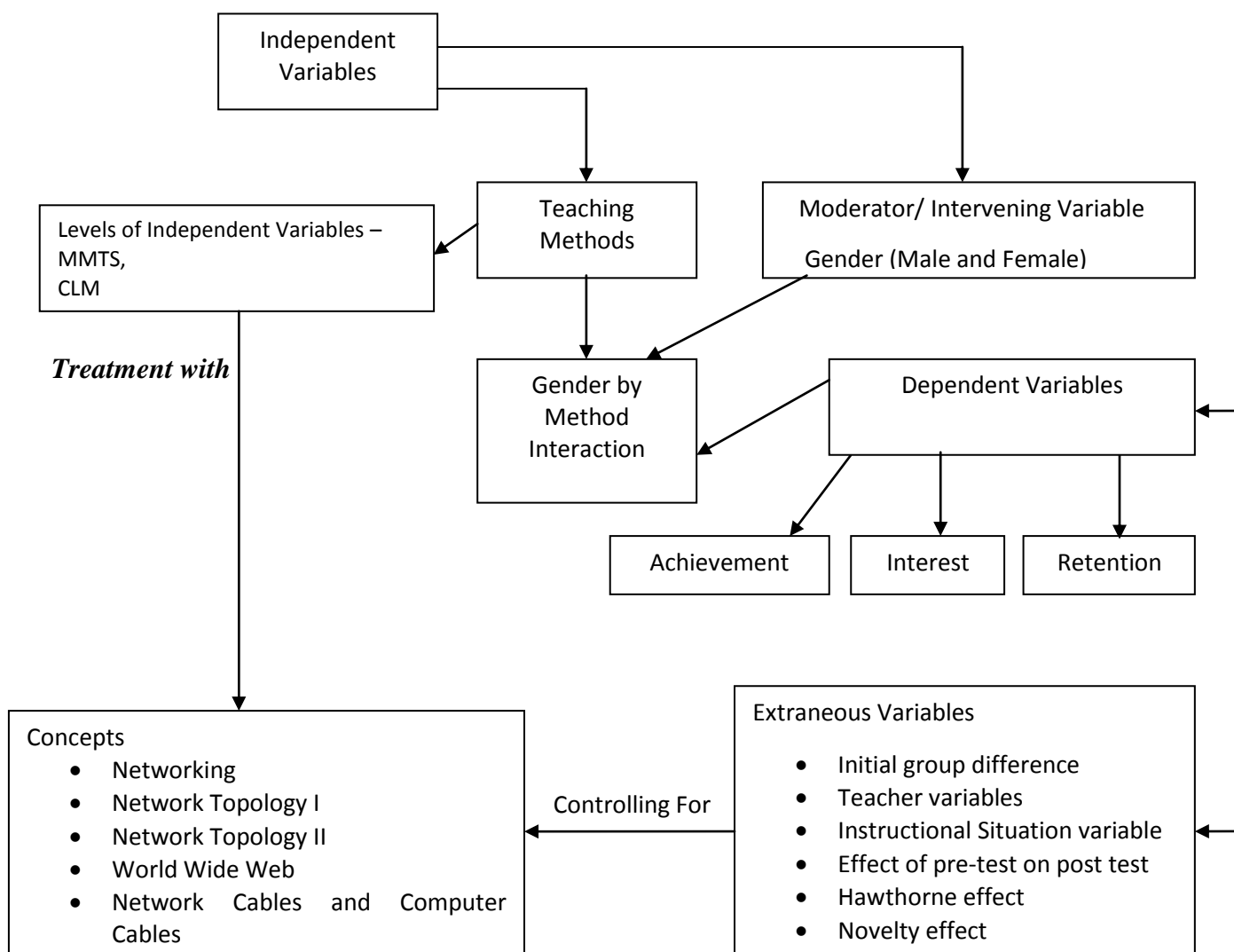
Figure 1: Schematic Representation of the Study Concepts

From figure 1, the independent variable which is the teaching methods at their different levels MMTS and CLM would be manipulated. The concepts used in the manipulation are networking, network topology 1, network topology 11, world wide web, network cables and computer cables. The intervening variables that may confound the outcome of the study which were controlled for are: initial group difference, teacher variables, instructional situation variable, effect of pre-test on post test, hawthorne effect, novelty effect. The effects of the manipulation were observed in the dependent variables which are achievements, interest and retention. Gender is used as moderating variable to make explicit the relationship between the dependent and independent variables. Further, the interaction of gender and teaching methods on achievement, interest and retention were observed and computed also.

2.2.0 Theoretical Framework

Theory related to the study was presented. This study was anchored on Learning Theory propounded by David Ausubel

2.2.1 Ausubel's Learning Theory

The theory was propounded by Ausubel in 1976. The fundamental idea of Ausubel's learning theory anchored on acquisition of new knowledge is dependent on what the learner already knows. Construction of knowledge

begins with our observation and recognition of events and objects which we know or possess.

Ausubel's assimilation theory of learning suggests that people learn better if they can find meaning in the leaning process. They can learn well if they have something that gears their interest in the learning process. This is learning how to learn. There are materials or ideas that could illicit interest and promote learning which David Ausubel described as advance organizer. Some examples of advance organizers are concept mapping, mind, mapping and web diagrams etc. Concept mapping is the mapping of a concept or group of concepts in a hierarchical arrangement or order. Conversely, mind mapping is the idea of mapping a concept or group of concepts in a star or tree structure. It involves brainstorming and the use of colors, pictures, portrait and photographs unlike concept mapping. Therefore, concept mapping and mind mapping are the same advance organizers but with different structural arrangements. The researcher therefore tenders that mind mapping and concept mapping are not the same but they are similar graphic organizers. Meaningful learning is achieving deep understanding of complex ideas that are relevant to students' lives. In order to learn meaningfully, an individual must relate new knowledge to prior knowledge. The new knowledge must interact with learner's previous knowledge and structure. MMTS fits into the two types of motivational teaching techniques namely extrinsic and intrinsic.

Extrinsic motivation refers to motivation to engage in an activity as means to an end, whereas intrinsic motivation is motivation to engage in an activity for its own sake. Mind mapping technique involves the two (i.e. hands-on-minds on activities) which arouses interest and sustain learning. The researcher posits that mind mapping process could enhance the acquisition of scientific skills, technological skills and even entrepreneurial skills because it motivates the user. Motivation is a force that energizes, sustains and directs behavior towards a goal. Researchers have found a strong positive correlation between motivation and achievement as well as interest.

MMTS can bring many advantages to students and educators while learning and teaching science subjects because it helps them to visually present connections between existing and new knowledge. Even though it seems challenging for them, after creating the concept maps on a different subject, students would be able to deeply analyze and understand interconnections and learn the material more effectively (Nesbit, 2006). In the end, they can discuss and elaborate the maps with each other and with their educators in order to determine whether there is a concept that is incorrectly presented. On the other hand, educators can use MMTS as teaching tools for lessons. Moreover, teachers can use students' MMTS as a testing method for evaluating how well a subject is understood by them.

2.3.0 Theoretical Studies

2.3.1 Mind Mapping Teaching Strategy (MMTS)

Mind mapping concept was developed in the 1970 by Tony Buzan. It all started when he was seven (7) years old. Buzan was puzzled by the differences in ability of his classmates and after many years of research, questioning and exploring, he developed mind mapping which he called 'Use your head'. This mind mapping book was produced as television series and a book with BBC (British broadcasting cooperation) in 1974. He has since developed powerful graphic techniques which are used by individuals worldwide in schools, universities and businesses. His mind map work has since been published in over 100 countries and in 30 languages in his quest for helping millions of people to use their brain more effectively to improve memory, reading skills and become genius in their own way. He has also developed numerous minds mapping software's. In the year 2006, Tony Buzan described the start of the new century as the 'millennium of the Mind and the century of the brain'. Buzan T is now World authority on the brain, memory, creativity and speed reading.

A mind map is a diagram used to represent words, ideas, tasks or other items linked to and arranged radial around a central key word or idea (Buzan, 2001). Buzan and Barry (2005) reported that mind map is needed to generate, visualize, structure and classify ideas, and as an aid in study, organization, problem solving, decision making, and writing . It is an image-centered diagram

of information. Mind map presents the connections in a radial, non-linear graphical manner. Hence it encourages brainstorming approach to any given intrinsically appropriate role for theoretical or conceptual framework to work with. To create your first mind map you will need a large white plain sheet of paper and some colored pens. A mind map uses 4 key characteristics to form 1st, Central image of the subjects' topic is formed. 2nd, main themes radiate from the central image. 3rd, Branches hold the key words on the central image. 4th, Smaller branches form a connected structure from main branches.

Once you have tried your first mind map take another topic or even prepare a mind map about yourself, your hobbies, interests, where you live, what key things you did last year etc. Practicing as much as possible will help you become more familiar with the mind mapping process. A mind map is based on radial or star structures. Hermann and Bovo (2005) stated that people have been using image centered radial graphic organization techniques referred to as mental or generic mind maps for centuries in areas such as engineering, psychology and education although the claim to the origin of the mind map has been made by a British popular psychologist and author Buzan in 2001. The mind map continues to be used in various forms and for various applications including learning in education (where it is often taught as webbing. Planning and in engineering diagramming.

Buzan (2001) suggested that mind maps have many applications in personal family, educational business situations, including note taking, brain storming where in ideas are inserted into the map radial around the central node, without the implication or sequential arrangement, and where in grouping and organizing is reserved for later stages, summarizing, revising and general clarifying of thought. Buzan and Vanda (2005) further suggested that one could listen to a lecture and take down notes using mind map for the most important points or key words. A mind map is similar to a road map to help you on your journey. It provides an overview or overall picture of a particular subject and helps you plan your route or choices. The mind map stores large amount of information efficiently, but the exciting part or form is discovering that the final mind map is not only easy to read and look at, but also uses the potential of the brain in a very exciting way. It helps develop new brain skills, which are overlooked by traditional teaching method (Buzan, 2001).

Similarly, Okwo (2002) stated that the activity mode of pictures, drawings and photographs facilitates instructions and mind map encompasses the above activities and similarly facilitates instructions. Buzan and Vanda (2005) stated that one of the main reasons why mind mapping is so effective is how it enhances the acquisition of scientific skills, technological skills and even entrepreneurial skills within our brain. One can also use mind maps as a mnemonic technique or to sort out a complicated idea. Mind maps are promoted as a way to collaborate in color or pen creativity sessions. The researcher

therefore suggested that mind maps can be drawn by hand, either as 'rough notes' for example, during a lesson or taking minutes of meeting.

Williams (2000) declared in his encyclopedia that software and technique research have concluded that managers and students find the technique of mind mapping to be useful, being better able to retain information and ideas than by using traditional 'linear' note taking (lecture) method. Buzan and Buzan (2006) suggested using the following foundation structures for mind mapping guidelines. The guidelines are stated in steps as shown. First, start in the centre of a piece or plain paper or cardboard with an image of the topic using at least 3 colors. Second, use images, symbols, codes and dimensions throughout your mind mapping. Third, select key words and print using upper or lower case letters. Fourth, each word or image must be alone and sitting on its own line. Fifth, the lines are connected starting from the central image. Sixth the central lines are thicker, organic and flowing becoming thinner as key radiate out from the centre. Seventh, make the lines same length as the word/image. Use colors your code throughout the mind map. Eight, develop your own style of mind mapping. Ninth, use emphasis and show association in your mind map. Tenth, keep the mind map clear by using radial hierarchy, numerical order or outlines to embrace your branches (Buzan, 2001).

Buzan(2001) also hypothesized that the mind utilizes the full range of left and right cortical skills, balances the brain, taps into the alleged 99% of

your used mental, as well intuition which he called "supper logic. However, research suggested that such may actually be a marketing hype based on misconception about the brain and the cerebral hemispheres. Hemispheric specialization theory has been identified as pseudo scientific when applied to mind mapping and concept mapping (Williams, 2000). He argued that there are benefits to be gained by applying a wide range of graphic organizers, and it follows that mind mapping specifically, is not equally suited to all learning tasks. Buzan and Buzan (2006) stated that the Mind Mapping laws are designed to help you more rapidly gain access to your intelligence by giving you specific techniques that are brain-compatible. By following the laws, your memory and creativity will be enormously enhanced.

2.3.2 Academic Achievement of Students

Academic achievement or (academic) performance is the extent to which a student, teacher or institution has achieved their short or long-term educational goals (Ugwuanyi, 2010). Academic achievement also refers to the average marks obtained by an individual in the final examination. It has long been recognized as one of the important goals of education. Academic achievement is commonly measured through examinations or continuous assessments but there is no general agreement on how it is best evaluated or which aspects are most important—procedural knowledge such as skills or declarative knowledge such as facts. Cumulative GPA and completion of educational benchmarks such as

secondary school diplomas and bachelor's degrees represent academic achievement (Chauham, 2009).

Academic achievement has long been recognized as one of the important goals of education the world over. However, it is general observation that learners placed in an identical set of academic situations vary in their scholastic achievement. Research conducted to prove into the academic achievement phenomenon, has convincingly, demonstrated that the academic achievement is product of a number of factors operating within the individual and outside him (Kathryn, 2005). Broadly speaking the factors which influence academic achievement can be categorized into three types, namely, intellectual, emotional and environmental. Of these types of factors, it has now been fairly established that the emotional factors most particularly the anxiety and environmental factors like self concept and levels of aspiration largely determined one's academic achievement.

Academic achievement refers to how well a student is accomplishing his or her tasks and studies (Nneji, 2013). Grades are certainly the most well-known indicator of academic achievement. Grades are the student's "score" for their classes and overall tenure. Grades are most often a tallying or average of assignment and test scores and may often be affected by factors such as attendance an instructor opinion of the student as well. Grading systems vary greatly by county and school; common scales include a percentage form 1-100,

lettering systems from A-F, and grade point averages (GPA) from 0-4.0 or above.

According to Yusuf (2012), academic achievement refers to the outcome of education; the extent to which the student, teacher or institution have achieved their educational goals. Academic achievement is the ability to study and remember facts and being able to communicate one's knowledge verbally or written on paper (Nneji, 2013). In the context of this study, academic achievement refers to the extent to which students have achieved mastery of the objectives of the subjects they are exposed to in school. According to Ezeamenyi (2012), academic achievement has been observed in school subjects' especially mathematic and English language among secondary school students.

Academic achievement of a child could be defined as the learning outcomes of the child. This includes the knowledge, skills and ideas, acquired and obtained through their course of study within and outside the classroom situation (Epunam, 2013). It is the outcome of determination, hard work, of student in academic pursuit. Nworgu (2013), defined academic achievement as the performance of the pupils in the subjects they study in the school. This determines the pupils' status in the class. This gives children an opportunity to develop their talents, improve their grades and prepare for future academic challenges. Academic achievement refers to a person's performance in a given academic area (e.g. reading or language arts, mathematics, science and other

areas of human learning. Academic achievement relates to academic subjects a child studies in school and the skills the child is expected to master in each (Ayogu, 2014).

Academic achievement refers to excellence in all academic discipline, in a class as well as extracurricular activities. It includes excellence in sporting behaviour; it includes excellence in sporting behaviour, confidence, communication skills, and others. Okeke (2015) posit that academic performance encompasses students' ability and performance; it is multidimensional; it is intricately related to human growth and cognitive, emotional and social physical development; it reflects the whole child; it is not related to a single instance, but occurs across time and levels, through a student's life in public school and into post secondary years and working life. Academic achievement refers to how well a student is accomplishing his tasks and studies.

Academic achievement in school is evaluated in a number of ways. For regular grading student students demonstrate their knowledge by taking written and oral tests, performing presentations, submission of homework and participating in class activities and discussion. Teachers evaluate in the form of assignment, test and examination to describe how well a student has done. Poor academic achievement is a performance that is adjudged by the examiner and some significant others as falling below an expected standard (Jibrin, 2015).

Gardner, (2012) pointed out that some environmental variables in a home influence the learning capabilities of a child either positively or negatively and thus affect their academic performances. Some of the variables include parental socio-economic status, level of parental supervision of children, location home, library facility among others. According to Olagunju (2011), parental socio-economic status of the children of literate and high income parents perform better in school than those from poor and uneducated parents. Children from, high socio economic homes eat balanced diet, enjoy good health and facilities that stimulates their intellectual activity and make them perform better academically than their counterparts who indulge in smoking cigarette, India hemp which have scattered their brain which may result to poor performance. He asserts that adolescent who come from homes regarded as having good or high socio-economic status may tend to do better than those who have poor homes. The study revealed that insufficient parental income; family type and lack of funding by government are factor influencing student's academic achievement. Lack of quality supervision by parents has been identified as one of the home environmental variables known to influence children's life to a great extent (Epunam, 2013).

Most fundamental issues of life are taught to children by their parents more especially mothers who spend longer hours with the children. The extents to which parents motivate their children in their academic works affect the level of performance of the children. Parental educational background has also been

identified to have a great impact on the education and academic achievement of a child. (Opara, 2017) observed that parents with high educational background tend to gear their children towards studying courses that they are talented in, observing them to make sure that they do their assignment, stick to their time table by reading always which will help their children to perform better academically. When parents are interested in their children's education, the children tend to perform better. On the other hand, children from parents that are businessmen and women in a bid for materialism, tend to leave the house as early as and come back late in the night. They left the training and supervision of their children in the hands of house help. The children comes back from school, spend most of their time playing, doing all sort of irrelevant thing at the expense of their studies. At the end of the day it will affect their academic achievement. Lack of parental supervision gives the growing child freedom that could be dangerous.

The adolescent engage in activities including delinquent acts without knowing the consequences. This is especially so as they are outside the family most of the time without parental supervision. Location of a home is another variable that affect the academic achievement of a child. Children from homes located in urban areas may tend to perform better academically than children from homes in rural areas. Epunam in Uche (2017) pointed out that location is an important variable that influence academic achievement of a child. Schools in urban area tend to be well equipped with material resources needed to

enhance learning. The type of accommodation provided to a child also affects his ability to learn and his subsequent academic achievement. Pleasant and conducive surroundings when provided give rise to pure thought, better concentration and understanding and enhance academic achievement. Noisy overcrowded and busy home environment tend to affect the rate of concentration of adolescents and lower their academic performance.

Existence of Library is another influencing factor of academic achievement. Library is the pivot of education enterprise. It is the platform for sharing of knowledge aimed at rejuvenating Nigerian schools through the provision of current books and journals (FRN, 2013). It is the storehouse of resources and as such provides many more opportunities to the learner to acquire the knowledge, develop to achieve greater academic achievement. It has been observed that there is a strong relationship between school library and academic achievement. Ezeh (2002) reports that schools with well equipped library perform higher than those schools with poorly developed libraries. Good school services in library would help to promote knowledge acquisition by the students.

2.3.3 Interest in school subjects

Interest is an important aspect of the learning process because the learners' interest is a fundamental factor in inculcating the right knowledge, skills, values and attitudes that the curriculum seeks to attain. It helps in

sustaining concentration, purpose and commitment and co-operation with the teacher in the learning process. Interest, according to Ugwuanyi, (2010) possesses the strongest strength for predicting performance. Teachers should therefore endeavor to use good innovative methods that will stimulate students' interest in their attempt to make the learning of science more meaningful to learners. Interest can also be viewed as something in which an individual identifies his or her personal wellbeing. It is a source of motivation. Interest is the key to educational success because learners learn better in subjects they have some degree of interest in.

Interest is the tendency to seek out and participate in certain activities (Habor-Peters, 2004). Accordingly, Chukwu (2010) stated that effective learning has to do with feelings and values and these influence our behavior in one way or the other. Educators believe that children learn more effectively when they are interested in what is presented to them and that they will achieve better if they like the subject.

Generally, if one has interest in something, one will want to learn or hear more about it and will take pleasure doing it. Studies on interest in science are concerned with identifying different approaches that may be used to generate and sustain students' interest in science for higher achievement. Anekwe (2012) submitted that interest can be seen as the feeling one has in the course of wanting to know or learn more about somebody or something. Ifeakor (2012)

stated that interest in an activity or object can be sustained depending on whether the individual whose interest is engaged stands to gain or lose by doing so. Interest is an activity that captivates an individual's attention and spurs him into action. Anekwe insisted that interest, from educational or psychological point of view is a motivational construct. There are numerous publications on the meaning of the interest construct (Azuka, 2013). General argument can be found with regard to the central characteristics of the interest construct. An example is that it is a multi-dimensional construct whose operational definition requires both cognitive and emotional categories (Chukwu, 2010).

The decisive criterion of the interest construct which enables it to be clearly distinguished from several similar motivational concepts is its content specification. An interest is always directed towards an object, activity, field of knowledge or goal. Gardner (2012) is of the opinion that "one cannot simply have an interest" one must be interested in something. Some educators (Hemmerich & Neel 2013) interpret interest as a specific form of attitude, characterized by a content object area. The object or content area of an interest can either be characterized in a general way by referring to a broad area of knowledge; a possibility of interaction with the environment (e.g. a scientific discipline) or by describing specific topics, activities, among others, in which a person is actually interested.

Researchers have identified two types of interest, situational and personal interest (Ozofor, 2011). Situational interest is spontaneous, transitory and environmentally activated whereas personal interest, also referred to as individual interest, is less spontaneous, of enduring personal value and activated internally. Situational interest often precedes and facilitates the development of personal interest. Situational interest appears to be especially important in catching students' attention, whereas personal interest may be more important in sustaining it (Opara, 2017).

Personal interest appears to be especially important for sustaining engagement and long-term learning (Okeke, 2015). Situational interest increases learning when the task or to-be-learned information is novel or when information is relevant to a task or learning goal. Text variables such as coherence, identification with characters, suspense and the concreteness and image-ability of salient text segments also increase situational interest. Collectively, these variables can explain over 50 percent of sample variance in students' learning from text (Njoku, 2005).

Personal interest increases learning due to increased engagement, the acquisition of expert knowledge and making mundane tasks more challenging. Personal interest is also important because it appears to mediate the relationship between short-term situational interest and long-term mastery and learning within a domain (Lumbsdaine, 2015). In addition, several studies suggest that

personal interest increases the amount and quality of information processing. For example, Child (2011) found that readers with personal interest in a topic were more likely to engage in deeper text processing, characterized by the construction of situational models, that is, a mental representation of the people, setting and events implied by the text.

Balogun (2015) suggested that personal interest develops over time because some topics or events motivate an individual's interest in a situational manner that is supported by learning events that help the person to sustain that interest. Sustained interest increases engagement and motivation to learn, as well as facilitates strategy use and deeper processing. Thus, the development of sustained personal interest is an important component of learning Computer Science. Several researchers have investigated the development of interest in more detail. Budd (2015) reported that situational factors lead to the development of sustained personal interest and that personal interest was related to positive effect, persistence and learning.

Agwagah (2013) described similar findings with one important exception. Experimental manipulations designed to get a learner's attention were effective if the learner has initial interest but undermined learning if the learner had little initial interest. Williams (2000) reported that background level of expertise had a mediating effect on situational and personal interest. These results suggest that both situational and personal interest are important but that manipulations

designed to increase situational interest may not lead to sustained personal interest or learning.

Definite evidence indicates that situational and personal interests are related to learning in three important ways. One way is that interest increases motivation, engagement and persistence. Situational interest has a positive effect on extrinsic motivation, whereas personal interest has a positive long-term effect on intrinsic motivation. Presumably, external factors such as teachers and interesting textbooks provide external motivation to learn more about a domain. Once situational interest develops into well-developed individual interest, external factors may likely play a smaller role in motivation, whereas intrinsic motivation and interest are likely to play larger roles.

A second way that interest is related to learning is through strategy use (Azuka, 2013). Students who are interested in a topic usually resort to using more strategies. These groups of students are more likely to monitor their performance and shift strategies when necessary and are better able to self-regulate their learning. Increased strategy use, metacognitive monitoring and self-regulation improve the efficiency of skill and knowledge acquisition as well as the amount of information learned. A third way that interest affects learning is through deeper information processing. Chidolue (2013) found that high-interest learners were more likely to construct deeper mental representations of

a text. This correlation may be due in part to the fact that high-interest learners are more likely to possess topic-specific knowledge and learning strategies.

2.3.4 Academic and Knowledge Retention

Retention plays a pertinent role when it comes to the effective or correct application of whatever a pupil or student has learnt. This is because a student retrieves the information he/she has retained in his/her memory when the need arises (may be during a test or examination). So what has been learnt and assimilated by the students can be measured by their ability to answer questions given to them in either test or examination.

Retention according to Chauham (2009) is a direct correlate of positive transfer of learning. This means that a student who has high retention ability should invariably achieve highly when achievement test is given. It is still a factor of many other variables such as interval between learning and retrieval, intervening experiences, specific subject involved, teaching strategies or methods used, environmental situations among others. However in researcher there is no consistency on the variable that may lead to the students retaining more of what they have learnt. Yet Ugwuanyi, (2010) maintained that the ability of the students to retain and hence remember what they have been taught by the teacher depends heavily on the appropriateness of the method of instruction. The teacher is mainly faced with the task of how to help the students improve on their ability to assimilate information. Mathematics concepts we know,

cannot be learnt properly by mere memorization through rote learning. It has been noted that man is endowed with limited capacity for memorization (Child, 2011).

Based on this assertion, teachers are challenged to find out ways to help students improve on their ability to assimilate and retain learnt materials. Buzan (2001) observed that the ability to remember takes place more effectively when experiences are passed to the learner through an appropriate instructional method. For a student to retain or hold back something, the student must have good memory where what he has learnt can be stored and hence retrieved when the need arises. This process relates to the main stages in information and retrieval of memory from information processing perspectives which are:

1. Encoding (processing and combination of retrieved information)

2. Storage (creation of a permanent record of encoded information)

3. Retrieval (calling back the stored information in response to some).

From the fore going, retention can be seen as the ability to absorb, hold or keep in memory what has been learned and hence remember or utilize the already acquired knowledge or skills over an extended period of time. In Computer studies teaching and learning, the ability to remember computer concepts takes place more effectively when the concepts are presented to the students through an appropriate instructional method. Dulton in Ezeamenyi (2012) asserts that failure to provide enough application to real life activities, social usage cum

poor teaching techniques are strong limiting factors to students' retention in Computer Studies. In support of this, Nneji (2013) states that retention depends mainly on teaching strategy adopted by the teacher. In the same vein, Azuka (2013) made case for adoption of instructional methods that promotes students involvement and activity in the teaching of secondary school Computer Studies so as to enhance students' retentiveness.

To clarify the meaning of retention among students Chauhan (2009) discussed some theories associated with retention thus:

1. Theory of decay: It can also be called theory of disuse. According to this view, impressions created by learning in the cortex fade away as the time passes. So forgetting is produced by time factor. Our wealth of experience tends to fade away with passage of time.

2. Theory of interference: This theory explains that certain activities which take place both before and after learning had occurred tend to inhabit retention of such information and is called proactive inhibition and retroactive inhibition respectively.

3. Theory of Trace-Change: According to the view of this theory, what has been learned tend to change steadily in a specific way. This usually results in the loss of experience of the property of the original learning or information. More perfect trace-change in the trace of original learning causes loss in the retention of the learnt materials.

4. Theory of forgetting as a retrieved failure: This theory focuses on where one tends to fail to recall some piece of information at times but under a different condition, such information comes back more spontaneously. This is called tip-of-the tongue. It shows how non-availability of relevant cues hinders retention. This theory regards forgetting as temporary rather them a permanent phenomenon. This is so because, one may forget information now, only to remember it the next day or two.

5. Theory of motivation: This theory sees the degrees of pleasantness or unpleasantness which the motive causes as a crucial determination of retention of such motive. Unpleasant motives tend to be quickly regressed and eventually lost in the person's memory. It can also be called dynamic theory.

6. Consolidation theory: The view of this theory is that the undisturbed period of memory tends to become durable and permanent because the memory traces unit remains. But if the newly formed traces are disturbed and no time is given for its consolidation, they will be wiped out as the memory traces. When this happens, retention will not take place.

From the above theories one can allude that the ability to retain information depends on many variables such as time interval between when learning occurred and retrieval, intervening experiences, environment, instructional strategies/material used, specific subject involved etc. These variables in one way or the other affect retention adversely.

The techniques that can aid retention should be sought by teachers and educators so as to improve the retentive ability of the pupils/students. These may include the following among others.

1. Meaningfulness of materials**:** Retention can be improved through the organization of materials in some meaningful way. Good teaching helps retention while poor teaching aids forgetting, so we teachers should take note. When materials learned are meaningful to students, it is not easily forgotten. Learning can be made meaningful by giving students examples which are in everyday life occurrence.

2. Over-learning**:** This is a repetition of learned tasks several times. It is a term used to describe practice that continues after a perfect recall has been made. Teachers can encourage over-learning by giving students exercises and assignments regularly.

3. Use of mnemonics**:** This is in form of abbreviations which are very useful in recalling major points in a topic. For instance in simplification of Computer Studies concepts, mnemonics like MODEM and CD-Rom have been very popular and very helpful to students in solving understanding computer concepts.

2.3.5 Gender and Students' Interest in Computer Studies

Ifegbo (2009) studied the effects of assessment techniques on student's interest in Computer studies and reported a significant effect on students'

interest towards Computer. In a related study Ezeh (2002) noted that teaching strategies have been known to influence students' interest in science. There is no consensus view on the contributive factors that affect Nigerian students' disposition in Computer studies and computer related careers. Truly, interest is very important to understand the individual learner and to guide students' future activities (Ifegbo, 2009). It should be noted that science in general and Computer studies in particular offers prospective career opportunity to students and as such, some students could have vocational interest in Computer studies and computer related career i.e. positive disposition. This underscores the need for strategies and methods that enhance students' interest in computer classroom.

In another related study Chidolue (2003) researched into the apparent lack of interest shown by female students towards physics and Computer studies. She reported that female students' aversion of Computer Studies and general lack of interest in sciences that require calculations by them is due to various laws and formulae to be committed to memory. The researcher therefore tenders that many secondary school Computer studies teachers do not relate these laws, formulae and convert them into activity based type for the students. Consequently the students instead of acquiring problem solving skills, they attempt committing the laws to memory.

Furthermore Ezeh (2002) noted in his study that teaching strategies have been known to influence students' interest in science. Therefore, there is no consensus views on the contributive factors that affect Nigerian students' interest in science especially in Computer studies. According to Balogun (2015), Okebukola and Jegede (2016), Nigerian students generally have interest in all the basic sciences. However the researcher proposes that Nigerian students find science difficult because of the uninteresting mode of presentation. The study of science especially Computer studies is activity based. Activity based teaching requires that the teacher does while the students by simulation do same over and over by themselves and learning would have taken place. In fact interest is very important to understand the individual learner and to guide his/her further activities. It should be noted that computer offers prospective carrier opportunity to students and as such many students could have vocational interest in their career choices. This therefore underscores the need for teaching strategy that could enhance interest in Computer classroom. The use of MMTS may invoke students' interest in Computer studies. The students may prefer being taught Computer studies using MMTS or without it. This should serve as a litmus test.

2.4.0 Empirical Studies

2.4.1 Effect of Mind Mapping Teaching Strategy on Students' Achievement, Interest and Retention

Entrekin (2012), carried out a study titled effect of mind mapping on students' achievement, interest and retention in selected units of hardware and software using a sample of 411 students who were selected through a multistage sampling technique. Two instruments computer achievement and retention test in hardware and software (ARTHS) with 30 items and hardware and software interest inventory (HSII) with 20 items were used in the study. Content validity was done on the ARTHS and face validity was done on HSII. The reliability of ARTHS using Kuder Richardson's formula 20 was 0.86 while that of HSII was 0.79 using Cronbach's alpha coefficient. It was found after due control of extraneous variable and data analysis that mind mapping had a significant effect on students' overall achievement, retention and interest in hardware and software. Mind mapping was superior to conventional method in enhancing retention and interest in hardware and software. Gender was consistently insignificant relative to achievement, retention and interest. So both male and female students performed, retained and showed interest in hardware and software. Significant interaction due to mind mapping, gender and treatment was found with respect to achievement but not with interest and retention. Mind mapping was more effective than the conventional methods in terms of

students' achievement, retention and interest in hardware and software. There was a significant difference in retention between students exposed to mind mapping and students exposed to conventional method which implies that mind mapping strategy is efficacious.

In a related study, Herietta (2014) carried out a study titled effect of Students' Interaction Pattern (SIP) on students' achievement in computer. The purpose of the study was to empirically examine the extent to which the SIP could facilitate achievement in computer. In carrying out the research, the extent to which the effect of the SIP would depend on gender was also explored. The sample consisted of 373 SSI students drawn from two (1 – all male and 1-all female), out of the seven government owned secondary schools in Owerri urban. The schools that had up to four intact classes were purposively selected. Two instruments were used for the study. They were four variations (cooperative, competitive, individualistic, control) of lesson plan based on the two units of study (separation technique and particulate nature of matter). The second one was a 40-item, 5-options multiple choice objective test in computer. An internal consistency estimate of 0.94 was computed for the test instruments. The instruments were developed by the researchers and validated by the experts. A number of steps were also taken to control some variables extraneous to the study. One of such steps was the use of Analysis of Covariance (ANCOVA) to control for the initial group differences and regression of scores. Data analysis was carried out using a 4 x 2 (SIP x Gender) Analysis of Covariance

(ANCOVA) in which the pretest scores were used as covariates. Post hoc multiple comparison test was also carried out using the Scheffee test. Result showed that SIP had significant effect on achievement in Computer. Gender is a significant factor on students' achievement in Computer. Also SIP and Gender interaction effect on students' achievement in Computer was significant.

Okafor (2016) investigated the effect of students' prior knowledge of instructional objectives on their achievement in computer. A sample of 184 SS2 Computer students was selected through multistage sampling technique and intact classes were used. The sample of 184 computer students used comprised of 90 males and 94 females from 4 secondary schools in Okigwe Educational Zone. The design of the study was pretest – posttest non randomized quasi experimental research. The instrument for data collection was Computer Achievement Test (CAT). The CAT is a 40 item multiple choice achievement test. The CAT was developed by the researcher and validated by experts. The internal consistency obtained for the CAT was 0.80. Data analysis revealed that the 4 research questions were answered using mean and standard deviation while the 3 hypotheses were tested using ANCOVA analysis. Result indicated that computer students taught with prior knowledge of instructional objectives group achieved higher than those taught without prior knowledge of instructional objectives i.e. Students in the experimental group achieved better than students in the control group. Males in the experimental and control groups achieved better than females in the experimental and control groups. There is no

significant interaction effect of strategy and gender on students mean achievement in computer.

The science process skills (SPS) are cognitive, affective and psychomotor skills which scientists employ in problem identification and solution. Science process skills involves providing students opportunity to interact with materials within an environment through observing, classifying, measuring, questioning, hypothesizing, collecting and interpreting data, accurate reporting, predicting and inferring. The researcher posits that the acquisition of science process skills is enhanced by acquiring laboratory skills. The acquisition of science process skills through laboratory activities is synonymous to science process skills acquired through constructivist's activities. This is true because both encourage hands-on-minds-on scientific activities under the guidance of science teachers. Therefore, the researcher tenders that MMTS is an innovative teaching technique. It would promote learning through science process skills as well as the acquisition of entrepreneurial skills if carefully used by teachers in teaching sciences especially Computer.

2.4.2 Effect of other Teaching Strategies on Students' Achievement, Interest and Retention in Computer Studies

Researchers have revealed that innovative teaching strategies generally confer significant positive achievement in topics of students' interest and retention in their studies. Ezeudu (2005) carried out a study on the effect of

concept mapping on students' achievement, interest and retention in selected units of computer application in selected secondary schools in Enugu State using a sample of 411 students who were selected through a multistage sampling technique. Two instruments Computer achievement and retention test in Computer graphics and visualization (CARTCGV) with 30 items and Computer interest inventory (CII) with 20 items were used in the study. Content validity was done on the CARTCGV and face validity was done on CII. The reliability of CARTCGV using Kuder Richardson's formula 20 was 0.86 while that of CII was 0.79 using Cronbach's alpha coefficient. It was found after due control of data analysis that concept mapping had a significant effect on students' overall achievement, retention and interest in Computer graphics and visualization. Significant interaction due to concept mapping and gender was found with respect to achievement but not with interest and retention. The above study is related to this study because it focuses on the teaching strategies adopted in the promotion of students' achievement, interest and retention in computer studies.

Okorie (2009) investigated the effect of students' previous knowledge of instructional objectives on their achievement in Computer studies. A sample of 184 SS2 Computer studies students was selected through multistage sampling strategy and intact classes were also used. The sample of 184 Computer studies students used comprised of 90 males and 94 females from four (4) secondary schools in Owerri North L.G.A of Imo State. The design of the study was

pretest - posttest non randomized quasi experimental research. The instrument for data collection was Computer achievement test (CAT). The CAT is a 40 item multiple choice achievement test. The CAT was developed and validated by the researcher. The internal consistency obtained for the CAT was 0.80. Data analysis revealed that the four (4) research questions were answered using mean and standard deviation while the three (3) hypotheses were tested using ANCOVA analysis. Result indicated that Computer studies students taught with prior knowledge of instructional objectives group achieved higher than those taught without prior knowledge of instructional objectives i.e. Students in the experimental group achieved better than students in the control group. Males in the experimental and control groups achieved better than females in the experimental and control groups. There is no significant interaction effect of strategy and gender on students mean achievement in Computer studies. Therefore, the researcher tenders that MMTS is an innovative teaching technique. It would promote learning through science process skills as well as the acquisition of entrepreneurial skills if carefully used by teachers in teaching sciences especially Computer studies.

Ozofor (2001) investigated the effects of mind mapping on students' achievement in hardware maintenance. The study also determined the differential effects of mind mapping on the achievement of boys and girls in hardware. Data were collected from 387 SS11 students using the Hardware Achievement Test. Results from the study showed that students exposed to the

mind mapping technique achieved more in the hardware content than students who were not.

Nwaigwe (2010) blamed the cause of poor achievement in computer software development on the use of inappropriate teaching strategy. She worked on the mistakes committed and the effects of software development on students' Computer Achievement. A sample of 242 SS 1 students from intact-classes purposively sampled from 3 schools in Orlu education zone were used. The achievement test used for the study were analyzed using the Analysis of Covariance (ANCOVA). The result showed that students taught with MMTS performed significantly better than students taught with other teaching strategies.

Ezeokoro (2005) in her study titled effect of concept mapping on students' achievement, interest and retention in Computer graphics. The design of the study was pretest posttest quasi experimental research. The author used mean and standard deviation to answer the research questions while the hypotheses were tested using ANCOVA analysis. Results obtained indicated that there was a significant difference in the overall achievement and retention between students exposed to concept mapping against students exposed to conventional methods. Gender was consistently insignificant relative to achievement and retention.

Anaekwe (2007) researched on the effect of students' interaction patterns (SIP) on students' achievement, interest and retention in Computer studies. The design of the study was pretest posttest quasi experimental research. Mean and standard deviation were used to answer research questions while hypotheses were tested with ANCOVA analysis. The researcher reported a significant effect of SIP on students' achievement in favor of females and insignificant effect of retention in favor of males.

In addition, Ezeh (2002) studied the effect of advance organizer on students' achievement, interest and retention in Computer studies. He used 356 JSS student in their intact classes, who were randomly drawn from five secondary schools in Isiuzo local Government Area of Enugu state. Two instruments were used. ANCOVA was used for data analysis. The result showed that advance organizer had significant effect on the students' mean achievement score and retention score were not significant.

Therefore, from the reports reviewed above. It may not be out of place to presume that the so called conventional lecture method (CLM) has not delivered the expected goal. Perhaps the innovative teaching technique MMTS could be of greater help in facilitating students' achievement, interest and retention in secondary school Computer studies. Hence there is the need to evaluate the effect of MMTS on students' academic achievement, interest and retention in Computer studies of senior secondary schools.

2.4.3 Gender, Achievement and Retention of Students in Computer Studies

Joseph (2009) sampled gender differences in senior secondary school Computer studies performance in Enugu State. Two null hypotheses guided the study. A sample of 380 SS 3 students was used in three different secondary schools for the study. The schools were selected through stratified random sampling. The instrument used was computer achievement test (CAT) which was administered to the students. The result revealed a significant gender difference in favor of males. This trend may be attributed to the fact that females regard science subject as intellectually complex and task oriented.

In another study, Ifegbo (2005) evaluated the effects of commercially produced computer assisted instruction package (CPCAIP) on students' achievement and interest in Computer studies. The study also sought the effect of CPCAIP and gender on students' academic achievement and interest in Computer studies. The performance of students taught with CPCAIP was compared with those of students taught with conventional teaching method (CTM). Six research questions and six hypotheses guided the study. The design of the study is the pretest-posttest quasi experimental non randomized control group type involving 4 intact classes. The sample size was 140 SSI Computer studies from two private secondary schools drown randomly using balloting from 31 private secondary schools in Owerri North and Municipal Local

Government Area of Imo State. Two instruments Computer achievement test (CAT) and Computer interest inventory (CII) were developed, validated and used for trial testing and collecting data. The data obtained were analyzed using mean and standard deviation to answer research questions while hypotheses were tested at 0.05 level of significance using ANCOVA f-statistics. The result of the analysis indicated among others that gender was a significant factor in the students overall cognitive achievement in Computer studies in favor of males.

Falade (2012) carried out a study on the construction and validation of a formation achievement test on Computer application for senior secondary three Computer studies students. The study was aimed at determining the effects of sex on students' achievement in Computer studies. Two instruments Computer achievement test (CAT) and Computer interest inventory (CII) were developed, validated and used for trial testing and collection of data. The result indicated that sex was a significant factor in the overall cognitive academic achievement in favor of males. The researcher reported that Computer studies students in secondary schools performed poorly over the years (WAEC, 2010-2016). Some other studies have been conducted in the area of gender and academic achievement in Computer studies.

Research findings on academic achievement due to gender- are contradictory. Some of the studies revealed significant gender-related differences in students' cognitive achievement in Computer studies. In general,

there are three categories of results from studies on gender-related differences in science achievement that are available. The first category is that in which there is significant gender difference in chemistry achievement score in favor of the boys. The second category is that in which there is significant difference in Computer achievement score in favor of the girls. The third group is that in which no gender difference in computer achievement score is neither detected in favor of the boys nor the girls. Studies reviewed above do not seem to provide a clear picture on gender differences in achievement scores in general. Indeed, the review of literature conducted in this section indicated an inconclusive and inconsistent trend in gender achievement in the sciences and Computer studies in particular. In view of the noted inconsistency, there is need to evaluate this issue of gender and its related differences in achievement using an innovative teaching strategy mind mapping teaching strategy (MMTS).

2.5   Summary of Review of Related Literature

Literature reviewed was presented under the following sub-headings: Theoretical framework, conceptual framework and empirical studies which house the variables focused in the study. It was established that if MMTS is adopted and applied strictly to learning situations in our secondary schools could enhance students mean achievement score, mean interest score, and mean retention score in secondary school Computer studies. Teaching strategies can be used to construct, organize, rehearse and elaborate information to be more

meaningful. One of such teaching strategies is MMTS. A mind map is a diagram used to represent ideas, words, tasks and other items linked to and arranged in radials around a central keyword or topic. This is needed to generate, visualize, structure and classify ideas, and as an aid in teaching, organizing, studying, problem solving and decision making. Mind mapping has rules or laws designed to help all of us gain access to our intelligence by giving us specifics that are brain compatibles. Following these rules may make our memory and creativity more enormously enhanced.

Constructive learning theory is also related to Ausubel's learning theory in recognition of prior knowledge and presence of motivational objects in classrooms. Several strategies of teaching computer were reviewed. The conclusion was that constructive (active) teaching strategies that encourage hands-on-mind-on activities are unique. MMTS and other similar teaching strategies could generate interest among computer students and as well may enhance academic achievement and retention. Some other research studies with same dependent variables of academic achievement, interest and retention in computer studies were reviewed. It was found out that there was no consensus report on academic achievement, interest and retention in computer studies of the gender groups. This was ascribed mainly to poor teaching methods and strategies adopted by individual teachers plus other factors.

The conventional lecture method which does not have lasting effect on the learners; still dominates our classrooms. There is therefore the need to back up their effectiveness with more pragmatic evidences so as to encourage teachers to use them for classroom instruction.

However, most of the studies explored the efficacy of concepts mapping in either other subject areas or other units in Computer studies. In addition, literature also revealed that MMTS is not widely used by teachers especially in Nigeria. Literature on interest as a factor in learning was also reviewed and many educationists view interest as an indispensable construct for achievement. It was established that teaching methods employed by teachers directly affects students' interest, retention and achievement.

Finally, the review addresses achievement and interest in relation to mind mapping. Literature revealed that MMTS affects students' performance but there is no consensus as to whether urban students perform better than those from rural locations or vice versa. It is hoped that from the studies reviewed, the gaps tinted will be filled with the results of the study. Furthermore, students' disposition in computer studies depends on many other factors including teaching strategies adopted by computer teachers. Review showed that some students may have vocational interest in computer and computer related careers i.e. positive disposition. Therefore, the researcher considered it worthwhile to explore effect of teaching students using MMTS and the dependent variables of

academic achievement, interest and retention in senior secondary school computer studies.

CHAPTER THREE

METHODS

3.0 Introduction

This chapter presents the research design, area of the study, population of the study, sample and sampling technique. It also discusses the instrument for data collection, validation and reliability of the instrument, experimental procedure, control of extraneous variable, method of data collection, and method of data analysis.

3.1 Research Design

This study adopted quasi experimental research design. Specifically, the study used pre-test, post-test non-equivalent control group design. Quasi experimental design is the one that seeks to establish cause and effect relationship between variables of interest in the study but where random assignment of the participants to experimental and control group is not possible (Nworgu, 2015). The design is appropriate because the administrative set up in school would not allow for random assignment of these participants into experimental and control groups.

The design is symbolically represented in Figure 2.

E O_1 X_1 O_2 O_3

C O_1 X_0 O_2 O_3

Figure 2: Design of the Study

Where;

E = Experimental Group

C = Control Group

O_1 = Pretest

X_1= Experimental treatment using MMTS

X_0 = Non experimental treatment using CLM

O_2 = Posttest

O_3 = Retention test/Delayed Posttest

$---$ = Non equivalence of the two groups

3.2   Area of the Study

The study was carried out in Owerri Municipal Council of Imo State. Owerri Municipal Council is one of the 27 Local Governments in the State. It is one of the cities found in the Capital of Imo State and Owerri Municipal Council has boundaries with Owerri North and Owerri West. Owerri Municipal Council is located at Douglas road and has an area of 58km^2. The council is commonly referred to as "The Heart of the State" because of the location and it is largely made up of civil servant, students, artisans, business people, who are largely immigrants (Onuoha, Alozie & Etom, 2014). The people inhabiting the

area are sociable and religious. The researcher used Owerri Municipal Council in order to ensure that all the students in the MMTS and the CLM groups share common socio cultural environment. Also, Owerri Municipal Council has well equipped computer science laboratories.

3.3   Population of the Study

All the senior secondary two (SS2) computer studies students in secondary schools in Owerri Municipal Council of Imo State made up the population. The total is 1,698 students as indicated in the Secondary Education Management Board (SEMB) statistical unit of Owerri Municipal Council, 2018/2019 academic session. There are 11 State Government owned secondary schools in all, made up of 7 single sex (4 male and 3 female) schools and 4 co-educational schools. The choice of this area of study was based on the fact that it has potentials to give necessary data for this study. It has secondary schools made up of Computer teachers who engage in teaching of Computer studies. Such teaching requires the use of MMTS. These students are expected to perform well in the subject.

3.4   Sample and Sampling Technique

The sample for this study is 105 SS2 Computer studies students composed from two sampled schools. These students offer Computer studies as one of their subjects. Two-stage sampling procedures was adopted; purposive

and simple random sampling. First, the four co-educational secondary schools in Owerri Municipal Council of Imo State were selected using purposive sampling. The reason being that male and female students are to be taught together by the same teacher and other classroom conditions. Also, two out of the four co-educational schools in Owerri Municipal Council were selected using simple random sampling. In furtherance, the two schools selected were grouped into experimental and control groups respectively using simple random sampling. Finally, in each of the two selected schools, classes C and D respectively are the only intact classes offering computer studies and as a result were selected using purposive sampling.

3.5 Instrument for Data Collection

Two instruments were developed by the researcher for data collection. They are the Computer Studies Achievement Test (CSAT) and the Computer Studies Interest Rating Scale (CSIRS). The CSAT was used for collection of pretest achievement score, posttest achievement score, retention test score. Achievement test is the same as retention test except that retention test was administered three weeks after post test to check for subjects' retention.

The CSAT has two sections, section A and section B. Section A contained personal data of the participants like sex, name of school and class. Section B contained instructions for answering the questions and the items. The CSAT is a 60 item, multiple choice objective test with four options A-D based

on the content of the study in SS2 computer studies curriculum. A table of specifications was used in selecting the items. The table of specification has four sub-units; Networking, Network Topology, World Wide Web and Network cables and Computer cables.

The number of weeks each topic lasted in the Secondary Education Management Board (SEMB) common scheme of work for secondary schools forms the basis of the weighting of the contents. The weighing for the objective level was based on the proportion of lower and higher order performance objectives in the units of the study. Lower order objectives included levels of intellectual function objectives such as knowledge, Comprehension and application. Higher order objectives included analysis, synthesis and evaluation. Each unit had 10 questions of lower order or 60% of the total and 5 questions of higher order or 40% of the total. Therefore, the total of lower order questions was 40 while higher order questions were 20. The sum total $= 40 + 20 = 60$ questions of equal item representation of the content in line with predefined objectives. The reliability of the test is 0.82. The psychometric indices were determined as follows (a) item discrimination (ID) (b) item facility (P) and (c) distracter index (DI). These helped the researcher to build the final CSAT package that was used. The key for acceptance is given as Item facility (P) 0.30 to 0.70 Discrimination index (D) 0.30 to 0.80. Distracter Index (DI) options are with positive indices.

The CSIRS restructured from Abdul, Gafoor, Haskar and Babu (1978), inventory scale was used for collection of pretest interest score and posttest interest score. The CSIRS was made up of section A and Section B. Section A contained personal information. Section B contained the items and instructions for ticking the chosen responses of each item. The CSIRS is a 65-item interest inventory developed by the researcher. It has a 4-point scale response. The responses are Strongly Agree (4 point), Agree (3 point), Disagree (2 point) and Strongly Disagree (1 point) for positive items and scoring the reverse for negative items. The respondents were expected to indicate their degree of agreement or disagreement on a number of statements (positive and negative) in relations to senior secondary Computer studies curriculum. The instrument is non-polychotomously scored because it has multiple rating and there are 30 of positively and 35 negatively directed items. The instrument is shown as Appendix D.

3.6   Validation of the Instruments

The CSAT was face and content validated by three experts, one from the Department of Computer Science Education, Alvan Ikoku Federal College of Education Owerri, one from Measurement and Evaluation, Faculty of Education, Imo State University, Owerri and one from Science Education Department, Faculty of Education, Nnamdi Azikiwe University, Awka. To achieve this, the experts were given the CSAT, purpose, design, scope

hypotheses etc as a guide. The instruments were validated in terms of clarity of instructions; correct wording of items and appropriateness and adequacy of the items in addressing the purpose and problems of the study. The critical appraisal and comments of the experts were used for reforming the items. The CSIRS was also face validated by the same three experts. The critical appraisal and comment of the experts were used for reforming the items. They determined how effective in selecting questions considering the percentage allocation of the various levels of the content units that were covered according to Blooms taxonomy. They also ensured that equal number of items for each topic or unit was reflected according to the curriculum content of the units (FME, 2005). Also, included are emphases on curriculum in generating questions of the items, content and number of questions generated from each topic or unit. The experts ensured that the statement items are opinion response oriented. The 4 point scale was in order and well represented. The CSIRS items have equal positive and equal negative cued items. The scales correspond to appropriate responses they are supposed to measure. Also they ensured that the instrument is none dichotomously scored.

The lesson plans were also validated by the same experts in the field of Education (Appendix G).

3.7   Reliability of the Instruments

The CSAT instrument was trial tested using 40 SS2 computer studies students of City Secondary School Owerri and 40 students of the Madonna Secondary School Ihitte/Uboma. The CSAT was administered to 40 students of the schools by their computer studies teachers. The CSIRS instrument was also trial-tested using the same 40 computer studies students of Madonna Secondary School Ihitte/Uboma. One hour was allowed for the CSAT. The papers were marked, scores collected and collated. The choice of the above school for the trial testing was because the school was considered equivalent to the sampled schools used for the study.

The students' scores in the CSAT was used to calculate the reliability coefficient of the CSAT using Kuder Richardson's Formula 20 (KR-20). Also the respondents' rating scores in the CSIRS was used to calculate the reliability coefficient using Cronbach alpha. The reliability coefficients for the CSAT and the CSIRS obtained were 0.84 and 0.92 respectively (Appendix H, page 106).

3.8.0 Experimental Procedure

This was carried out in five stages;

3.8.1 Training of Research Assistant

There was one week training of four contacts for two teachers each from the two groups (MMTS and CLM) in the two sampled schools. To avoid confusion

and ensure efficiency, the two teachers for both MMTS and CLM respectively were taught differently based on their respective roles. On the first and second day of the training, the MMTS teachers were trained while the third and fourth day was for the CLM teachers. The researcher presented copies of the MMTS lesson plans to the teachers. The researcher read the MMTS lesson plans of the four units to their hearing. Discussion sessions and questions were asked. Answers were given by the researcher who coordinated. They were informed of the MMTS lesson plans, date of teaching and time of each test must be strictly adhered to. Discussion of the mind mapping procedures of each of the four units of computer studies was carried out. The researcher sent copies of CLM lesson plans to the CLM teachers. He had discussions with them and implore that the lesson plans, date of commencing to teaching and time of each test must be strictly adhered to.

3.8.2 Pretesting

Before the treatment, the participants were given a pre-test. The test was administered by the regular Computer studies teachers in the sampled schools. The scripts were marked by the researcher. The pre-test was used to determine the students' initial knowledge of the materials they would learn later and determine the comparability of the two groups (experimental and control) with respect to their achievement in the pre-test scores. The scores obtained showed that the two groups are comparable.

3.8.3 Teaching of Students

The Computer studies teacher in control group was allowed to teach the students normally using the conventional lecture method lesson plan and note prepared by the researcher. The researcher kept monitoring them to ensure that they do not deviate from the procedure of instruction given to them.

3.8.4 Mind Mapping Procedure

1. Obtain a plain-paper A4 or A3 size preferably.

2. Write the title or topic of the subject you are teaching in the centre of the page of the paper or chalkboard and draw a circle around it. Mark the circle 1 or any letter you may use to create order e.g. A, B, C etc.

3. Draw lines out from this circle. Label these lines with these subheadings or subdivision as 2, 3 etc.

4. As you "borrow" into the topic and uncover another level of information (further subheadings, or individual facts) belonging to the subheading above, draw lines linking to the subheading lines and mark them 3.

5. Finally, for individual facts or ideas, draw lines out from the appropriate heading lines and label them as 4 progressively.

A complete mind map should have main topic lines radiating in all directions from the center of a circle. Subtopic lines and facts lines branching as twigs

from the trunk of a tree. Do not worry about the structure being produced, as this will evolve on its own accord.

Note that the ideas of numbering levels as 1, 2 etc. is to show how the mind map was created. All that are being shown is that major leadings radiate from the center, with lower level headings and facts ranching off from the higher level heading.

Improve your mind maps. Your mind maps are your own intellectual property. Once you understand how to make notes in the mind map format, you can develop your own conventions to them.

Finally, Mind Mapping is an extremely effective method of taking Notes. It shows not only facts, but also the overall structure of a topic and the relative importance of individual parts of it. They help you to associate ideas and make connections that might not otherwise make.

The teaching of both groups lasted for five weeks.

3.8.5 Posttesting

After the treatment, the post–CSAT and CSIRS were administered to both the control and experimental groups. The scripts were marked by the researcher and the students' score were recorded. The aim of the posttest is to find out if there is any gain in achievement and interest that arises from the treatment.

3.8.6 Delayed Post Testing/Retention Test

Three weeks after the post-CSAT and post CSIRS, the retention test was administered. One hour was allowed for CSAT but CSIRS was not timed. This is to check retention and interest in computer studies concepts. The test was marked by the teachers. Scores was collated, collected by them and handed over to the researcher.

3.9   Control of Extraneous Variables

Some of the extraneous variables that were controlled in this study are:

1. Initial group differences: Randomization is a procedure for controlling initial group differences in experimental studies. However, this was not done in the present study because the process will disrupt normal school period. Instead, intact classes were used as well as analysis of covariance (ANCOVA) in data analysis to control the initial group differences and reduce error variance.

2. Teacher variables: When different teachers are involved in an experiment, the problem of teacher variable arises though all the four teachers are graduates of Computer Science Education. Since different teachers possess different standards in terms of knowledge of the content, the researcher prepared same lesson plans on the topics of computer studies for teachers of the MMTS group. The researcher also organized one week intensive training for the two teachers involved on the use of MMTS

lesson plans. They were drilled on how to teach using MMTS lesson plans. Also, the two teachers of CLM group were briefed on the purpose of the study.

3. Instructional situation variable**:** Homogeneity of instruction across groups was ensured. The researcher provided the instructional procedures and guide lines that were involved. The MMTS and CLM subjects were taught within the regular periods allotted to computer studies in the schools' common timetable in Owerri Municipal Council.

4. Effect of pre-test on post-test**:** In order to minimize the influence of memory effect due to either remembrance or forgetfulness, the time lag between pre-test and post-test and post-test and retention test. The periods were considered to be neither too short nor too long. The pretest items were arranged and produced in white question papers before they were rearranged and used as yellow question papers in the post-test and further rearranged as white again in the retention test.

5. Hawthorne effect: This is a situation in which the students' behavior may be affected by their knowledge of participation in a study. This was controlled by the use of the regular computer studies teachers of the schools. The teachers conducted the teaching, administration of instruments, invigilation of pretest, posttest, retention test and marking of the tests. The researcher was not directly involved in the treatment or else the students were sensitized that they would be used for a research. This

might cause them to fake their behaviours and actions. The researcher monitored them regularly and encouraged them also with caution.

6. Novelty effect: This is an increase in interest as a result of motivation or participation on the part of the research subjects because they did something different from what they used to do. This was avoided by conducting the teaching and testing in the two SS2 computer studies classes only in the four sampled schools. Their regular computer studies teachers in their intact classes were used. Normal computer studies periods of three periods a week was adhered to for five weeks.

3.10   Method of Data Collection

The pre-test scores, post-test scores and the retention test scores were recorded after each marking exercise. The CSAT has 60 items scored 1 mark each and was converted to 100% before recording was made. The minimum mark for pass is 40 while the maximum mark is 100 for pre-test, post-test, and retention test respectively. The CSIRS has 65 items. A total of 105 copies of the CSAT and the CSIRS were issued and retrieved. Those that started with the experiment finished with the experiment or exercise.

3.11   Method of Data Analysis

The research questions were answered using mean and standard deviation scores while the nine null hypotheses were tested at 0.05 level of significance using Analysis of Covariance (ANCOVA). The pre-test scores were used as

covariates to the post- test and post-test scores used as covariate measures to the delayed post-test scores. ANCOVA is appropriate here because it serves as a procedure for controlling the initial group's differences as well as increasing the precision due to the extraneous variables thus reducing error variance. In taking decisions, null hypothesis is rejected if the probability value (p-value) is less than or equal to significant value of 0.05, otherwise you reject.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1.1 Research Question 1

What is the difference between the mean achievement scores of students taught Computer Studies using Mind mapping teaching strategy (MMTS) and those taught using conventional lecture method (CLM)?

Table 1: **Mean and standard deviation on mean achievement scores of Students taught Computer Studies using MMTS and conventional method**

Group	N	Mean Pre-test	Mean Post-test	Mean Gain Score	SD Pre-test	SD Post-test
MMTS	52	33.2	62.9	29.6	9.43	11.3
CLM	53	30.2	51.4	21.2	8.84	12.9

From Table 1, MMTS group has a mean gain score in achievement of 29.6 while conventional lecture method group has a mean gain score of 21.2. This shows that MMTS is very effective on students' achievement in Computer Studies. Also, from Table 1, MMTS group has a higher standard deviation score of 9.43 in pre-test than the lecture method group with standard deviation of 8.84 in pre-test. Conversely in the post-test, MMTS group has a lower standard deviation of 11.3while the conventional lecture method has 12.9. Thus, the table reveals that the standard deviation score for each group is low in both pre-test

and post-test. By implication, it shows that groups used in this study are homogeneous.

4.1.2 Research Question 2

What is the difference between the mean interest rating scores of students taught Computer Studies using MMTS and those taught using CLM?

Table 2: Mean and standard deviation on interest scores of students taught Computer Studies using MMTS and conventional method

Group	N	Mean Pre-test	Mean Post-test	Mean Gain Score	SD Pre-test	SD Post-test
MMTS	52	57.7	119.0	61.3	15.1	15.1
CLM	53	57.7	115.0	57.3	12.3	12.3

From Table 2, the gain score in interest of students taught using MMTS is higher (61.3) than the gain score in interest (57.3) of those taught with the lecture method group. This indicates that the use of MMTS enhanced the mean interest score of students. Also, the standard deviation (15.1) for the pre-test and post-test scores of MMTS group is the same with that of the standard deviation of the lecture method group in pre-test and post-test scores. This shows that the interest of the MMTS group prior to and after the treatment is equally spread. Thus, the two groups have homogeneous interest in mathematics before and after treatment.

4.1.3 Research Question 3

What is the difference between the mean retention scores of students taught Computer Studies using MMTS and those taught using CLM?

Table 3: Mean and standard deviation on retention scores of students taught Computer Studies using MMTS and conventional method

Group	N	Mean Pre-test	Mean Post-test	SD Pre-test	SD Post-test	Mean Diff
MMTS	52	33.2	66.3	9.43	11.6	1.8
CLM	53	30.2	64.5	8.84	11.9	

From Table 3, MMTS group has a mean retention score of 66.3 while conventional lecture mean retention score of 64.5. This shows that MMTS has effectively enhanced the memory of the MMTS group more than the control group in Computer Studies. Also, from Table 1, MMTS group has a higher standard deviation score of 9.43 in pre-test than the lecture method group with standard deviation in pre-test of 8.84. Conversely in the post-test, MMTS group has a lower standard deviation of 11.6while the lecture method (11.9). In general, the table reveals that the standard deviation score for each group is low in both pre-test and post-test. By implication, it shows that groups used in this study are homogeneous.

4.1.4 Research Question 4

What is the difference in the mean achievement scores of male and female students taught Computer Studies using Mind mapping teaching strategy (MMTS)?

Table 4: **Mean Achievement scores of Male and Female subjects taught with MMTS**

Group	N	Mean Pre-test	Mean Post-test	Mean Gain Score	SD Pre-test	SD Post-test
Male	42	33.6	61.1	27.5	10.7	12.4
Female	63	30.6	54.5	23.9	7.98	13.6

From Table 4, the mean gain score in achievement of male (27.5) is higher than the mean gain score of their female (23.9) counterparts taught Computer Studies with MMTS. Table 4 further reveals that male students had higher standard deviation (SD) score before treatment (10.7) and lower SD after treatment (12.4) than their female counterparts whose standard deviation score is (7.98) before treatment and (13.6) after. In general, male students achieved higher than their female counterparts when taught with MMTS.

4.1.5 Research Question 5

What is the difference in the mean interest rating scores of male and female students taught Computer Studies using MMTS?

Table 5: **Mean Interest scores of Male and Female subjects taught with MMTS**

Group	N	Mean Pre-test	Mean Post-test	Mean Gain Score	SD Pre-test	SD Post-test
Male	42	33.6	194.3	160.7	10.7	12.2
Female	63	30.6	199.1	168.5	7.98	14.5

Table 5 shows that the mean gain score in interest of female (168.5) is higher than that of their male (160.7) counterparts in Computer Studies. Also the male students have a standard deviation scores (10.7) before and (12.2) after treatment while their female counterparts have SD scores are 7.98 and 14.5 in pre-test and post-test respectively.

4.1.6 Research Question 6

What is the difference in the mean retention scores of male and female students taught Computer Studies using MMTS?

Table 6: **Mean Retention scores of Male and Female subjects taught with MMTS**

Group	N	Mean Pre-test	Mean Post-test	Mean Gain Score	SD Pre-test	SD Post-test
Male	42	33.6	64.2	30.6	10.7	12.6
Female	63	30.6	66.3	35.7	7.98	11.3

From Table 6, the mean gain score in retention of female (35.7) is higher than the mean gain score of their male (35.7) counterparts taught Computer Studies with MMTS. Table 6 further reveals that male students had higher standard deviation (SD) score before treatment (10.7) and lower SD after treatment

(12.6) than their female counterparts whose standard deviation score is (7.98) before treatment and (11.3) after. In general, female students retained higher than their male counterparts when taught with MMTS.

4.2   Test of Hypothesis

4.2.1 Hypothesis One

There is no significant difference between the mean achievement scores of students taught Computer Studies using Mind mapping teaching strategy (MMTS) and those taught using conventional lecture method (CLM).

Table 7:   One way ANCOVA Comparison Difference between the Achievement of MMTS group and Conventional group

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5168.045a	4	1292.011	9.518	.000	.276
Intercept	18747.776	1	18747.776	138.107	.000	.580
Pre-Test	476.628	1	476.628	3.511	.064	.034
Method	2167.686	1	2167.686	15.968	.000	.138
Total	361600.000	105				
Corrected Total	18742.857	104				

Table 7 reveals that significant difference exists between the achievement scores of students taught computer studies with MMTS and those taught with conventional lecture method (CLM) in favour of MMTS group. This shows that the MMTS is very effective ($p < 0.05$).

4.2.2 Hypothesis Two

There is no significant difference between the mean interest rating scores of students taught Computer Studies using MMTS and those taught using CLM.

Table 8: **ANCOVA Comparison Difference between the Interest of MMTS group and Conventional group**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	17971.856a	4	4492.964	330.330	.000	.930
Intercept	23430.162	1	23430.162	1722.623	.000	.945
Pre-Test	16660.878	1	16660.878	1224.934	.000	.925
Method	31.600	1	31.600	2.323	.031	.023
Error	1360.144	100	13.601			
Total	1456677.000	105				
Corrected Total	19332.000	104				

Table 8 shows that significant difference also exists between the interest scores of students taught computer studies with lecture method and those students taught with MMTS in favour of MMTS group ($p < 0.05$). This shows that MMTS improve the interest of students in computer studies.

4.2.3 Hypothesis Three

There is no significant difference between the mean retention scores of students taught Computer Studies using MMTS and those taught using CLM.

Table 9: **ANCOVA Comparison Difference between the Retention of MMTS group and Conventional group**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	363.222a	4	90.806	.645	.632	.025
Intercept	27600.988	1	27600.988	196.047	.000	.662
Pre-Test	147.398	1	147.398	1.047	.309	.010
Method	59.204	1	59.204	.421	.018	.004
Gender	169.670	1	169.670	1.205	.275	.012
Method *Gender	3.206	1	3.206	.023	.880	.000
Error	14078.740	100	140.787			
Total	464198.000	105				
Corrected Total	14441.962	104				

Table 9 reveals that significant difference exists between the retention scores of students taught computer studies with MMTS and those taught with lecture method in favour of MMTS group. This shows that the MMTS has effectively enhanced the memory of the MMTS group more than the control group ($p < 0.05$).

4.2.4 Hypothesis Four

The difference in the mean achievement scores of male and female students taught Computer Studies using Mind mapping teaching strategy (MMTS) is not significant.

Table 10: **Two way ANCOVA Comparison Difference between the Achievement of Male and Female students in MMTS**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5168.045a	4	1292.011	9.518	.000	.276
Intercept	18747.776	1	18747.776	138.107	.000	.580
Pre-Test	476.628	1	476.628	3.511	.064	.034
Method	2167.686	1	2167.686	15.968	.000	.138
Gender	618.819	1	618.819	4.559	.085	.044
Method * Gender	551.428	1	551.428	4.062	.047	.039
Error	13574.812	100	135.748			
Total	361600.000	105				
Corrected Total	18742.857	104				

From the result of the ANCOVA test as shown in Table 10, the statement of hypothesis 4 is accepted; implying that difference in the mean achievement scores of male and female students taught Computer Studies using Mind mapping teaching strategy (MMTS) is not significant ($p > 0.05$).

4.2.5 Hypothesis Five

The difference in the mean interest rating scores of male and female students taught Computer Studies using MMTS is not significant.

Table 11: **ANCOVA Result on the effect of MMTS on interest of male and female students in computer Studies**

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	17971.856a	4	4492.964	330.330	.000	.930
Intercept	23430.162	1	23430.162	1722.623	.000	.945
Pre-Test	16660.878	1	16660.878	1224.934	.000	.925
Method	31.600	1	31.600	2.323	.031	.023
Gender	18.383	1	18.383	1.352	.248	.013
Method *Gender	.245	1	.245	.018	.893	.000
Error	1360.144	100	13.601			
Total	1456677.000	105				
Corrected Total	19332.000	104				

From the result of the ANCOVA test as shown in Table 11, the statement of hypothesis 5 is accepted; implying that difference in the mean interest rating scores of male and female students taught Computer Studies using MMTS is not significant ($p > 0.05$).

4.2.6 Hypothesis Six

The difference in the mean retention scores of male and female students taught Computer Studies using MMTS is not significant.

Table 12:   ANCOVA Result on the effect of MMTS on retention of male and female students in computer Studies

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	363.222a	4	90.806	.645	.632	.025
Intercept	27600.988	1	27600.988	196.047	.000	.662
Pre-Test	147.398	1	147.398	1.047	.309	.010
Method	59.204	1	59.204	.421	.018	.004
Gender	169.670	1	169.670	1.205	.275	.012
Method *Gender	3.206	1	3.206	.023	.880	.000
Error	14078.740	100	140.787			
Total	464198.000	105				
Corrected Total	14441.962	104				

From the result of the ANCOVA test as shown in Table 12, the statement of hypothesis 6 is accepted; implying difference in the mean retention scores of male and female students taught Computer Studies using MMTS is not significant ($p > 0.05$).

4.2.7 Hypothesis Seven

There is no interaction effect of gender and teaching methods on academic achievement of SS2 students in Computer Studies.

Table 13:   Interaction Effect of Gender on Teaching Method (MMTS)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5168.045a	4	1292.011	9.518	.000	.276
Intercept	18747.776	1	18747.776	138.107	.000	.580
Pre-Test	476.628	1	476.628	3.511	.064	.034
Method	2167.686	1	2167.686	15.968	.000	.138
Gender	618.819	1	618.819	4.559	.085	.044
Method * Gender	551.428	1	551.428	4.062	.047	.039
Error	13574.812	100	135.748			
Total	361600.000	105				
Corrected Total	18742.857	104				

Table 13 reveals that there was no interaction between gender and teaching method (MMTS) as measured by the mean achievement scores in computer studies($p > 0.05$). Therefore, hypothesis Seven is up-held. This shows that the achievement of students in relation to MMTS is not influenced by gender of the students.

4.2.8 Hypothesis Eight

There is no interaction effect of gender and teaching methods on academic achievement of SS2 students in Computer Studies.

Table 14:   Interaction Effect of Gender on Teaching Method (MMTS)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	17971.856a	4	4492.964	330.330	.000	.930
Intercept	23430.162	1	23430.162	1722.623	.000	.945
Pre-Test	16660.878	1	16660.878	1224.934	.000	.925
Method	31.600	1	31.600	2.323	.031	.023
Gender	18.383	1	18.383	1.352	.248	.013
Method *Gender	.245	1	.245	.018	.893	.000
Error	1360.144	100	13.601			
Total	1456677.000	105				
Corrected Total	19332.000	104				

Table 14 reveals that there was no interaction between gender and teaching method (MMTS) as measured by the mean interest scores in computer studies ($p > 0.05$). Therefore, hypothesis 8 is up-held. This shows that the interest of students in relation to MMTS is not influenced by gender of the students.

4.2.9 Hypothesis Nine

There is no interaction effect of gender and teaching methods on retention of SS2 students in Computer Studies.

Table 15:   Interaction Effect of Gender on Teaching Method (MMTS)

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	363.222a	4	90.806	.645	.632	.025
Intercept	27600.988	1	27600.988	196.047	.000	.662
Pre-Test	147.398	1	147.398	1.047	.309	.010
Method	59.204	1	59.204	.421	.018	.004
Gender	169.670	1	169.670	1.205	.275	.012
Method *Gender	3.206	1	3.206	.023	.880	.000
Error	14078.740	100	140.787			
Total	464198.000	105				
Corrected Total	14441.962	104				

Table 15 reveals that there was no interaction between gender and teaching method (MMTS) as measured by the mean retention scores in computer studies (p > 0.05). Therefore, hypothesis 9 is up-held. This shows that the retention of students in relation to MMTS is not influenced by gender of the students.

4.3   Discussion of the Findings

This chapter presented the discussion and interpretation of result in the previous chapter. The discussion is organized under the following headings:

- The effect of MMTS on the mean achievement score.

- The influence of gender on the mean achievement score.

- The effect of MMTS on the mean interest score.

- The influence of gender on the mean interest score.

- The effect of MMTS on the mean retention score.

- The influence of gender on the mean retention score.

- The effect of MMTS and gender interaction on the mean achievement score, the mean interest score and the mean retention score.

4.3.1 The effect of MMTS on the mean achievement score

This study revealed that mean achievement score of students taught using MMTS was significantly higher than those of the students taught using conventional lecture method (CLM). The reasons for the higher achievement by the experimental group could be that they were more actively involved in mind mapping of the concepts and principles of Computer Studies which involved drawing and painting the maps which were absent in the control group throughout their lesson periods. It could also be that the experimental group members were able to link up new concepts in Computer Studies to the relevant concepts in their mind mapping which they were familiar with. This was absent in the conventional lecture method.

In addition, it could be as a result of excitement over creating new shapes (maps) emerging on their own from each topic which was similar or nearly the same with that of their teachers. Furthermore, the mind mapping and pictorial adjunct mode presentation provided by the MMTS was completely absent in the CLM. The teacher and students participatory role in mind mapping technique is unique which made for better achievement of the MMTS group than the CLM. This was also completely absent in CLM group. The above findings observed when mind mapping teaching strategy was used to teach one group of students

supported the findings of Ezeudu (2005) who used different structural graphic organizer concept map. The result also supported the works of Anaekwe (2007) and Entrekin (2012) that used effect of students' interaction patterns and found significant effect on the mean achievement score of students in their studies. The researcher therefore tenders that most teaching strategies which involve active participation of the students and encourage hands on minds on activities by the students have been found significant achievement score in their studies.

4.3.2 The Influence of gender on the mean achievement score

This study revealed that the mean achievement score of students taught using MMTS was not significantly influenced by gender. This is an indication that gender inclusive science teaching strategy (MMTS) does not influenced mean achievement score of students in their mind mapping of Computer activities. This also implies that the use of gender inclusive instructional mind mapping teaching strategy may not have influenced the gender groups positively. Generally, there are two categories of result from studies on gender influence on mean achievement score. The finding of this study did not support the first category in which there was significant gender influence on mean achievement scores (Ezeudu 2005; Ifegbo, 2005; Anaekwe 2007). Conversely, the result corroborated with the findings of the second category in which there was no significant gender influence on mean achievement scores (Okerie, 2009; Joseph, 2009; Falade, 2012).

4.3.3 The effect of MMTS on the mean interest score

Result of this study revealed that the mean interest score of students taught using MMTS was significantly higher than mean interest score of those taught using CLM. Therefore, the use of mind mapping teaching strategy enhanced the mean interest score of students. This means that the mode of instruction has significantly affected the mean interest score of the students. The overall higher mean interest score shown by the treatment group against the control group was as a result of high level of activities and excitement over creating new shapes and structures (maps) emerging from their intellect and is similar to that of their teachers. Furthermore, the pictorial adjunct mode of presentation by the use of MMTS activities stimulated interest in the experimental group. Finally, the researcher tenders that constructive teaching strategy (MMTS) is not a gender inclusive instructional technique and involves hands on minds on activities was the main source of their interest. The finding was in agreement with Ozofor (2001) and Ezeh (2002). This finding also agreed with Ezeudu (2005), Anaekwe (2007).and Nwaigwe (2010). One can rightly say that mind mapping has the ability of arousing and sustaining interest.

4.3.4 The influence of gender on the mean interest score

This study revealed that the mean interest score of students taught was not influenced significantly by gender. This is an indication that gender had no influence on the mean interest score of students taught using MMTS. Any observed difference in mean interest score is due to chance. This finding

contradicted Nworgu (1990) and Obodo (1990) in which they reported that students' interest towards science was significantly dependent on gender.

However, the finding supported Anaekwe (2007) and Ifegbo (2009) that reported no significant effect of gender on students' development of interest in Computer studies. They also reported that female students showed equal interest with their male counterpart. Some studies on gender influence on students' interest in science were of the opinion that boys are more exposed to scientific activities very early in life than girls. More over they are more encouraged to enter for science related courses like engineering and technology while girls go for biology, home economics and other related domestic subjects. The result of this study has shown that giving equal science and unlimited access to education for females, they would as well develop interest in physical sciences like Computer studies. The implication is that the use of MMTS gender inclusive strategy has eliminated masculine image of science related differences in students' interest in favour of the girls in this study.

4.3.5 The effect of MMTS on the mean retention score

This study revealed that the mean retention score of students taught using MMTS was higher than those taught using CLM. This implies that MMTS had effectively enhanced the memory of the experimental group more than the control group as much that had caused a significant different. This higher mean retention score by the treatment group could be as a result of the MMTS was

able to have enhanced the brain cells of the experimental group.

Furthermore, the gender inclusive instructional technique of MMTS made it possible for the experimental group to obtain higher mean retention score than the control group. The finding of this study showed that there was a significant difference on the mean retention score of students taught using MMTS and those taught using CLM. The finding supported similar innovative teaching reported by Ozofor (2001) and Ezeh (2002), Ezeokoro (2005) and Ezeudu (2007). The study of science especially Computer studies is activity based. Activity based teaching technique requires that the teacher does while the students by simulation do the same over and over by themselves and learning would have taken place.

4.3.6 The influence of gender on the mean retention score

Evidence from this study revealed that the influence of gender on mean retention score of students taught using MMTS was not significant. This is an indication that students' gender group memory was greatly enhanced as a result of gender inclusive MMTS. Therefore gender influence on the mean retention score of students taught using MMTS was not significant. This finding supported the findings of Ezeudu (2005) and Joseph (2009) who found no significant gender influence on mean retention score in Computer studies.

4.3.7 The effect of MMTS and gender interaction on mean achievement score, mean interest score and mean retention score.

The interaction effect of treatment and gender on mean achievement score was not significant. This finding supported Ifegbo (2005) who found no significant interaction effect of gender and use of resource materials in integrated science taught. Similarly, the finding supported Ifeakor (2003) in which it was reported that the interaction effect of assessment technique and gender on mean achievement score was found not significant. Similarly, the interaction effect of treatment and gender on mean interest score was not significant. This finding also supported Anaekwe (2007) who found that the effect on students' interaction patterns and gender on mean interest score was not significant. More so the interaction effect of treatment and gender on mean retention score was not significant in this study. This is an indication that the interaction effect of treatment and gender on mean retention score may be present but was insignificant. This finding supported Ezeh (2002) and Ezeudu (2005).

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATION

5.1   Summary of the Findings

1. The MMTS has a significant positive effect on students' cognitive achievement, interest and retention in Computer studies.

2. The MMTS is more efficacious than the CLM.

3. The influence of gender on mean achievement score and mean interest and retention score were not significant.

4. Male students showed to be superior to their female counterparts in Computer studies.

5. The interaction effect of gender and treatment on the mean achievement score is not significant.

6. The interaction effect of gender and treatment on the mean interest score is not significant.

7. The interaction effect of gender and treatment on the mean retention score is not significant.

5.2   Conclusion

This study has shown that the MMTS has significant effect on students' cognitive achievement, interest and retention in Computer studies. The MMTS is more efficacious than the CLM. The influence of gender on mean achievement score and mean interest and retention score were not significant.

Male students showed to be superior to their female counterparts in Computer studies. The interaction effect of gender and treatment on the mean achievement score, mean interest and mean retention score were not significant.

5.3 Implications of the Study

The result of this study has some obvious implications for all the stakeholders in Education. The use of MMTS has been proved to be effective in facilitating greater achievement, interest and retention in Computer studies content. Computer studies teachers in Colleges of education, Institute of education, department of Science education, Curriculum planners and textbooks authors may adopt it in order to ensure meaningful teaching and learning in Computer studies. The mind mapping teaching strategy is a recent innovation which is very effective. The Computer studies teachers should be trained on the use of this strategy. The MMTS should be included in science method content in teacher training institutions like Colleges of Education, departments of Science Education and Institutes of Education. Furthermore, since the study revealed that there is no significant interaction effect of gender and MMTS on students' achievement, retention and interest. It implies that both male and female students benefitted equally in the use of MMTS. It will then be meaningless to develop different curriculum teaching methods for male and female students. Finally, major stakeholders should sponsor Computer studies teachers to seminars and workshop on regular basis to keep the teachers abreast with this innovative teaching strategy of teaching Computer studies.

5.4 Limitations of the study

The regular Computer studies teachers taught intact classes selected for the study in their schools but they may not have adhered very strictly to the procedure of teaching and administration of the instruments. This may be due to their individual differences and attitude to work irrespective of the fact that they were all trained for same duration. The training sessions organized for teachers involved in this study may not have been sufficient enough for the expected level of mastery needed in mind mapping techniques.

5.5 Recommendations

Based on the findings of this study, the following recommendations are made:

1. Since MMTS is found to be an effective teaching strategy for improving students mean achievement score, mean interest score and mean retention score in Computer studies. Computer studies teachers should adopt it as a teaching strategy in Computer studies classrooms and laboratories.

2. Workshops and seminars should be organized for in-service Computer studies teachers. The teacher training institutions should include the use of MMTS in their Computer studies method course content to ensure the training of the pre-service Computer studies teachers.

3. Authors of Computer studies text-books should include MMTS in their texts for easy access for students and teachers.

4. Finally, the curriculum planners should include MMTS in senior

secondary Computer studies scheme for teachers and students.

5.6   Suggestion for further research

1. Similar investigations should be carried out to determine the effect of MMTS on other areas of Computer studies.

2. Similar studies can be replicated using a wider geographical area.

3. A case study of this study can be conducted.

4. Similar studies can be replicated in other subject areas like arts subjects, engineering and mathematics.

REFERENCES

Abdul, E.R., Gafoor, T.N.,Haskar,A.C., and Babu, P.C (1978). Inventory Scale for Experimental Research: the Implications of Education, *Educational Relations Journal*, Vol. 26, issue3, Pp230-237.

Abimbade, A. (1998). Information technology: The current strategy for effective science and technology instruction. *Bichi Journal of Education*, 2 (1), 33 –39.

Abimbade, E.B (2014). *Effective Teaching Methods for Science Subjects*: Japan McGraw Hill International Books Company/

Agwagah, U.N.V, (2013). Instruction in mathematics reading as a factor in students' achievement and interest in word problem solving. *Unpublished Ph.D Thesis*, Department of Mathemaics, University of Nigeria Nsukka.

Alexander, P.M. & Jetton, C. A. (2012). Mind-mapping learning. *Paper delivered at the International Conference on Computer Aided Education and Training in Developing Countries. Pretoria*: University of South Africa.

Anaekwe, M.C. (2009). Effects of students interaction patterns on students' cognitive achievement, retention and interest in computer studies. *Unpublished Ph.D. Thesis,* Nsukka: University of Nigeria.

Anekwe, J.U. (2012). Effect of constructivist based instructional model on students' interest and achievement in French language in Anambra State. *Unpublished Doctoral Dissertation*, University of Port Harcourt.

Ausubel, D.P. (2002). *The psychology of meaningful learning*: *An introduction to school learning.* New York: Grune and Stratton.

Ausubel. D. O. (2006). *Schematic cognitive structure and advance organizers,* University of Chicago Press.

Ayogu Z.C. (2014). Influence of gender and school location on students' achievements in physics. *40th STAN Annual Conference Proceedings,* 217-221.

Azuka, B.F. (2013). *Active learning in classroom. Training manual for capacity building workshop for secondary and primary schools building science teachers.* Abuja: National Science Centre.

Badamus, M.& T.O. Ocho (ed) *Science, mathematics and technology education in Nigeria* (pp 10-24).

Balogun, T.A. (2015). Interest in science and technology education in Nigeria. *Journal of the Science Teachers of Nigeria 23 (1 & 2)* 92-99.

Brinkmann, A. (2013). *Mind mapping – eine methods zurforderung der kreativitat and lerneffektivital in mathematikunterricht.* Pedagogischerzeitschriftenverlag. Berlin.

Budd, H. Z. (2015). The relation between abstract concept achievement and prior knowledge, formal reasoning ability and gender in Egypt. *International Education II Journal of Science*, (12) 227 – 230.

Buzan T. (2001). The mind-map book New York. Mind-mapping gridlines

Buzan T. (2016). *The mind-map book New York, Mind-mapping gridlines*

Buzan, T (2010). *Principles of teacher and learner Relations*. New York St. maryins Limited.

Buzan, T& Barry, H (2005). *Brain power for the youths*. www.mindmap

Buzan, T. & Vanda, N. (2005).*Colourful practical easy and writing for children* (ISBN 1874374007).

Buzan, T. &Buzan, B. (2006) *A comprehensive guide to mind maps* (ISBN 063487011).

Buzan, T. (2000). *The mind map book*. New York: Penguin Books.

Chauhan, S. S. (2009). *Innovations in teaching learning process*. New Delhi: Vikas publishing House PVT ltd.

Chauhan, S.S. (2007). *Advanced educational psychology* (3rd ed.). New DelhiVitkas, India.

Chidolue, M.F. (2013). *An investigation into the indifference of girls towards the study of sciences in Nigerian secondary schools. Journal of Science Teacher Association of Nigeria 21(1), 106 – 116.*

Child, D. (2011). *Advanced educational psychology.* New Delhi: VikasPublishing House RVT Limited.

Chukwu, J.O. (2010). Effect of delayed formalization approach on students' achievement in quadratic equation. *Unpublished M.Sc. Thesis.* Enugu State University of Science and Technology.

Chukwu, J.O. (2011). Effect of games on the achievement and interest of JSS students in Igbo grammar. *Unpublished Ph.D. Thesis*, University of Nigeria, Nsukka.

Entrekin, V. (2013). Mathematical Mind Mapping. *The Mathematics Teacher*, 85 (6), 444 – 445.

Epunnam, A. D. (2013). Influence of school environmental variables on academic performance as perceived by students. *Unpublished M.Ed. Thesis*. University of Nigeria Nsukka.

Ezeamenyi, M.O (2012). Effects of four games on mathematics achievement of JSS students on some selected topics in mathematics. Nigerian *Journal of Functional Education (NAPFED)* 6 (1) 156-161.

Ezeh D.N. (2002). Effects of study questions as advanced organizers on students' achievements, retention and interest in integrated science.*Unpublished Ph.D. Thesis*, University of Nigeria, Nsukka.

Ezemenyi, M.N. (2012). The effect of games on mathematical achievement, interest and retention of junior secondary students. *Unpublished Doctoral Dissertation*, University of Nigeria Nsukka.

Ezeokoro, A. (2005). *Motivation and Personality*, New York: Harper and Row Publishers.

Ezeudu, F.O. (2015). Effect of concept maps on students' achievements, interest and retention in computer studies.*Unpublished Ph.D Thesis,* Nsukka: University of Nigeria.

Fafunwa A.B. (2013). *Case of male literacy in science and technology*

Farrand, P., Hussain, F. &Hennesy, E. (2014). The efficacy of the mind-mapstudy technique. *EBSCOHOST*. 36 (5), 426 – 430.

Federal Republic of Nigeria (2013). *National Policy on Education, Lagos:*

Gardner, H. (2012). *Art, mind and brain: A cognitive approach to creativity*. NY. Basic Books.

Harbor-Peters, V.F.A. (2011). *Some aversive aspect of schools mathematics and strategies for unmasking averting them. University of Nigeria Nsukka Inaugural Lecture.* Enugu: Snap Press Limited.

Hemmerich, H. Lim. W. &Neel, K. (2013). *Prime time: Strategies for life-long learning in computer science in the middle and high school grades.* Heinemann, Portsmouth.

Herietta, J.H.(2014). Computer lexicon on good teaching approach 2nd edition. New Jessy. Prentice Hill.

Hermann, W. &Bovo, V. (2005) Mappasmentaisenrequencendo intelligence *manual de AprecizagemeDesenvowiment deintelligencias'* (PX 127,   33) Ed ID P.H.

Ifeako, M.D. (2010). Effect of peer assessment on students' academic achievement and interest in computer. *Published M. Ed Thesis*, National Open University of Nigeria.

Ifeakor, M.D. (2012). Evaluation of commercially produced computer assisted instruction package for teaching secondary school computer. *Published Thesis*, University of Port-Harcourt.

Ifegbo, J.C (2014). *Useful Teaching Strategy and Class Room Behaviour.* Boston Massachusetts

Joseph, E. B. (2009). *Contemporary Issues in Achievement, Retention and Interest in Students* Owerri: REmd Publishers.

Jibrin, A. G. (2014). Improving the academic achievement of senior secondary school students in biology through enhanced problem- solving strategy in Bauchi Metropolis *Journal of Technology and Educational Research (JOTER),* 4(2)20-30.

Kathryn, M. D. (2005).The practical of sustainable education through a participatory and holistic teaching approach. Retrieve from *http:www.ccponline.org/docs/artikel*

Luepruti, M. (2012). International comparison in science education. *Journal of Research in Science Education,*18 (3), 87 – 104.

Lumbsdaine, O. C. (2015). The relative effectiveness of two methods of teaching science at junior secondary levels of education. *Journal of Science Teacher Association of Nigeria.* 24 (12) 220 – 280.

Mento, A. E., Martinelli, S. D. &Hannessy, L. M. (1980). *Educational psychology for teachers,* New Jersey: Prentice – Hall Inc.

National Policy on Computer Education – NPCE,(2014). Societal Pointer: Abuja : NPCE.NERDC Press.

Nesbit, M.O (2006). Constraints to effective retention in teaching , *The Nigeria Journal of economic and computer studies,* Vol. 40, No 3, pp 3569.

Njoku Z.C (2005). Comparison of students' achievement in the three categories of questions in SSCE practical chemistry examination, *JSTAN* 42: (1,2) 67-72.

Nneji, S.O. (2013). Effect of Q-basic quadratic equation game on secondary school students' achievement, interest and retention in computer science. *Unpublished M.Sc. Thesis* Enugu State University of Science and Technology, Enugu.

Nworgu, B.G. (2015). Gender and content areas interaction in computer studies achievement and discrepancies in gender difference in gender difference in science achievement. *Journal Studiesin education* 8 (1), 35 – 38.

Obodo, G.C. (2011). The deferential effect of three teaching modes of performance of junior secondary schools students in some computer studies concepts. *Unpublished Ph.D. Thesis.* Nsukka, University of Nigeria.

Obodo, G.C. (2016). Sex difference aptitude among 13 – 14 old students. *Journal of Studies in Education* 111 (2) 15-23.

Okebukola, P.A.O. &Jegede, O. J. (2016). Students'anxiety towards and perception of difficulty of some biological concepts under the concept mapping heuristics.*Research in Science and Technological Education.* 7(91), 85 – 92.

Okeke, O.J. (2015). Effect of students' prior knowledge of instructional objectives on their achievement in senior secondary computer studies. *Unpublished M.Sc. Thesis:* ESUT.

Okoli, J.N. (2016). Effect of investigative laboratory approach and expository method on acquisition of science process skills by science students of different levels of scientific literacy. *Journal ofthe Science Teacher Association of Nigeria Vol. 4* (1, 2) 29– 88.

Okorie, N. (2009). ICT and educational performance: The inter-relationship of selected critical variables. *www.itdl.org/Journal/May10/article03.* htmlretrieved December 20th, 2010.

Okwo, F. A. (2002). Effect of activity made of diagram on pupil achievement in primary mathematics. *Nigerian Journal of curriculum Studies. 9(2) 116 – 120.*

Olagunju A.M (2011). Increasing girls' interest, participation and achievement in science. *42nd STAN Annual Conference Proceedings.*

Onuoha, A.A., Alozie, R.W, and Etom, A.K (2014). Global Teaching Methods: Its Impact in Computer Education and prospects for the future, *World Health and Population* Vol. 10, (3): 12-24.

Opara, E.N. (2017). *A survey of development in the instructional process in R.N.A. Amadi (Ed) principles and methods of teaching and learning:* Owerri .M. (ATEC Publication).

Ozofor, N.M. (2001). Effect of two modes of computer aided instruction on students' achievement and interest in statistics and probability. *Unpublished Ph.D Thesis*, University of Nigeria, Nsukka. Press.

Retrieved from *http://www.mindtools.com*. software.com

Ugwuanyi, C. U. (2010). The 6-3-3-4 system of education and employment: Problems and prospects. *Journal of Studies in Education* 4, (2), 14-17.

Williams, T. (2000).*The encyclopedia of pseudosciene. Fast on File.*Oxford

Yusuf, F. I. (2012). Effects of using computer assisted instruction on the learning of mathematics at senior secondary school level in Minna, Niger state. *Unpublished M. Tech. Thesis*, Federal University of Technology, Minna, Nigeria.

Yusuf, M. (2012). Effects of an assessment supported instructional model (ASIM) on Students' academic achievement and interest in secondary school mathematics in Niger State. *Unpublished M.Ed. Thesis,* University of Nigeria, Nsukka.

Yusuf, S. (2012). *Modern methods in science education in Africa.* Abuja. Totan Publishers Ltd.

Zhao, D. F. (2013). *Teacher's use of analogies to enhance students' conceptual understanding in science.* Research Project Funded by the Australian Research Council, Curtin University of Technology, Perth.

APPENDIX A

WAEC STATISTICS ON STUDENTS' PERFORMANCE IN COMPUTER STUDIES FROM 2014 TO 2017

Year	Number and Percentage of Grade obtained		
	Credit %	Pass %	Fail %
2014	50.74	23.16	26.10
2015	44.45	22.23	33.32
2016	50.63	21.79	27.58
2017	42.95	20.35	36.70

waeconline.org/elearning13/computerstudies/comp226mw.html

APPENDIX B

DISTRIBUTION OF SUBJECTS IN THEIR VARIOUS INTACT CLASSES IN THE SCHOOLS OF STUDY

S/N	SCHOOLS	MMTS (EXPERIMENTAL) GROUP	CTM (CONTROL) GROUP	TOTAL
1	A	24	-	24
2	A	30	-	30
3	B	-	22	22
4	B	-	29	29
	Total	54	51	105

APPENDIX C

TABLE OF SPECIFICATIONS FOR COMPUTER STUDIES ACHIEVEMENT TEST (CSAT)

Content	Number of Test items	Lower levels -Knowledge -Recall -Comprehension	Higher levels -Application -Analysis -Synthesis -Evaluation
Networking	15	10 (1,2,4,6,7,8,10,12,14,15,)	5 (3,5,9,11,13)
Network Topology	15	10 (16,17,18,20,22,24, 25,27, 29,30)	5 (19,21,23,26,28)
World Wide Web	15	10 (32,35,37, 39, 42,45, 34,36,38,43)	5 (31,33,40,41,44)
Network Cables and Computer Cables	15	10 (46,48,50,52,54,56, 59, 53,55,57)	5 (47,49,51,58,60)
Total	60	40	20

APPENDIX D

COMPUTER STUDIES ACHIEVEMENT TEST (CSAT)

Instruction: Answer all the questions. Each question is followed by four (4) options lettered A-D. Write the letter that corresponds to the option you think is correct in your answer sheet.

Questions for Computer Science (ICT) SS2 CSAT (Duration, 1 hour)

1. Networking deals on designing, implementing and _____ of computer network (a) Resolving (b) Explanation (C) Ring (d) Maintaining.

2. _____ is the connection of computers to exchange information and share resources. (a) Computer technology (b) Computer token (c) Computer network (d) Computer communication

3. ETHERNET is a _____ and data link layer technology for Local Area Network (a) Physical (b) Popular (c) Collision (d) Method

4. Carrier _____ Multiple Access (CSMA) is used in the operation of ETHENNET computer network. (a) Scheming (b) Sense (c) Software (d) Shewing.

5. One of the following is not a type of network. (a) ARCNET (b) ETHERNET (c) TOKEN RING (d) MAPP

6. Local area network involves the _____ computer within a limited area. (a) operation (b) storage (c) connection (d) organization

7. _____ Computer network is used in networking the entire city. (A) WAN (B) MAN (C) PAN (D) LAN

8. _____ networks a country. (a) Wide Area Network (b) World Area Network (c) Web Area Network (d) Window Area Network.

9. _____ is a global network (a) PAN (b) WAN (c) LAN (d) MAN

10. Each system in computer networking is called _____ (a) CMSA (b) CD (c) NODE (d) HUB

11. Each connection between the systems in computer Network is described as a _____ (a) LAN (b) RING (c) TOKEN (d) HUB

12. _____ is a system where each computer listens to the cable before sending information through the Network (a) ETHERNET (b) Server (c) MODEM (d) Bronter

13. _____ is the shape or structure of a Network (a) STAN (b) Topology (c) Node (d) Terminator

14. _____ topology is the layout of connected devices on a network (a) Station (b) Central (c) Network (d) Ambiguous

15. Data and information passes through the _____ to its destination (a) SERVER (b) LINK (c) LOG (d) Flowchart

16. It is easy to detect fault in _____ topology (a) Linear (b) STAR (c) Node (d) Tree

17. Linear Bus topology consists of a main run of cable with a _____ at each end. (a) Peripheral (b) Terminator (c) Server (d) Ringform

18. Each node depends on each other to function properly in the _____ network topology (a) Ring (b) Mesh (c) Star (d) Tree

19. Mesh Topology involves the concept of _____ (a) ROOT (b) ROUTINES (c) RING (d) Connector

20. One of the following is a type of Network Topology (a) Tree (b) Mesh (c) Ring (d) Algorithm

21. The _____ topology is the most complicated in wiring. (a) Star (b) Linear-Bus (c) Mesh (d) Tree

22. Computers in a_____ environment are used to communicate with each other (a) networked (b) sequenced (c) defined (d) transmitted

23. Networking provides easy access to _____ (a) Operation (b) Transmission (c) Zipdrive (d) Information

24. _____ is one of the benefits of Networking (a) E-learning (b) Mother boarding (c) Techniques (d) Navigators

25. One of the following should be considered while choosing a Network Topology (a)Cable Type (b)Data file (c)Memory Ship (d)Field Name

26. The type and _____ of a network should be considered before choosing a network. (a)Control (b)Program(c)Size (d)Data Item

27. _____ensures easy transmission of data and information in the network (a) Slot (b) RAM (c) Linus (d) HUB

28. The two types of Hub are _____ (a)Passive and Active HUB (b)Update and Access HUB (c)Reference and Sequence HUB (d)Serial and Index HUB

29. The Network device that transmits information between computer through telephone lines is known as _____ (a) Switch (b) MODEM (c) Routes (d) Bronter

30. _____ network device are used to connect multiple device on the same network within a building (a) Internet (b) Bridge (c) Switches (d) Amplifier

31. Static and _____ Routes are the two types of Routes (a) Update (b) Connector (c) Dynamic (d) Flowchart

32. Brouter is the connection of these words _____(a) Browse and Route (b) Broom and Routing (c) Brick and Ridge (d) Bridge and Router

33. _____ combines the functions of a bridge and a router (a) Gateway (b) Amplifier (c) Brouter (d) BASIC

34. The Bridge network device joins two network _____ together (a) Segments(b) Content (c) Sequence(d) Memory

35. Amplifier increases transmission distance on network that use _____ signed (a) Hybrid (b) Digital (c) Analogue (d) Android

36._____ is a hardware protocol translation network device that allows users work in one network to another (a)Gateway (b)Equivalent (c)Symbol (d)Translator

37. Another word for Network Interface Cards (NICs) is _____ (a)Toolbox (b)Dropdown (c)Unit (d)Adapter

38. The _____ network device controls the flow of information between the computer and the network (a)Temporary (b)Adapter (c)Symbol (d)Complex

39. World Wide _____ is a connection of millions of files stored on server all over the world (a)Web (b)Write (c)Wood (d)Wet

40. With a Web browser, you can view Web _____ that contains images, text and multimedia (a)Documents (b) Page (c) Content (d) Data

41. The first page of the website is known as _____ (a) Web Page (b) Hypertext (c) Home Page (d) Hyperlink

42. The electronic page on world wide web is called the _____ page (a) Home Page (b) Hyper Page (c) Web Page (d) Doc Page

43. _____ is a collection of web pages (a)Website (b)Baic Page (c)Hyperlink (d)Hypermedia

44. Hypertext is the attachment of _____ and text (a) Hyperlink (b)Multimedia (c)Domain (d)Navigation

45. _____ allows you to view information without using complex commands and knowing the source of information (a)URL (b)Navigation (c)Hyperlink (d)Webpages

46. The extension of hyper text that provides multimedia facilities is known as _____ (a)Hypermedia (b)WWW (c)Domain (d)Protocols

47. Uniform Resource Identifier (URI) is a _____ character used in identification of a name or resources on the internet.

48. World Wide Web Protocols are sets of rules guiding the _____ of data between computers and devices (a)Compensation (b)Ranking (c)Transmission (d) none of the Above

49. One of the following is an example of World Wide Web Protocol _____ (a)Domain (b)Multimedia (c)All of the above (d)None of the above

50. The Network _____ connects network devices (a)Phone (b)Coding (c)Cables (d)Program

51. _____ pair cable is used mainly as telecommunication cable (a)Twisted (b)Shielded (c) Coaxial (d)Unshielded

52. _____ are the two types of coaxial cable (a)Big and Swell (b)Thin and Thick (c)Hard and Soft (d)All the above

53. There are _____ types of twisted pair network cable (a)2 (b)3 (c)4 (d)8

54. Fibre Optic cable transmits _____ mainly (a)Electronic Signal (b)Fibre (c) Light (d)Circuits

55. The _____ cable transmits data through the telephone (a)mode (b)None of the above (c)Transmitter (d)Connector

56. The printer Cable transmits data from the _____ to the printer (a)Printer (b)UPS (c)Scanner (d)Computer

57. The _____ transmits data through the USB parts (a)Monitor Cable (b)Power Cable (c)USB cable (d)Sequence Cable

58. The _____ allows BASE BOND transmission from a transmitter to the receiver (a)USB C able (b)All of the above (c)VDU Cable (d)Serial Cable

59. The _____ is designed for short transmission use in Local Area Network System (a)Perl Mode Cable (b)Fotran Mode Cable (c)Multi mode Cable (d)Single Mode Cable

60. The _____ connects the monitor and the system unit (a)VDU Cable (b)Serial Cable (c)Power Cable (d)Thin Coaxial Cable

APPENDIX E

COMPUTER STUDIES INTEREST RATING SCALE (CSIRS)

This inventory is designed to find out how you feel about the problems of pollution and waste management. Read the statements carefully and indicate how you feel by ticking (√) against the point that best expresses your interest. The four points of the scale are:

Strongly Agree …………………………………….. SA

Agree …………………………………………………. A

Disagree ……………………………………………… D

Strongly Disagree ………………………………….. SD

Please note that all information you will provide will be used strictly for the research exercise only and will be treated under strict confidentiality.

Sex: Male ☐   Female ☐

Name of School …………………………...

Class …………………………………………………………….....

S/N	ITEMS	SA	A	D	SD
1	Computer is important compared to other subjects.				
2	I hope to place Computer at the top of curricula.				
3	I early attend the Computer lesson.				
4	I think that there is a dire need to learn Computer.				
5	I feel that learning Computer helps a lot in travelling.				
6	I feel angry with any extra curricula activity not concerned with Computer.				
7	I am interested in paying attention in the Computer lesson.				
8	Learning Computer participates in community progress.				
9	I think that Computer does not matter with other language.				
10	Mastering Computer facilitates using equipments.				

11	Learning Computer helps you be familiar with the traditions and customs of the foreign countries.				
12	I feel that Computer lesson time runs fast.				
13	I am alert to understand the explanation in the Computer lesson.				
14	I try to finish Computer assignments on time.				
15	The topics I study in Computer benefit in my daily life.				
16	I like to read books in Computer.				
17	I avoid being occupied with extra things while the teacher of Computer explains the lesson.				
18	I feel sad when the teacher of Computer is absent.				
19	The Computer lessons arise my curiosity to acquire new knowledge.				
20	I am interested in learning Computer.				
21	Computer helps better understand life.				
22	I seek to learn Computer more deeply.				
23	I like to develop my skills in learning and teaching in Computer.				
24	My life skills are increased when mastering Computer				
25	I enjoy when answering the activities of Computer lessons.				
26	Learning Computer gives me better communication with the world.				
27	I feel at ease when learning Computer.				
28	Learning Computer is interesting and exciting.				
29	I feel comfortable when studying Computer.				
30	I like to spend more time learning Computer.				
31	I do not speak to my classmates in the class of Computer in irrelevant topics.				
32	Computer language satisfies my desires and needs.				
33	I hope to become a Computer teacher.				
34	I now enjoy solving problems involving computer hardware and software.				
35	After learning this topic-using mind mapping, I feel encouraged to study the topic.				
36	I understand how to construct mind maps.				
37	I felt comfortable preparing for the test				
38	I felt comfortable writing the test.				

39	I will use concept maps when revising other computer topics.				
40	I want many more computer topics to be taught using mind maps.				
41	I will teach some topics using mind maps when I start my teaching at secondary school.				
42	Reasoning skills learnt through this topic can help me in everyday life.				
43	I connect what I learnt to everyday life				
44	In understanding this topic, I related new information to what I already knew.				
45	I have discussed mind maps with friends.				
46	Constructing a concept map is a stimulating and effort-demanding job.				
47	When I was constructing a map and encountered an impasse, I usually wished I could get some assistance.				
48	The number of concept nodes and relation links did not affect the map-construction load				
49	I can complete a map by myself, so the hints were not necessary.				
50	Knowing the accuracy of a map is important for map construction.				
51	Mind mapping is helpful to computer learning.				
52	Concept mapping is helpful for organizing lesson contents.				
53	Mind mapping is helpful for mastering the learning materials				
54	It's much easier to catch the essential concepts after map construction.				
55	Learning the skill of concept mapping is too difficult.				
56	I like the teacher using concept mapping as an instructional aid				
57	If it's possible, I would like to use concept mapping in my future studies.				
58	It's boring to construct a concept map; I will not do it any more Using the computerized concept mapping (for two computer-based groups)				
59	I think it would be easier to construct a map through paper and pencil.				
60	Constructing a concept map using the computer is very				

	interesting.				
61	Providing some parts of a map would be helpful for thinking.				
62	The function of 'Hint' in the system is of no use for map-construction.				
63	When I was constructing a map, I benefited a lot from the evaluation function of the system.				
64	Knowing the accuracy of a map is important for map construction.				
65	Concept mapping is helpful to computer learning.				

APPENDIX F

Answers of CSAT

1. D	32. D
2. C	33. C
3. A	34. A
4. B	35. C
5. D	36. A
6. C	37. D
7. B	38. B
8. A	39. A
9. B	40. B
10. C	41. C
11.D	42. C
12.A	43. A
13.B	44. A
14.C	45. C
15.A	46. A
16.B	47. C
17.B	48. C
18.A	49. D
19.B	50. C
20.D	51. A
21.C	52. B
22.A	53. A
23.D	54. C
24.A	55. B
25.A	56. D
26.C	57. C
27.D	58. B
28.A	59. C
29.B	60. A
30.C	
31.C	

APPENDIX G
VALIDATION REPORT

APPENDIX H

RELIABILITY ESTIMATE OF CSAT

S/N	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15
1	4	3	2	3	3	2	1	2	3	3	2	3	2	3	2
2	3	3	2	3	4	4	3	3	4	3	4	3	3	4	3
3	4	4	2	4	4	2	4	4	4	4	4	4	4	4	2
4	4	4	2	4	4	2	4	4	4	4	4	4	4	4	2
5	3	4	4	4	3	3	4	4	3	4	3	4	4	3	3
6	4	4	4	4	3	3	4	4	4	3	4	4	4	4	4
7	4	4	3	3	3	3	3	4	3	4	4	4	4	3	3
8	4	4	4	3	3	4	4	2	4	2	4	3	3	4	4
9	4	4	4	3	3	3	3	4	4	4	3	4	3	4	3
10	4	3	4	2	1	2	2	2	4	3	4	3	4	4	4
11	4	3	4	3	4	3	4	3	4	3	4	3	3	3	3
12	4	3	2	3	4	3	3	3	3	3	3	3	3	4	4
13	4	4	3	4	4	1	2	4	4	4	4	2	4	3	4
14	3	3	3	4	3	3	3	4	3	3	3	4	4	4	4
15	4	4	2	4	3	4	4	2	4	4	3	3	4	3	2
16	3	3	3	3	3	4	4	3	2	4	4	4	4	4	4
17	4	3	2	3	4	1	1	1	3	4	4	1	3	2	1
18	4	4	3	4	4	3	4	3	4	4	4	4	4	2	3
19	3	4	2	4	3	3	4	1	2	4	3	4	4	4	3
20	4	4	1	4	4	1	4	1	4	4	4	3	4	4	1

Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27	Q28	Q29	Q30
3	2	3	2	3	2	3	3	3	3	2	3	3	2	3
3	4	4	4	3	3	4	3	3	2	2	3	4	3	4
2	2	3	1	4	4	4	4	4	4	1	4	4	4	4
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4	3	4	3	4	3	4	3	4	3	4	3	4	4	4
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4	2	2	3	3	3	4	2	4	3	2	2	4	4	4
3	4	1	1	2	4	4	4	4	3	1	4	3	3	3
1	2	2	1	4	4	4	1	4	4	1	3	4	4	4

Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39	Q40	Q41	Q42	Q43	Q44	Q45
4	3	2	3	3	2	1	2	3	3	2	3	2	3	2
3	3	2	3	4	4	3	3	4	3	4	3	3	4	3
4	4	2	4	4	2	4	4	4	4	4	4	4	4	2
4	4	2	4	4	2	4	4	4	4	4	4	4	4	2
3	4	4	4	3	3	4	4	3	4	3	4	4	3	3
4	4	4	4	3	3	4	4	4	3	4	4	4	4	4
4	4	3	3	3	3	3	4	3	4	4	4	4	3	3
4	4	4	3	3	4	4	2	4	2	4	3	3	4	4
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4	3	4	2	1	2	2	2	4	3	4	3	4	4	4
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4	3	2	3	4	3	3	3	3	3	3	3	3	4	4
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4	4	3	4	4	3	4	3	4	4	4	4	4	2	3
3	4	2	4	3	3	4	1	2	4	3	4	4	4	3
4	4	1	4	4	1	4	1	4	4	4	3	4	4	1

Q46	Q47	Q48	Q49	Q50	Q51	Q52	Q53	Q54	Q55	Q56	Q57	Q58	Q59	Q60
3	2	3	2	3	2	3	3	3	3	2	3	3	2	3
3	4	4	4	3	3	4	3	3	2	2	3	4	3	4
2	2	3	1	4	4	4	4	4	4	1	4	4	4	4
2	2	3	1	4	4	4	4	4	4	1	4	4	4	4
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4	4	2	1	5	5	5	5	5	3	1	4	4	4	4
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1	2	1	1	2	4	4	3	2	2	1	3	3	3	3
4	2	2	3	3	3	4	2	4	3	2	2	4	4	4
3	4	1	1	2	4	4	4	4	3	1	4	3	3	3
1	2	2	1	4	4	4	1	4	4	1	3	4	4	4

Case Processing Summary

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

a. Listwise deletion based on all variables in the

procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.915	65

The reliability coefficient of **0.92** shows that the instrument is reliable.

APPENDIX I

RELIABILITY ANALYSIS OF CSIRS

S/N	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13
1	1	1	1	1	1	1	1	1	1	0	1	1	1
2	1	0	1	1	1	1	1	1	1	1	0	0	1
3	1	1	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	0	1	1	0	0	1	1	0	1	1
5	1	0	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1	1	1
7	0	1	0	1	1	1	0	1	1	1	1	0	1
8	1	1	1	1	0	1	1	1	1	1	1	1	1
9	1	0	1	0	1	1	1	1	1	1	1	1	1
10	0	1	1	1	1	0	1	1	0	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1	0	0
12	1	1	1	1	1	1	1	0	1	1	1	1	0
13	1	1	1	1	1	1	0	1	0	1	0	1	0
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15	1	1	1	1	1	1	1	1	1	1	1	1	1
16	0	1	1	1	1	1	0	1	1	1	1	0	1
17	1	0	1	1	1	1	1	1	1	1	0	1	1
18	1	1	1	1	1	1	1	0	1	1	1	1	1
19	1	0	3	1	1	1	1	1	1	0	1	1	1
20	0	1	1	1	0	1	1	1	0	1	1	0	1

Q14	Q15	Q16	Q17	Q18	Q19	Q20	Q21	Q22	Q23	Q24	Q25	Q26	Q27
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1	0	1	1	1	1	1	0	1	0	1	1	1	0
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1	0	1	0	1	1	1	0	0	1	0	1	0	1
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1	1	1	1	1	1	1	1	1	1	0	0	0	1
0	1	1	0	1	1	0	1	0	0	1	0	1	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1

1	1	1	1	1	1	1	1	1	0	1	1	1	0
1	1	0	1	0	1	1	1	1	1	0	1	0	1

Q28	Q29	Q30	Q31	Q32	Q33	Q34	Q35	Q36	Q37	Q38	Q39
1	1	1	1	1	1	1	0	1	1	1	1
1	1	1	1	1	1	1	1	0	0	1	1
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1	1	1	1	0	1	0	1	0	1	0	1
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1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	0	1	1	1	1	0	1	1
1	1	1	1	1	1	1	1	0	1	1	0
1	1	1	1	1	0	1	1	1	1	1	1
3	1	1	1	1	1	1	0	1	1	1	1
1	1	0	1	1	1	0	1	1	0	1	1

Q40	Q41	Q42	Q43	Q44	Q45	Q46	Q47	Q48	Q49	Q50	Q51
1	1	1	1	1	1	0	1	1	1	1	1
0	1	1	1	1	1	0	1	0	1	1	1
1	1	1	1	1	1	0	1	1	1	0	0
1	1	1	1	0	0	0	1	1	1	1	1
1	1	1	1	1	0	0	1	1	1	1	1
0	1	1	1	0	1	1	1	0	1	1	1
1	1	1	1	0	0	1	1	1	1	0	0
0	0	0	0	1	1	1	1	1	1	1	1
0	1	0	1	1	1	1	0	1	0	1	1
0	1	0	1	1	1	0	0	1	0	1	1
1	1	1	1	1	1	1	0	1	1	1	1
0	1	0	1	1	0	1	0	1	1	0	0
0	1	0	1	1	1	1	1	1	1	1	1
1	0	1	0	0	1	1	1	1	1	1	1
1	1	1	0	1	1	0	1	1	1	0	0
1	1	1	1	1	1	1	1	1	0	0	0
1	1	0	1	1	0	1	0	0	1	0	0
1	1	1	1	1	1	1	1	1	1	1	1

1	1	1	1	1	1	1	1	0	1	1
1	0	1	0	1	1	1	1	1	0	1

Q52	Q53	Q54	Q55	Q56	Q57	Q58	Q59	Q60	Q61	Q62	Q63	Q64	Q65
1	1	1	1	1	1	1	0	1	1	1	1	1	1
1	0	1	1	1	1	1	0	1	0	1	1	1	0
1	1	1	1	1	1	1	0	1	1	1	0	1	1
0	1	1	1	1	0	0	0	1	1	1	1	1	1
0	1	1	1	1	1	0	0	1	1	1	1	1	0
1	0	1	1	1	0	1	1	1	0	1	1	1	1
0	1	1	1	1	0	0	1	1	1	1	0	0	1
1	0	0	0	0	1	1	1	1	1	1	1	1	1
1	0	1	0	1	1	1	1	0	1	0	1	1	0
1	0	1	0	1	1	1	0	0	1	0	1	0	1
1	1	1	1	1	1	1	1	0	1	1	1	1	1
1	0	1	0	1	1	0	1	0	1	1	0	1	1
1	0	1	0	1	1	1	1	1	1	1	1	1	1
1	1	0	1	0	0	1	1	1	1	1	1	0	0
1	1	1	1	0	1	1	0	1	1	1	0	1	1
1	1	1	1	1	1	1	1	1	1	0	0	0	1
0	1	1	0	1	1	0	1	0	0	1	0	1	0
1	1	1	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	0	1	1	1	0
1	1	0	1	0	1	1	1	1	1	0	1	0	1

Case Processing Summary

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

a. Listwise deletion based on all variables in the

procedure.

Reliability Statistics

Kuder-Richardson	N of Items
.841	65

The reliability coefficient of **0.84** shows that the instrument is reliable.

APPENDIX J

LETTER TO SCHOOLS

> Department of Science Education,
>
> Faculty of Education,
>
> Nnamdi Azikiwe University, Awka.

The Principal,

………………………...............

………………………...............

………………………...............

Sir/Ma,

PERMISSION TO CARRY OUT AN EXPERIMENT

I write to request your permission to carry out an experiment with the SS 2 Computer students in your school. I am a post-graduate student of the above named institution. This experiment is purely for research purposes only and not for public consumption. It will not in anyway, jeopardize the smooth running of the school. If permitted, the experiment will last for five-weeks starting from.......................to.........................

Thanks for your anticipated co-operation

Yours faithfully,

Okereke Chukwuemeka Martin

2016607004F

APPENDIX K
MIND MAPPING TEACHING PROCEDURE

- Obtain a plain-paper A4 or A3 size preferably.

- Write the title or topic of the subject you are teaching in the centre of the page of the paper or chalkboard and draw a circle around it. Mark the circle 1 or any letter you may use to create order e.g. A, B, C etc.

- Draw lines out from this circle. Label these lines with these subheadings or subdivision as 2, 3 etc.

- As you "borrow" into the topic and uncover another level of information (further subheadings, or individual facts) belonging to the subheading above, draw lines linking to the subheading lines and mark them 3.

- Finally, for individual facts or ideas, draw lines out from the appropriate heading lines and label them as 4 progressively.

A complete mind map should have main topic lines radiating in all directions from the center of a circle. Subtopic lines and facts lines branching as twigs from the trunk of a tree. Do not worry about the structure being produced, as this will evolve on its own accord.

Note that the ideas of numbering levels as 1, 2 etc. is to show how the mind map was created. All that are been shown is that major leadings radiate from the center, with lower level headings and facts ranching off from the higher level heading.

Improve your mind maps. Your mind maps are your own intellectual property. Once you understand how to make notes in the mind map format, you can develop your own conventions to them.

Further, the following suggestions may help to increase mind map effectiveness.

- Use <u>Single strong words</u> and simple meaningful phrases for information to avoid words <u>cluttering</u> the map.

- Print words in upper case preferably.

- Use color to separate different ideas (lines).

- Use symbols and images to enhance remembrance if available.

- Use cross-linkages of lines where information in one part of the mind map relates to another part. Finally, Mind Mapping is an extremely effective method of taking Notes. It shows not only facts, but also the overall structure of a topic and the relative importance of individual parts of it. They help you to associate ideas and make connections that might not otherwise make.

APPENDIX L

LESSON PLAN ON MIND MAPPING TEACHING STRATEGY

Week One
Mind Mapping Teaching Strategy
Lesson Plan on Networking

Subject: **Computer studies**
Class: **SS II**
Age: **16 Years +**
Duration: **40 Minutes**
Topic: **Networking**

Specific Objectives: At the end of the lesson, the students should be able to;
  i. Define Networking
  ii. Outline the types of Network
  iii. Define Computer Network
  iv. Outline the types of Computer Network

Instructional Materials: A plain white paper A4 size with many colors of pen at least 4-7 colors.

Entry Behaviour: The students has been taught; Bus, types of Bus, internet and some basic terms on the internet.

Set Induction: The teacher could arouse the student's interest by asking them to provide coloured pens and A4 white paper.

INSTRUCTIONAL PROCEDURE

Content Development	Teacher's Activities	Learners' Activities	Instructional Resources	Teaching Method and Strategies
Step I				
Networking	Ask the students to place their A4 size papers on the desk while placing your own on the table. Tell them to write the topic at the centre of the paper while writing your own. Draw a circle round the topic **Networking** while the students do the same. They should label the circle as level 1. Ask them to think out the	Students listen to the teacher and ask questions where explanation is not clear.	Chalkboard/A4 Paper size	MMTS

	sub levels that should be drawn out from the circle with straight lines. 1. Definition of Networking as sub level 2 2. Outlining the types of Network as sub level 2 3. Definition of Computer Network as sub level 2 4. Outlining the types of Computer Network as sub level 2			
Step II				
Definition of Networking	Definition of Networking as sub level 2 has one sub level marked as sub levels 3. Types of Network as sub level 2 have 3 sub levels marked as sub levels 3. They are: i. ETHERNET sub level 3 ii. Token Ring sub level 3 iii. ARCNET sub level 3	Students listen to the teacher as he explains and complies to the instructions.	Chalkboard/A4 Paper size	MMTS
Step III				
Types of Computer Network	Definition of Computer Network as sub level 2 has one sub level of 3. Types of Computer Network as sub level 2 have 4 sub levels marked as levels 3. They are	Students listen to the teacher as he explains and complies to the instructions.	Chalkboard/A4 Paper size	MMTS

	1. PAN (Personal Area Network) as sub level 3 2. LAN (Local Area Network) as sub level 3 3. MAN (Metropolitan Area Network) as sub level 3 4. WAN (Wide Area Network) as sub level 3			

Evaluation: Inform the students that evaluation comes at last.

Conclusion: Goodbye till next class

Week two
Mind Mapping Teaching Strategy
Lesson Plan on Network Topology I

Subject: **Computer Studies**
Class: **SS II**
Age: **16 Years +**
Duration: **40 Minutes**
Topic: **Network Topology I**

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

    i. Define Topology
    ii. Define Network Topology
    iii. List five types of Network Topology
    iv. Outline advantages and disadvantages of Network Topology

Instructional Materials: A plain white paper A4 size with many colors of pen at least 4-7 colors.

Entry Behaviour: The students has been taught; Networking, Types of Network, Computer Network and its types.

Set Induction: The teacher could arouse the student's interest by asking them to provide coloured pens and A4 white paper.

INSTRUCTIONAL PROCEDURE

Content Development	Teacher's Activities	Learners' Activities	Instructional Resources	Teaching Method and Strategies
Step I				
Network Topology 1	Ask the students to place their A4 size papers on the desk while placing your own on the table. Tell them to write the topic at the centre of the paper while writing your own. Draw a circle round the topic **Network Topology I** while the students do the same. They should label the circle as level 1. Ask them to think out the sub levels that should be	Students listen to the teacher and ask questions where explanation is not clear.	Chalkboard/A4 Paper size	MMTS

	drawn out from the circle with straight lines. The sub-levels are: 1. Definition of Topology as sub level 2 2. Definition of Network Topology as sub level 2 3. Types of Network Topology as sub level 2 4. Outlining the advantages and disadvantages of Network Topology as sub level 2			
Step II				
Definition of Topology and Network Topology	Definition of topology as sub level 2 has one sub level marked sub level 3. Definition of Network Topology as sub level 2 also has one sub level marked sub level 3.	Students listen to the teacher as he explains and complies to the instructions.	Chalkboard/A4 Paper size	MMTS
Step III				

Types of Network Topology	Types of Network Topology as sub level 2 has five sub levels marked sub level 3 1. Star Topology as sub level 3 2. Linear Bus Topology as sub level 3 3. Ring Topology as sub level 3 4. Mesh Topology as sub level 3 5. Tree Topology Explanation of the types of Network Topology as sub level 3 has one sub level each marked sub level 4.	Students listen to the teacher as he explains and complies to the instructions.	Chalkboard/A4 Paper size	MMTS
STEP IV				
Advantages and disadvantages of Network Topology	Advantages and disadvantages of the mentioned types of topologies as sub level 2 has two sub levels each marked sub level 3	Students listen to the teacher as he explains and complies to the instructions	Chalkboard/A4 Paper size	MMTS

Evaluation: Inform the students that evaluation comes at last.

Conclusion: Goodbye till next class

Week three
Mind Mapping Teaching Strategy
Lesson Plan on Network Topology II

Subject: **Computer studies**
Class: **SS II**
Age: **16 Years +**
Duration: **40 Minutes**

Topic: **Network Topology II**

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

 i. Outline the benefits of Networking

 ii. Enumerate some considerations when choosing a Topology

 iii. List Ten (10) Network devices

Instructional Materials: A plain white paper A4 size with many colors of pen at least 4-7 colors.

Entry Behaviour: Students has been taught; Networking, Network Topology I and the Types of Network Topology.

Set Induction: The teacher could arouse the student's interest by asking them to provide coloured pens and A4 white paper.

INSTRUCTIONAL PROCEDURE

Content Development	Teacher's Activities	Learners' Activities	Instructional Resources	Teaching Method and Strategies
Step I				
Network Topology 11	Ask the students to place their A4 size papers on the desk while placing your own on the table. Tell them to write the topic at the centre of the paper while writing your own. Draw a circle round the topic **Network Topology II** while the students do the same. They should label the circle as level 1.	Students listen to the teacher and ask questions where explanation is not clear.	Chalkboard/A4 Paper size	MMTS

	Ask them to think out the sub levels that should be drawn out from the circle with straight lines. The sub-levels are:			
	i. Outlining the benefits of Networking as sub level 2			
	ii. Enumerating some considerations when choosing a Topology as sub level 2			
	iii. Listing Ten (10) Network devices as sub level 2			
Step II				
Benefit of Networking	The next sub level should be drawn from the sublevel 2 and labeled as sub level 3. The benefit of networking alongside its explanation as sub level 2 has seven sub levels marked sub level 3. They are: 1. Ease of Communication as sub level 3 2. Ease of Collaboration as sub level 3 3. Sharing of Computing Resources as sub level 3	Students listen to the teacher as he explains and complies to the instructions.	Chalkboard/A4 Paper size	MMTS

	4. Allows software to be shared as sub level 3 5. It helps in research work as sub level 3 6. E-learning as sub level 3 7. It provides easy access to information as sub level 3			
Step III				

Explanations on the considerations of choosing a topology	Explanations on the considerations of choosing a topology as sub level 2 have one sub level marked sub level 3.
	
	  i. Cost as sub level 3
	
	  ii. Length of cable needed as sub level 3
	
	  iii. Future expansion and growth as sub level 3
	
	  iv. Type of Network as sub level 3
	
	  v. Size of Network as sub level 3
		Students listen to the teacher as he explains and complies to the instructions.	Chalkboard/A4 Paper size	MMTS

STEP IV				
Network devices	Listing the Nine (9) Network devices as sub level 2 has nine sub levels marked sub level 3: 1. Hub as sub level 3	Students listen to the teacher as he explains and complies to the instructions	Chalkboard/A4 Paper size	MMTS

	2. Modem as sub level 3			
	3. Switches as sub level 3			
	4. Routers as sub level 3			
	5. Brouter as sub level 3			
	6. Bridges as sub level 3			
	7. Gateways as sub level 3			
	8. Amplifiers as sub level 3			
	9. Network Interface Cards (NICS) as sub level 3			

Evaluation: Inform the students that evaluation comes at last.

Conclusion: Goodbye till next class

Week four
Mind Mapping Teaching Strategy
Lesson Plan on World Wide Web

Subject: **Computer studies**
Class: **SS II**
Age: **16 Years +**
Topic: **World wide web**
Duration: **40 Minutes**

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

    i. State the full meaning of www
    ii. Define world wide web (www)
    iii. Outline the basic terminologies of www
    iv. List the www protocols and the benefits of www

Instructional Materials: A plain white paper A4 size with colored pens.

Entry Behaviour: Students has been taught: Internet and some basic terms of the Internet.
Set Induction: The teacher could arouse the student's interest by asking them to provide coloured pens and A4 white paper.

INSTRUCTIONAL PROCEDURE

Content Development	Teacher's Activities	Learners' Activities	Instructional Resources	Teaching Method and Strategies
Step I				
World wide web	Ask the students to place their A4 size papers on the desk while placing your own on the table. Tell them to write the topic at the centre of the paper while writing your own. Draw a circle round the topic **World Wide Web (www)** while the students do the same. They should label the circle as level 1. Ask them to draw 4 lines representing: i. Definition of	Students listen to the teacher and ask questions where explanation is not clear.	Chalkboard/A4 Paper size	MMTS

	World Wide Web as sub level 2			
	ii. World Wide Web Protocols as sub level 2			
	iii. The benefits of World Wide Web as sub level 2			
Step II				
Definition of World Wide Web	Definition of World Wide Web as sub level 2 has one sub level marked as sub level	Students listen to the teacher as he explains and complies to the instructions.	Chalkboard/A4 Paper size	MMTS
Step III				
Basic terminologies of World Wide Web	World Wide Web (www) Protocols as sub level 2 has four sub levels marked sub level 3. They are; i. HTTP (Hyper Text Transfer Protocol) as sub level 3 ii. HTML (Hyper Text Mark-up Language) as sub level 3 iii. TCP (Transmission Control Protocol) as sub level 3 iv. IP (Internet Protocol) as sub level 3	Students listen to the teacher as he explains and complies to the instructions.	Chalkboard/A4 Paper size	MMTS
STEP IV				
Benefits of	Benefits of World Wide	Students listen	Chalkboard/A4	MMTS

| World Wide Web | Web as sub level 2 has six sub levels marked sub level 3. They include;

  i. Research work, as sub level 3
  ii. Sources of information, as sub level 3
  iii. Contact building, as sub level 3
  iv. Rapid interactive communication, as sub level 3
  v. It brings the world's information to one's door step, as sub level 3
  vi. It provides a vast array of experience including multimedia presentations, interactive pages, music video, radio and television broadcasting; as sub level 3 | to the teacher as he explains and complies to the instructions | Paper size | |

Evaluation: Inform the students that evaluation comes at last.

Conclusion: Goodbye till next class

Week five
Mind Mapping Teaching Strategy
Lesson Plan on Computer Cables, Network Cables and Network Connectors

Subject: **Computer studies**
Class: **SS II**
Age: **16 Years +**
Duration: **40 Minutes**

Topic: **Computer Cables, Network Cables and Network Connectors**

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

 i.   Define Network Cables
 ii. List the types of Network Cables
 iii. Define Computer Cables
 iv. List types of Computer cables
 v.   Define Network Connectors and Computer Connectors
 vi. Examples of Network Connectors.
 vii.   Examples of computer connectors

Instructional Materials: A plain white paper A4 size with many colors of pen at least 4-7 colors.

Entry Behaviour: Students has been taught: Networking, and Types of Network

Set Induction: The teacher could arouse the student's interest by asking them to provide coloured pens and A4 white paper.

INSTRUCTIONAL PROCEDURE

Content Development	Teacher's Activities	Learners' Activities	Instructional Resources	Teaching Method and Strategies
Step I				
Computer Cables, Network Cables and Network Connectors	Ask the students to place their A4 size papers on the desk while placing your own on the table. Tell them to write the topic at the centre of the paper while writing your own. Draw a circle round the topic **Computer Cables, Network Cables and Network Connectors** while the students do the	Students listen to the teacher and ask questions where explanation is not clear.	Chalkboard/A4 Paper size	MMTS

	same. They should label the circle as level 1. **Step 2:** Ask them to draw 4 lines representing: i. Computer Cables as sub level 2 ii. Network Cables as sub level 2 iii. Computer Connectors as sub level 2 iv. Network Connectors as sub level 2			
Step II				
Definitions	Definition of Computer cables, Network cables, Computer connectors and Network connectors as sub level 2 respectively has one sub level each marked as sub level 3.	Students listen to the teacher as he explains and complies to the instructions.	Chalkboard/A4 Paper size	MMTS
Step III				
Types of Computer Cables	The types of Computer Cables which is drawn out from sub level 2 as sub level 3 has five sub levels marked sub level 4. They are; 1. Power cable as sub level 4 2. Printer cable as sub level 4 3. USB cable as sub level 4 4. Monitor cable as	Students listen to the teacher as he explains and complies to the instructions.	Chalkboard/A4 Paper size	MMTS

	sub level 4			
	5. Serial cable as sub level 4			
STEP IV				
Types of Network Cables	The types of Network Cables which is drawn out from sub level 2 as sub level 3 has four sub levels marked sub level 4. They are;	Students listen to the teacher as he explains and complies to the instructions	Chalkboard/A4 Paper size	MMTS
	1. Twisted Pair Cable as sub level 4			
	2. Coaxial Cable as sub level 4			
	3. Fibre Optic Cable as sub level 4			
	4. Telephone Cable as sub level 4			
STEP V				
Examples of Computer Connector and Network Connector	The examples of Computer connector is drawn out from sub level 2 as sub level 3 has two sub levels marked as sub level 4. They are;			
	1. Male connector sub level 4			
	2. Female connector sub level 4			
	The examples of Network connector is drawn out from sub level 2 as sub level 3 has one sub levels marked as sub			

	level 4. They are; 1. Registered Jack connector sub level 4			

Evaluation: Inform the students that evaluation comes at last

Conclusion: Goodbye

APPENDIX M

LESSON PLAN ON CONVENTIONAL LECTURE METHOD (CLM)

Week One (I)
Conventional Lecture Method (CLM)
Lesson Plan on Networking

Subject:　**Computer studies**
Class:　　**SS II**
Age:　　　**16 Years +**
Duration:　**40 Minutes**
Topic:　　**Networking**

Specific Objectives: At the end of the lesson, the students should be able to;
  i.　　Define Networking
  ii.　Outline the types of Network
  iii.　Define Computer Network
  iv.　Outline the types of Computer Network

Instructional Materials: Computer system, computer textbooks, chalkboard, and drawing on cardboards' instructional technique method. Conventional method, explanations, questions and answer, i.e. CTM procedure.

Entry Behaviour: The students has been taught; Bus, types of Bus, internet and some basic terms on the internet.

Set Induction: The teacher could arouse the students' interest by asking them Some questions based on their previous lesson. For example
  i.　Explain Internet
  ii.　How the Internet works
  iii.　Define BUS
  iv.　Mention and explain the types of BUS

INSTRUCTIONAL PROCEDURE

Content Development	Teacher's Activities	Learners' Activities	Instructional Resources	Teaching Method and Strategies
Step I				
Definition of Networking	Networking is the designing, implementation and maintaining of Computer Network	Listen to the teacher. Respond to the teachers questions. Ask questions to the	Chalkboard and Drawing on the cardboard	CLM Demonstration, Conventional, Questioning

		teacher for clarification		
Step II				
Types of Network	Lists and explain the types of Network with diagram specification as; 1. **Ethernet:** It is a physical and data link layer technology for Local Area Networks (LANs) where each computer listen to the cable before sending information through the Network. 2. **Token Ring:** It is a network that forms a complete electrical Loop or Ring 3. **ARCNET:** It is a network with distributed computing power operation. It means Attached Resource Computer Network	Listen to the teacher. Respond to the teachers questions. Ask questions to the teacher for clarification	Chalkboard and Drawing on the cardboard	CLM Demonstration, Conventional, Questioning
Step III				
Definition of Computer Network	Computer Network is the connection of computers to exchange information	Listen to the teacher. Respond to the teachers questions. Ask	Chalkboard and Drawing on the cardboard	CLM Demonstration, Conventional, Questioning

	and share resources. It involves computer systems which interact with one another. Each system in the network is referred to as a NODE and the connection between the systems is described as a HUB	questions to the teacher for clarification		
Step IV				
Types of Computer Network	1. **PAN (Personal Area Network)** is a computer network organized around an individual person within a single building. It could be inside a small office or residence. 2. **LAN (Local Area Network)** is computer network that inter-connects computers within a limited area such as a residence, school, laboratory, hospital, university campus or building. 3. **MAN (Metropolitan**	Listen to the teacher. Respond to the teachers questions. Ask questions to the teacher for clarification	Chalkboard and Drawing on the cardboard	CLM Demonstration, Conventional, Questioning

| | **Area Network)** is a computer network used in networking an entire city.

4. **WAN (Wide Area Network)** is a computer network used in networking a very large area such as a country or even the world. | | | |

Evaluation: The teacher informs the students that evaluation comes at last
Closure: The teacher says goodbye till next class and leaves the class instructing the students to clean the chalkboard**.**

Week Two (II)
Conventional Lecture Method (CLM)
Lesson plan on Network Topology I

Subject: **Computer studies**
Class: **SS II**
Age: **16 Years +**
Duration: **40 Minutes**
Topic: **Network Topology I**

Specific Objectives: At the end of the lesson, the students should be able to;
    i. Define Topology
    ii. Define Network Topology
    iii. List five types of Network Topology
    iv. Outline advantages and disadvantages of Network Topology

Instructional Materials: Textbooks, Chalkboard, Computer System.

Entry Behaviour: The students has been taught; Networking, Types of Network, Computer Network and its types.

Set Induction: The teacher will ask them to list the types of Network and Computer network to establish their entry behaviour of the lesson.

INSTRUCTIONAL PROCEDURE

Content Development	Teacher's Activities	Learners' Activities	Instructional Resources	Teaching Method and Strategies
Step I				

Definition of Topology and Network Topology	Defines Topology as the shape or structure of a network. Also explains network topology as the arrangement of cables, computers and other peripherals on the network. Network topology means the layout of a network. It is the layout of connected device on a network.	Students listen to the teacher as he explains and ask questions where explanation is not clear.	Chalkboard	CLM
Step II				
Types of Network Topology	Lists and explain the types of Network Topology as: 1. **Star Topology:** data and Information are connected through the HUB or SERVER and if the HUB breaks down, none of the computers can communicate with each other. 2. **Linear Bus Topology:** Here, all nodes, work stations and peripheral are connected to the linear cable. It consists of a main run of cable with a	Students listen to the teacher as he explains.	Chalkboard and Computer System	CLM

	terminator at each end. 3. **Ring Topology:** This type of network topology is set up in a circular or ring form. Each mode depends on the other for it to function properly. 4. **Mesh Topology:** This involves the concept of Routes. It provides each device with a point-to-point connection to every other device on the network. 5. **Tree Topology:** It comprises of multiple STAR topologies into a BUS. It is a type of network topology in which a central "ROOT" is connected to one or more other nodes.			
Step III				
Advantages of the mentioned types of Network Topology.	**Star Topology** i. It is easy to install. ii. Network functions even	Student listens to the teacher.	Chalkboard	CLM

	when one computer is faulty
	Linear Bus Topology
	  i. It ensures easy broadcasting and multicasting.
	  ii. It requires less cable for installation.
	Ring Topology
	  i. It covers a very long distance.
	  ii. There is nothing like central wiring.
	Mesh Topology
	  i. Data has access to the fastest path hence extremely reliable.
	  ii. It makes fault identification and isolation easy.
	Tree Topology
	  i. It facilitates point-to-point wiring.
	  ii. It is supported by several topologies.			

Step IV				

Disadvantages of the Network Topologies.	**Star Topology**
	  i. It requires more cable length for installation.
	  ii. It is expensive.
	Linear Bus Topology
	  i. It is difficult to identify the
		Student listens to the teacher.	Chalkboard	CLM

	problem if the entire network shuts down.
	ii. If one NODE fails, the whole network will shut down.
	Ring Topology
	  i. It is difficult to identify the problem if it arises.
	ii. Transmission speed of the network depends on the number and processing speed of the participating nodes.
	Mesh Topology
	  i. Wiring is very complicated.
	ii. Cabling cost is high and expensive.
	Tree Topology
	  i. If the central source breaks down, it affects the entire segment..
	ii. It is difficult to configure.			

Evaluation: The teacher informs the students that evaluation comes at last.

Closure: The teacher says goodbye till next class and leaves the class instructing the students to clean the chalkboard**.**

Week Three (III)
Conventional Lecture Method (CLM)
Lesson Plan on Network Topology II

Subject: **Computer studies**
Class: **SS II**
Age: **16 Years +**
Duration: **40 Minutes**
Topic: **Network Topology II**

Specific Objectives: At the end of the lesson, the students should be able to;
    i. Outline the benefits of Networking
    ii. Enumerate some considerations when choosing a Topology
    iii. List Ten (10) Network devices

Instructional Materials: Computer Textbooks, Computer System and Chalkboard.

Entry Behaviour: Students has been taught; Networking, Network Topology I and the Types of Network Topology.

Set Induction: The teacher asks the student the types of Network Topology I and why they think Network Topology is necessary in order to establish their entry behaviour of the lesson.

INSTRUCTIONAL PROCEDURE

Content Development	Teacher's Activities	Learners' Activities	Instructional Resources	Teaching Method and Strategies
Step I				
Benefits of Networking	i. **Ease of Communication:** Computers in a networked environment are used to communicate with each other e.g. email, chatting etc. ii. **Ease of Collaboration:** People now share opinions on	Listen to the teacher. Respond to the teachers questions. Ask questions to the teacher for clarification	Chalkboard and Computer System	CLM Demonstration, Conventional, Questioning

	different socio-cultural and technological innovations. iii. **Sharing of Computing Resources:** Computers in a networked environment share resources shuch as Printers, MODEM, Scanner, files etc. iv. **Allows software to be shared:** Operating program and software can be shared using network. v. **It helps in research work**: It helps one in carrying out research work hence making it easy to access material for the research. vi. **E-learning:** It helps in teaching. Through the network, one can gain a lot of knowledge and experiences. vii. **It provides easy access to information**: It ensures easy			

	access to information.			
Step II				
Considerations in choosing a Topology	i. Cost ii. Length of cable needed iii. Future expansion and growth iv. Type of Network v. Size of Network	Listen to the teacher. Respond to the teachers questions. Ask questions to the teacher for clarification	Chalkboard and Computer System	CLM Demonstration, Conventional, Questioning
Step III				
Network Devices.	Hub, Modem, Switches, Routers, Brouter, Bridges, Gateways, Amplifiers, Network Interface Cards (NICS)	Listen to the teacher. Respond to the teachers questions. Ask questions to the teacher for clarification	Chalkboard and Computer System	CLM Demonstration, Conventional, Questioning

Evaluation: The teacher informs the students that evaluation comes at last.

Closure: The teacher says goodbye till next class and leaves the class instructing the students to clean the chalkboard**.**

Week Four (IV)
Conventional Lecture Method (CLM)
Lesson Plan on World Wide Web (www)

Subject: **Computer studies**
Class: **SS II**
Age: **16 Years +**
Duration: **40 Minutes**
Topic: **World Wide Web (www)**

Specific Objectives: At the end of the lesson, the students should be able to;
  i. State the full meaning of www
  ii. Define world wide web (www)
  iii. Outline the basic terminologies of www
  iv. List the www protocols and the benefits of www

Instructional Materials: Computer Textbooks and Chalkboard.

Entry Behaviour: Students has been taught: Internet and some basic terms of the Internet.

Set Induction: The teacher asks the students about the internet and some terms on the Internet platform to establish their entry behaviour of the lesson.

INSTRUCTIONAL PROCEDURE

Content Development	Teacher's Activities	Learners' Activities	Instructional Resources	Teaching Method and Strategies
Step I				
Meaning of world wide web (www) and definition of world wide web (www).	**www** means world wide web or W3. It is the web used in sending and receiving web pages. It is a system of interlinked hypertext documents accessed through the Internet.	The students listen to the teaching and ask questions for clarifications.	Chalkboard and Computer System.	CLM, Explanation and Illustration with a Computer System.

Step II				
Basic Terminologies of www	**Home Page:** This is the first page of the website. It is the page that displays each time you open browser. **Web Page:** It is the electronic page in the world wide web. **Website:** It is the collection of web pages. **Hypertext:** It is simply the attachment of hyperlink to text. **Hyperlink:** Allows you to view information without using complex commands, and without even knowing the source of the information. **Hypermedia:** This is an extension of hypertext providing multimedia facilities such as handling sound and video. **Multimedia:** This is the combination of text, audio, images, video and animation in presenting information on computer. **www:** world wide web **URI (Uniform Resource Identifier):** Is a strong character used to identify a name or resource on the internet **URL (Uniform Resource Location):** It specifies where a known resource is available and mechanism for retrieving	The students listen to the teacher and ask questions for clarifications where necessary.	Chalkboard and Computer System.	CLM, Explanation and Illustration using an internet connected Computer System.

	it.			
	Domain: It is the particular website that is running e.g. hosting one's website or email address.			
	Protocols: These are set of rules or procedures governing the transmission of data between computer and devices.			
Step III				
Some examples of Protocols	**HTTP:** Hyper Text Transfer Protocol **HTML:** Hyper Text Mark-up Language **TCP:** Transmission Control Protocol **IP:** Internet Protocol	The students listen to the teacher and ask questions for clarifications where necessary.	Chalkboard and Computer System.	CLM, Explanation and Illustration using an internet connected Computer System.
Step IV				
Uses and Benefits of world wide web (www)	i. It helps in research work. ii. It gives access to different sources of information. iii. It helps in contact building. iv. It helps in rapid interactive communication. v. It brings the world's information to one's door step. vi. It provides a vast array of experience including multimedia presentations,	The students listen to the teacher and ask questions for clarifications where necessary.	Chalkboard and Computer System.	CLM, Explanation and Illustration using an internet connected Computer System.

	interactive pages, music video, radio and television broadcasting.			

Evaluation: The teacher informs the students that evaluation comes at last.
Closure: The teacher says goodbye till next class and leaves the class instructing the students to clean the chalkboard**.**

Week Five (V)
Conventional Lecture Method (CLM)
Lesson plan on Cables, Network Cables and Network Connectors

Subject: **Computer studies**
Class: **SS II**
Age: **16 Years +**
Duration: **40 Minutes**
Topic: **Cables, Network Cables and Network Connectors**

Specific Objectives: At the end of the lesson, the students should be able to;
    i. Define Cables and Network Cables
    ii. List the types of Network Cables
    iii. Define Network Connectors and Computer Connectors
    iv. State types of Network Connectors.
    v. Explain the two types of computer connectors
    vi. Define computer cables, list types of computer cables

Instructional Materials: Computer Textbooks, Computer System, and Chalkboard.

Entry Behaviour: Students has been taught: Networking, and Types of Network

Set Induction: The teacher asks the students the types of Network and what links them in order to establish their entry behaviour of the lesson.

INSTRUCTIONAL PROCEDURE

Content Development	Teacher's Activities	Learners' Activities	Instructional Resources	Teaching Method and Strategies
Step I				

Define Cables and Network Cables.	They are sets of wires, which covers plastics that carry electric current, telephone signets either overhead or underground. Network cables are used to connect one network device to another. It is used to connect two or more computers to share printers and scanners.	Students listen to the teacher as he explains and ask questions where explanation is not clear.	Chalkboard	CLM
Step II				
Types of Network Cable	1. **Twisted Pair Cable:** It consists of copper wires that are twisted into pairs. It is commonly used as telecommunication cable. 2. **Coaxial Cable:** This is widely used for cable television system, office building. 3. **Fibre Optic Cable:** This is the type of network cable that transmits light rather than electronic signal. 4. **Telephone Cable:**	Students listen to the teacher as he explains.	Chalkboard	CLM

	Telephone cable transmits data through the telephone.			
Step III				
Network Connectors and Computer Connectors.	**Network connectors** are used in connecting two or more networks together. **Example:** RJ which means Registered Jack. **Computer connectors** are devices that physically links or connects two or more computers together.	Student listens to the teacher.	Chalkboard	CLM
Step IV				
Types of Computer Connectors	**Male Connector:** It is a plug with a solid pin for a centre conductor. **Female Connector:** It is a jack that has center conductors with a HOLE in it to accept the male pin.	Student listens to the teacher.	Chalkboard	CLM
Step V				
Computer Cables and types	They are wires used for computer network and connectors. **Types of Computer Cables** i. **Power Cable** which is used to connect to the electricity. ii. **Printer Cable** which transmits information from the computer to the printer.	Student listens to the teacher.	Chalkboard	CLM

	iii. **USB:** Universal Serial Bus Cable is used to transmit data through the USB ports. iv. **Monitor Cable:** Used in connecting the monitor and the system unit. v. **Serial Cable:** Used to transfer information between devices using a serial communication.			

Evaluation: The teacher informs the students that evaluation comes at last.

Closure: The teacher says goodbye.

APPENDIX N

DATA COLLECTION &RESULTS: SPSS PRINTOUT

S/N	PreTest	PostTest	ReTScore	Method	Gender	PreTest	PostTest	InTScore
1	40	55	60	1	3	80	96	150
2	35	60	70	1	3	60	101	110
3	40	70	85	1	3	60	111	120
4	20	65	70	1	3	50	106	110
5	30	60	70	1	3	75	101	135
6	35	65	80	1	3	70	106	130
7	35	50	60	1	3	70	91	134
8	25	55	70	1	3	80	96	140
9	25	70	75	1	3	50	111	110
10	20	80	84	1	3	85	121	145
11	40	60	70	1	3	45	101	105
12	25	65	70	1	3	84	106	144
13	40	70	80	1	3	70	111	135
14	25	55	60	1	3	70	96	130
15	25	75	80	1	3	80	116	140
16	30	50	60	1	3	60	91	120
17	35	55	60	1	3	80	96	140
18	40	50	50	1	3	60	91	128
19	20	80	55	1	3	60	121	120
20	40	60	70	1	3	55	101	115
21	40	55	70	1	3	40	96	100
22	25	50	50	1	3	40	91	108
23	30	70	50	1	3	65	111	125
24	30	50	55	1	3	60	91	120
25	30	80	45	1	3	45	121	105
26	25	60	84	1	3	30	101	109
27	25	50	70	1	3	40	91	100
28	40	80	70	1	3	30	121	90
29	20	60	80	1	3	70	101	130

30	50	80	84	1	4	60	121	120
31	60	70	80	1	4	65	111	125
32	40	50	60	1	4	70	91	130
33	35	75	60	1	4	55	116	115
34	20	70	80	1	4	75	111	135
35	35	50	55	1	4	50	91	110
36	40	60	70	1	4	45	101	105
37	40	50	70	1	4	50	91	110
38	40	55	50	1	4	60	96	116
39	55	95	50	1	4	60	136	120
40	20	55	55	1	4	55	96	115
41	40	55	45	1	4	50	96	110
42	45	60	84	1	4	55	101	115
43	35	50	70	1	4	40	91	100
44	25	80	70	1	4	40	121	102
45	20	75	80	1	4	65	116	125
46	35	60	60	1	4	60	101	120
47	40	50	80	1	4	45	91	105
48	40	70	60	1	4	30	111	90
49	40	70	60	1	4	40	111	100
50	40	80	50	1	4	30	121	114
51	25	50	55	1	4	80	91	140
52	20	60	70	1	4	60	101	120
53	45	70	70	2	4	65	111	125
54	20	60	50	2	4	70	101	130
55	25	60	50	2	4	55	101	115
56	30	50	55	2	4	75	91	135
57	40	45	45	2	4	50	86	110
58	20	50	84	2	4	45	91	105
59	30	50	70	2	4	50	91	110
60	25	40	70	2	4	60	81	120
61	45	80	80	2	4	50	121	110

62	20	65	60	2	4	55	106	115
63	20	60	80	2	4	50	101	110
64	30	70	60	2	4	55	111	115
65	25	50	70	2	4	40	91	100
66	40	50	70	2	4	40	91	100
67	40	55	50	2	4	65	96	125
68	20	50	50	2	4	60	91	120
69	25	50	55	2	4	45	91	105
70	25	60	45	2	4	30	101	90
71	45	80	84	2	4	40	121	100
72	20	50	70	2	3	30	91	90
73	20	20	70	2	3	70	61	130
74	35	45	80	2	3	60	86	120
75	40	55	60	2	3	65	96	125
76	40	65	80	2	3	70	106	130
77	30	30	60	2	3	55	71	115
78	30	40	60	2	3	75	81	135
79	40	65	50	2	3	50	106	110
80	40	60	55	2	3	45	101	105
81	20	35	70	2	3	50	76	110
82	25	50	70	2	3	70	91	130
83	20	55	50	2	3	60	96	120
84	20	60	50	2	3	55	101	115
85	20	75	55	2	3	50	116	110
86	25	45	45	2	3	55	86	115
87	40	40	84	2	3	55	81	115
88	25	35	70	2	3	40	76	100
89	30	35	70	2	3	65	76	125
90	35	60	80	2	3	60	101	120
91	35	40	60	2	3	45	81	105
92	20	40	80	2	3	30	81	90
93	20	50	60	2	3	40	91	100

94	35	40	60	2	3	30	81	90
95	20	50	70	2	3	80	91	140
96	25	30	70	2	3	60	71	120
97	40	30	50	2	3	65	71	125
98	30	40	50	2	3	70	81	130
99	25	50	55	2	3	55	91	115
100	30	50	75	2	3	75	91	135
101	50	50	84	2	3	50	91	120
102	45	60	70	2	3	45	101	105
103	40	60	70	2	3	50	101	110
104	35	70	80	2	3	60	111	130
105	30	50	60	2	3	60	91	120

PreTestPostTestRetScore * Method

Method		PreTest	PostTest	RetScore
Experimental	Mean	33.2692	62.9808	66.3654
	N	52	52	52
	Std. Deviation	9.43942	11.30069	11.65018
Control	Mean	30.2830	51.4151	64.5472
	N	53	53	53
	Std. Deviation	8.84781	12.94877	11.95595
Total	Mean	31.7619	57.1429	65.4476
	N	105	105	105
	Std. Deviation	9.22426	13.42460	11.78410

PreTestPostTestRetScore * Gender

Gender		PreTest	PostTest	RetScore
Female	Mean	30.5556	54.5238	66.2857
	N	63	63	63
	Std. Deviation	7.98745	13.55140	11.26288
Male	Mean	33.5714	61.0714	64.1905
	N	42	42	42
	Std. Deviation	10.66598	12.37305	12.55862
Total	Mean	31.7619	57.1429	65.4476
	N	105	105	105
	Std. Deviation	9.22426	13.42460	11.78410

Descriptive Statistics

Dependent Variable: PostTest

Method	Gender	Mean	Std. Deviation	N
Experimental	Female	62.2414	10.14064	29
	Male	63.9130	12.78818	23
	Total	62.9808	11.30069	52
Control	Female	47.9412	12.68008	34
	Male	57.6316	11.22601	19
	Total	51.4151	12.94877	53
Total	Female	54.5238	13.55140	63
	Male	61.0714	12.37305	42
	Total	57.1429	13.42460	105

Tests of Between-Subjects Effects

Dependent Variable: PostTest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	5168.045[a]	4	1292.011	9.518	.000	.276
Intercept	18747.776	1	18747.776	138.107	.000	.580
PreTest	476.628	1	476.628	3.511	.064	.034
Method	2167.686	1	2167.686	15.968	.000	.138
Gender	618.819	1	618.819	4.559	.035	.044
Method * Gender	551.428	1	551.428	4.062	.047	.039
Error	13574.812	100	135.748			
Total	361600.000	105				
Corrected Total	18742.857	104				

a. R Squared = .276 (Adjusted R Squared = .247)

Descriptive Statistics

Dependent Variable: RetScore

Method	Gender	Mean	Std. Deviation	N
Experimental	Female	67.3448	11.35868	29
	Male	65.1304	12.14797	23
	Total	66.3654	11.65018	52
Control	Female	65.3824	11.27081	34
	Male	63.0526	13.28104	19
	Total	64.5472	11.95595	53
Total	Female	66.2857	11.26288	63
	Male	64.1905	12.55862	42
	Total	65.4476	11.78410	105

Tests of Between-Subjects Effects

Dependent Variable: RetScore

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	363.222[a]	4	90.806	.645	.632	.025
Intercept	27600.988	1	27600.988	196.047	.000	.662
PreTest	147.398	1	147.398	1.047	.309	.010
Method	59.204	1	59.204	.421	.518	.004
Gender	169.670	1	169.670	1.205	.275	.012
Method * Gender	3.206	1	3.206	.023	.880	.000
Error	14078.740	100	140.787			
Total	464198.000	105				
Corrected Total	14441.962	104				

a. R Squared = .025 (Adjusted R Squared = -.014)

Pre-Test Post-Test InterestScore * Method

Method		Pre-Test	Post-Test	InterestScore
Experimental	Mean	57.7692	117.7692	198.7692
	N	52	52	52
	Std. Deviation	15.06016	15.06016	15.06016
Control	Mean	57.7692	114.6226	195.6226
	N	53	53	53
	Std. Deviation	12.39762	12.39762	12.39762
Total	Mean	56.1810	116.1810	197.1810
	N	105	105	105
	Std. Deviation	13.80481	13.80481	13.80481

PreTestPostTest InterestScore * Gender

Gender		PreTest	PostTest	InterestScore
Female	Mean	58.0794	118.0794	199.0794
	N	63	63	63
	Std. Deviation	14.54615	14.54615	14.54615
Male	Mean	53.3333	113.3333	194.3333
	N	42	42	42
	Std. Deviation	12.23084	12.23084	12.23084
Total	Mean	56.1810	116.1810	197.1810
	N	105	105	105
	Std. Deviation	13.80481	13.80481	13.80481

PreTestPostTestInterestScore * Method

Method		PreTest	PostTest	InterestScore
Experimental	Mean	57.7692	103.9808	119.0385
	N	52	52	52
	Std. Deviation	15.06016	11.30069	14.48726
Control	Mean	54.6226	92.4151	115.0000
	N	53	53	53
	Std. Deviation	12.39762	12.94877	12.55756
Total	Mean	56.1810	98.1429	117.0000
	N	105	105	105
	Std. Deviation	13.80481	13.42460	13.63395

PreTestPostTestInterestScore * Gender

Gender		PreTest	PostTest	InterestScore
Female	Mean	58.0794	95.5238	119.0952
	N	63	63	63
	Std. Deviation	14.54615	13.55140	14.56323
Male	Mean	53.3333	102.0714	113.8571
	N	42	42	42
	Std. Deviation	12.23084	12.37305	11.57283
Total	Mean	56.1810	98.1429	117.0000
	N	105	105	105
	Std. Deviation	13.80481	13.42460	13.63395

Descriptive Statistics

Dependent Variable: InterestScore

Method	Gender	Mean	Std. Deviation	N
Experimental	Female	122.3448	15.71686	29
	Male	114.8696	11.81411	23
	Total	119.0385	14.48726	52
Control	Female	116.3235	13.10267	34
	Male	112.6316	11.47079	19
	Total	115.0000	12.55756	53
Total	Female	119.0952	14.56323	63
	Male	113.8571	11.57283	42
	Total	117.0000	13.63395	105

Tests of Between-Subjects Effects

Dependent Variable: InterestScore

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	17971.856[a]	4	4492.964	330.330	.000	.930
Intercept	23430.162	1	23430.162	1722.623	.000	.945
PreTest	16660.878	1	16660.878	1224.934	.000	.925
Method	31.600	1	31.600	2.323	.131	.023
Gender	18.383	1	18.383	1.352	.248	.013
Method * Gender	.245	1	.245	.018	.893	.000
Error	1360.144	100	13.601			
Total	1456677.000	105				
Corrected Total	19332.000	104				

a. R Squared = .930 (Adjusted R Squared = .927)