EFFECT OF META-HEURISTIC STRATEGYON INTEREST, PERFORMANCEANDRETENTION IN SETTLEMENT CONCEPTS AMONG SECONDARY GEOGRAPHY STUDENTS IN MINNA EDUCATION ZONE, NIGERIA

BY

Abdullahi Dokochi MOHAMMED
B. Tech. Geography Education (FUTMIN 2010)
M. Ed. Science Education (ABU, Zaria 2017)
P17EDSC9039

A THESIS SUBMITTED TO THE DEPARTMENT OF SCIENCE EDUCATION,
FACULTY OF EDUCATION,
AHMADU BELLO UNIVERSITY,
ZARIA, NIGERIA

OCTOBER, 2021

EFFECT OF META-HEURISTIC STRATEGYON INTEREST, PERFORMANCE AND RETENTION IN SETTLEMENT CONCEPTS AMONG SECONDARY GEOGRAPHY STUDENTS IN MINNA EDUCATION ZONE, NIGERIA

BY

Abdullahi Dokochi MOHAMMED
B. Tech. Geography Education (FUTMIN 2010)
M. Ed. Science Education (ABU, Zaria 2017)
P17EDSC9039

A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD FOR THE DOCTOR OF PHILOSOPHY DEGREE IN GEOGRAPHY EDUCATION

DEPARTMENT OF SCIENCE EDUCATION,
FACULTY OF EDUCATION,
AHMADU BELLO UNIVERSITY,
ZARIA, NIGERIA

OCTOBER, 2021.

DECLARATION

I declare that this work titled**Effect of Meta-Heuristic Strategy on Interest, Performanceand Retention in Settlement Concepts among Secondary Geography Students in Minna Education Zone, Nigeria** was carried out by me in Department of Science Education, Faculty of Education, Ahmadu Bello University, Zaria. The information derived fromother literature were duly acknowledged in the text and list of references provided. No part of this thesis was previously presented for another degree or diploma at this or any other institution.

_____ _____

Abdullahi Dokochi MOHAMMED Date
P17EDSC9039

CERTIFICATION

This thesis titled **Effect of Meta-Heuristic Strategy on Interest, Performanceand Retention in Settlement Concepts among Secondary Geography Students in Minna Education Zone, Nigeria** by me Abdullahi Dokochi MOHAMMED (**P17EDSC9039**) meets the regulations governing the award of degree of Doctor of Philosophy in Geography Education of the Ahmadu Bello University, Zaria, and is approved for its contribution to knowledge and literary presentation.

_____ _____

Prof. B. Abdulkarim Date
Chairperson, Supervisory Committee

_____ _____

Prof.S. S. Bichi Date
Member, Supervisory Committee

_____ _____

Prof.M. Musa Date
Member, Supervisory Committee

_____ _____

Prof. S.S. Bichi Date
Head of Department

_____ _____

Prof. S.A. Abdullahi Date
Dean, School of Postgraduate Studies

DEDICATION

The study is dedicated to my parents and family members for their moral and financial support rendered to me for the successful accomplishment of the thesis and all the people in the world.

ACKNOWLEDGEMENT

My congenial gratitude goes to Almighty Allah whom granted me with His Wisdom and endowed me with His goodly entrance and exit, also sustained me with His Great Bounty throughout my course of study in Ahmadu Bello University, Zaria. I absolutely wish to appreciate the ingenious effort of my humble and dynamic supervisors, Prof. B. Abdulkarim, Prof. S.S. Bichi and Prof. M. Musa for their efficacious scrutiny, honesty, observation, appropriate supervision, corrections and recommendations, constructive and meaningful criticisms, vigorous and open-minded suggestions, guidance and double checking that subjected this work to ascertain standard and level of proficiency which also led to the successful completion of this thesis. I prosodly mimic their excellent and veneraneous charisma as well as conviviality which enable them to obtained educational ranks and leadership pedestal in this institution.

I am tenterhook to extend my splendid gratitude to my role models, workaholic and humble Dr. M.O. Ibrahim, Prof. I.A. Usman, Prof. Y.K. Kajuru,Prof. S.S. Obeka, Prof. M.A. Lakpini, Prof. J.S. Mari, Prof. J.O. Olajide,Prof. M.M. Atadoga, Prof. F.K. Lawal,Prof. T.E. Lawal, Dr. M.K. Falalu, Dr. A.U. Ginga and Dr. (Mrs) O.O. Akinwande for their ruthless observation and words of courage. I am also overwhelmed to extend my regards to all the lecturers in Science Education Department for their expedient contributions to my education. I specially appreciate the efforts of Mr. A. David who typed this thesis. May God bless you.

Generally, I am fully indebted to tender my delightfulness to my parents, wife, children, brothers and sisters as a family, whose efficacious memory and images can never be forgettable in terms of courage, foster, inspiration, upliftment, compassionate, servitude, patience, pleasure, tranquillity, faithfulness, moral and financial support to see that, dreams of a family member's education come true. "True courage allows no room for doubt". I say a very warm thanks to you all. May Allah guide you all in your futures' endeavours, because Allah's guidance is the best guidance. I intend to convey my fervent appreciation to my friends as well as sincere well-wishers whose names are not mentioned whereas their images remained intact in my heart, especially those whom I came across at various stages of my education. I say Al-Hamdullilah! "Getting education has played a tremendous role in raising my level of self-awareness, self- important and confident".

LIST OF ABBREVIATIONS

FRN: Federal Republic of Nigeria

NECO: National Examinations Council

ANG: Association of Nigeria Geographers

GIS: Geographical Information System

MHS: Meta-Heuristic Strategy

SCPT: Settlement Concepts Performance Test

SIIQ: Settlement Inventory Interest Questionnaire

SCHOOL 'A': Bosso Secondary School

SCHOOL 'B': Day Secondary School Father Minna

SCHOOL 'C': Maryam Babangida Girl's Science School

SCHOOL 'D': Zarumai Model School Minna

OPERATIONAL DEFINITION OF TERMS

The following terms have been used to suit this study.

i. **Meta-Heuristic Strategy:**It refers to teaching and learning activities aimed at developing skills which could contribute to students' success in their current and future learning. It is a method that gives learners ability to learn how to learn, learning how to think, self-direct their learning and gain mastery of tasks and learn new skills.

ii. **Interest:**An attraction or desire which forces otherwise compels a learner to response to a particular stimulus.

iii. **Academic Performance:** It is the exhibition of knowledge attained or skills developed by learners in a course of study. It is a measure of result of test scores that was administered to the learners.

iv. **Retention:** It is the ability to actively hold information in the mind needed to accomplish a task such as active thinking, comprehension and learning.

v. Settlement: Theseare groups of houses with people living in them. It is a place where people settled to collectively utilize the local resources found in the environment.

LIST OF TABLES

Table **Page**

LIST OF FIGURES

Figure **Page**

LIST OF APENDICES

TABLE OF CONTENTS

ABSTRACT

The study determined the Effect of Meta-Heuristic Strategy on Interest, Performance and Retention in Settlement Concepts among Secondary School Geography Students in Minna Education Zone, Niger State. The study contained nine objectives with their corresponding research questions and null hypotheses. The research design employed for the study was Quasi-experimental design, particularly prestest, posttest and post-posttest groups design. The study consists of experimental and control groups. The non-equivalent control groups design involving two groups were used, that is, experimental group and control group.The population of the studycomprised of 93,900 SSSII students offering Geography as at 2018/2019 academic session in government own senior secondary schools in Minna, Niger State.A sample of two hundred and one(201) students were derived from two co-education and two single schools, that is, one hundred and seven (107) male and ninety-four (94) female students using stratified random sampling procedure. Two validated instruments were developed by the researcher namely; Settlement Concepts Performance Test (SCPT) and Settlement Inventory Interest Questionnaire (SIIQ) with reliability coefficients of 0.8 and 0.7 respectively. Research questions raised were answered using descriptive statistics of mean and standard deviation while null hypotheses formulated were tested using inferential statistics of t-test and Mann Whitney (U-test) at conventional threshold value of $p \leq 0.05$ level of significance. The finding showed that, there was significant difference between the mean academic performance scores of co-education students taught settlement concepts using meta-heuristic strategy and those taught using lecture method. Also, the finding indicated that, there was significant difference between the interest ability of students taught settlement concepts using meta-heuristic strategy and those taught using lecture method only at senior secondary schools of the study area. Similarly, the finding portrayed that, there was no significant difference between the mean academic performance scores of single and co-education male and female students taught settlement concepts using meta-heuristic strategy only at senior secondary school of the study area. The study recommended the need for State Ministry of Education and Science Teacher's Association of Nigeria (STAN) to encourage teachers on the use of meta-heuristic strategy in teaching Geography at secondary schools level. Generally, conclusion as well as suggestions for further studies were also given.

CHAPTER ONE

THE PROBLEM

1.1 Introduction

Science is concerned with critical analysis of fundamental issues that relates or affects science knowledge as equality, autonomy, equity, freedom analysis of the kind and nature that influence society. Singh (2014) defined science as the study that involves systematic study of natural phenomena which allows the students to experience the richness and excitement of the natural world, the process of inquiring, critical thinking and demonstration of skills. Science and technology education had to do with the teaching and training individuals to acquire skills, knowledge and attitudes systematically and the application of these values to the society.

Geography was derived from two Greek words “Geo” meaning the Earth, and “Graph” meaning description. Therefore, Geography could be defined simply as the description of the earth. Geography is the study of the earth’s surface and its features and the processes that occur. It is also centred with the study of the size, shape and movement of the earth and other heavily bodies. As defined by Iwena (2018) Geography is the study of people, their activities, places and physical surroundings within the earth.

Geography is an academic subject taught in senior secondary schools and tertiary institutions in Nigeria. It is the study of natural features and phenomena on the earth's surface and in the atmosphere. It also focuses on locations, space relations and changes of physical phenomena on the earth's surface. Thus, Geography as an academic subject is geared towards teaching the interrelationships among phenomenon on the earth surface and those in the atmosphere.

The concept of settlement is a component of Geography as course of study that develops the skills of observation, measurement, recording and classifying of settlements into patterns (Saulawa, 2005; Abdulkarim, 2010).

Mayhew (2009) paraphrased that, Geography is one of the structures of how we understand society, space, practiced, inter alia, by seeing, dwelling, collecting, travelling, mapping, representing, recording, narrating, an approach which encourages a focus on complexity, multiplicity relational thinking. Geography is much more than names and locations. It is the study of spatial variation of how and why things differ from place to place on the surface of the earth. It refers to the study of how observable spatial patterns evolved through time (Getis, 2011; Ati and Sawa 2011).According to Usman (2010) one of the aims of the National Policy on Education (FRN, 2013) is to equip students to live effectively in modern age of science and technology. Based on this, the researcher usedmeta-heuristic strategy which enhanced the interest and academic performance of students based on the findings of the study.

The objective of teaching Geography at Senior Secondary School level as spelt out by National Policy on Education (FRN, 2013) include given students a sound knowledge of the immediate environment and inculcating meaningful knowledge to students so as to contribute positively to their communities and nation at large. This indicates that, knowledge is passed to students as skills and values which can improve the meta-cognitive structures of the students (Asiruwa, 2005). Adeyemi (2008) opined that, the learning of Geography should be based on teaching materials, variety of teaching methods and dynamic approach. Students learn through observation and doing, which signifies hands-on and minds-on strategies that could be introduced to the phenomena of nature which surround them through the use of fascinating learning materials that will make them to be exploratory in nature.

Meta-heuristic strategy is also amethod of inculcating knowledge to learners. In this method, learners actively involved in meta-heuristic. Cognitive processes of planning, monitoring and reflecting which allows learners to show, tell and create knowledge in process of learning. It helps students to develop effective learning ability on their own (Van Gog, Pass and Kostons, 2010). Veeman (2010) posited that, meta-heuristic strategy specifically addresses four commonly distinguished meta-heuristic skills as; orientating, planning, monitoring and evaluation. While working on the exercises, students are stimulated to ask meta-heuristic questions and reply to the questions latte, which trains them to reflect and organise the process of the solution. ChiefExaminer's Report (NECO, 2019) indicated that, students' performance in questions related to settlement concepts are relative poor. This is because majority of candidates could not indicate and interpret a given patterns of settlement on map. The situation was the same in 2018 and 2019 where the majority of students who sat and attempted for June/July, 2018 and 2019 Geography Paper I, question number one on map reading could not properly indicate and name patterns of settlement such as nucleated, ring, linear and dispersed patterns of settlement. Likewise stated that, geography students failed to attempt questions on map reading because ofstudents inability to locate, indicate and differentiate the types and patterns of settlement as well as direction of flow of river from one settlement to another on map. It was based on this background, the researcher used meta-heuristic strategy and taught studentssettlement concepts, based on the findings of the study, the instructional strategy has improved students' interest, retention and performance in settlement concepts among Geography students in Minna education zone, Niger State.

Meta-heuristic strategy is defined as guide that help in solving problems. Meta-heuristic in modern forms are based on a variety of interpretation that constitutes "intelligent" search by use of adaptive memory-based programming. Also, this incorporate other strategies with the goal of guiding the search based on combining flexibility and ingenuity focused on human

intuition as a way of solving problems. In the world of education, practices reflecting these ideas have been taken up in various ways (Glover 1986). The following terms can be found in regular use by educators: Thinking about thinking, learning how to think, learning to study, learning how to learn, and learning about learning (Chin and Brown, 2000). The concept of thinking about thinking meta-cognitive or heuristic has emerged at the beginning of the seventies to add a new dimension to cognitive psychology, where it opens up a wide horizons for experimental studies and theoretical discussion on topics of intelligence, thinking, memory, comprehension learning skills (Jarwan, 2009).

Meta-heuristic strategy allows students to develop skills that will enable them to effectively adapt to changes, stay up to develop into self-directed and lifelong learners (Guglinelmino, 2013). Meta-heuristic strategy is an instructional technique that provides students with opportunities to develop and improve their abilities to direct their own learning (Song, and Bank, 2016). According to Kan'an and Osman (2015) it is a teaching and learning activities aimed at developing skills which may contribute to students' success in their current as well as future learning. Saks and Leijen (2014) posited that, it is the ability to accept responsibility for owning learning and to view problems as challenges, not as obstacles but a desire to learn and the ability to manage own learning. Mentz and Van Zyl (2016) lamented that, meta-heuristic strategy provides individual the opportunity to have the innate and universal need for competency. Also, it affords one ability to gain mastery of tasks and learn new skills, to interact with others and feel accepted to experience the feeling of being in control of one's own actions and goal. Gurickis and Markant (2012) explained that, students tend to be more successful learners when they control the learning process themselves, which means that, they have the ability to self-direct their learning, hence, this indicates the significance of meta-heuristic strategy. Havenga (2015) stated that, a meta-heuristic strategy enables students to manage their learning, which leads them to become responsible and independent learners.

It seems that, most students are ignorant about meta-heuristic and are not involved in meta-heuristic thinking, unless they are encouraged to do so through appropriate teaching and learning activities (Gezer-Templeton, 2017).

Meta-heuristic strategy is paraphrased as accelerated learning technique with enormous potential which allows learners to identify facts from instructions by creating concrete images of sights, sounds, feelings and strong association of one image with another through learning more new materials in memory. No learning can take place without memory. To achieve good memory, students need to link a series of facts or ideas together, so that when one is remembered, it triggers recall for a whole series of others (Asante, 2012). The following are sequential steps to achieve an ideal that permanent meaningful knowledge, through the use meta-heuristics strategy (Cole, 2008). Immediate rehearsal of new facts in the short term.Repetition or testing of the facts a few minutes later, review of the facts an hour later, a short recap of them after a night's rest, (sleep approves to help memorization; new information is reviewed during REM-rapid eye movement-sleep), short review a week late, short review a month later (Cooper and Moulding, 2007).

Stacy (2010) explained that, the acquisition of meta-heuristic skills can help the learners to understand, learn in a positive and effective manner, ease the acquisition of new habits of thinking, the acquisition of mental skills that enable independent self-learning, control thinking to improve ability to understanding management, planning, problem solving. Due to the importance of developing the skills of meta-heuristic strategy, the researcher examined the Effect of Meta-Heuristic Strategy on Interest, Retention and Performance in Settlement Concepts among Secondary Geography Students in Minna Education Zone, Niger State. The used of instructional technique (meta-heuristic strategy) has significant effects on interest, academic performanceand retention of Geography students according to the findings of the study.

Gender is another moderating factor in this study, especially since it involves the use of meta-heuristic strategy. The usual assertion is that since boys are more predisposed to the use of technology, they may benefit more from the integration technology for teaching and learning. Girls on the other hand may be limited in their learning when it involves technology.Gender differences in academic performance have been observed in teacher grades and in standardized tests for many years (Obeka, 2010). Girls generally receive high classroom grades while boys outperform girls on standardized tests. Several reasons have been offered for these differences. In standardized testing situations, individual differences in knowledge or skills are more directly assessed. Perhaps of even greater importance is the transfer of knowledge to different situation. Evaluation of academic performance among male and female over the years has to who performs better in classroom situation and during evaluation process has for long remain a controversial issue (Usman, 2010;Oloyede, 2011; Obeka, 2012; Nuruddeen, 2013).

The effect of gender on learning outcomes in sciences is still an issues of debate among educators as a result of conflicting results from studies that focus on gender and performance. Researchers have come up with different findings on the effect of gender on learning outcomes. While some found no significant differences based on gender (Oludipe, 2012).Nuruddeen (2013) disclosed that, the influences of students' gender in their academic achievement had been a concern to researchers in education, yet no consisted result had emerged. These situations therefore sustain the curiosity of researchers, making it necessary for the need to understand how academic achievement was influence by gender on instructional package. Ochu and Atagher (2011) findings which have demonstrated differences due to gender in various academic achievements have become popular and generally accepted by scholars. Females tend to score higher on verbal test and always do better on coding tests, which call for short memory, speed and daftness. The males on the

other hand, invariably achieved higher scores on arithmetic, although there was no enough evidence that males and females differ in average intelligence.Oloyede (2011) in his findings showed that there was no significant difference between the academic performance of male and female students taught chemistry with pictorial and written organizers. The non-significant difference in the achievement of male and female chemistry students agreed with the findings of Nsofor (2010) who reported that both male and female could do well in science if exposed to similar learning conditions.

Based on foregoing ideas, the researcher made the use of meta-heuristic strategy andtaught studentssettlement concepts the instructional approach had increased the students' cognitive ability also improved learners' academic performance and retention ability for attainment of meaningful knowledge. Promoting self-directed learning in school is to teach students that, learning is a lifelong is not confined to the four falls of a class; that each individual develops the responsibility for that leaning. Self-directed learning is that, individuals take the initiative from their learning; for example, when a secondary school student suddenly develops a keen interest in learning everything he is to know about settlement concepts and emerges after a few months as a self-confident on the environment. Hence, it is need to harness this enthusiasm for learning and train students to develop that internal locus of control. Therefore, the need to employ hands-on and minds-on teaching strategies in the school that learner belongs. These can assist students to gain deeper self-knowledge of their learning styles, strengths, interests and develop techniques to determine their readiness level in different content areas as well as develop a sense of their own identities as learners (Marzaon, Pickering and Pollock, 2000). So, addressing the issues, the investigator had categorically investigated the effect of meta-heuristic strategy on interest, retention and performance in settlement concepts among secondary Geography students in Minna Education Zone, Niger State. Hence, the findings of the study portrayed that, the exposure of students to the

instructional approach had positive effect on interest, academic performance and retention of both male and female students in learning settlement concepts of Geographyin Minna Education Zone. As a result of that, the teaching method is gender friendly.

Interest is an attraction or desire which compels a learner to respond to a particular stimulus. Mangal (2010) observed that, interest is the key factor driving force that help us in paying attention as well as remaining engaged in our so attended activities. It is the great motivating force capable of moulding and shaping one's behaviour. Interests are not permanent fixed; they change as a result of maturation and other environmental factors. Obeka (2010) defined interest as the course of certain actions which acts as motivation that propels to act in certain ways and as the effect of an activity which a child is learnt to pay attention as the lesson goes on, if he or she is interested in the particular lesson and the method of learning. According to Aggarwal (2008) paraphrased interest as a feeling that prompts leaners on spontaneous activity. It is the motivating force that impels learners to attend to a person, a thing or an activity as well as effective experience that has been stimulated by the activity itself. Interest is also aroused in studies and good conduct. Thus, interest could be the cause of activity and the result of participation in a given task.Therefore the investigator determined the effect of meta-heuristic strategy on interest of students in learning settlement concepts of Geography. As a result of that, the findings of the study indicated that, interest is motivating factor capable of shaping and broadens learners' behaviourin acquiring meaningful knowledge of settlement concepts of Geographyin Minna Education Zone.

Academic performance is the exhibition of knowledge attain or skills developed by learners in course of study. Academic performance in students' learning has been a matter of concerned in the present day research. According to Ogundukun and Adeyemo (2010) defined academic performance as the display of knowledge by students in the school subject. It is the level of performance in the subject as exhibited by an individual. Academic

performance as observed by Shuaibu (2017) is the exhibition of knowledge attained or skills developed by students in a subject designed by test scores assigned by teachers. The attitude towards academic performance when equal opportunities are given on gender issue irrespective of co-education or single school a learner attends. Also, the process towards improving academic performance of students is when learners are exposed to appropriate teaching strategies in learning concepts of Geography in order to achieve a meaningful knowledge(Riordan, 2008). Based on the points explained, the researcherused meta-heuristicstrategy on academic performance among secondary Geography students in learning settlement concepts and examined that, theinstructional method hasimproved the students'academic performancein acquiring meaningful ideas of settlement concepts among secondary Geography students in Minna Education Zone.

Retention is the ability to remember things, task or material learned previously. Adeniyi (2013) opined that, the nature of the material to be coded contributed to the level of retention. Materials are related to the quality of retention in terms of their meaningfulness, familiarly and image evolving characteristics. Bichi (2006) perceived retention as the ability to retain and later recall information or knowledge gained after learning. It is the endurance of behaviours, which have been learned, or acquired. Aggarwal (2008) explained that, the term retention was the process of relegation of the past experience in the sub-conscious mind of the individuals in the form of mental experience. Retention is defined as a preservative factor of the mind. The mind acquired the material of knowledge through sensation perception. These acquired materials in the mind need to be preserved inform images for knowledge to develop. Whenever a simulating situation occurs retained images are received or reproduced to make memorization possible. Based on the points explained, the researcherused meta-heuristicstrategy on retention among secondary Geography students in learning settlement

concepts and examined that, the pedagogical technique has enhanced the students' retention ability in acquiring meaningful skills of settlement concepts of Geographyin the study area.

Settlement can be defined as a group of houses with people living in them. It is a unit or organised group of men, women and children making out of their surrounding environment. These units vary in size, complexity and stage of development (Areola, Ahmed, and Adeleke, 2016). A settlement is a way of arranging houses into a hierarchy based upon their population or some other criteria. The greater the population in a settlement, the large geographic area, the higher the status and the greater the availability of services. A settlement is also referred to grouping of houses which can result to gregarious nature of human beings. According to social scientists, a settlement comes into existence when the people settle down at a place to collectively utilize the local resources (Singh, 2014). The researcher selected and taught studentssettlement conceptsbecause ofChief Examiner's Report (NECO, 2019) which indicated that, students' performances in questions related to settlement concepts arerelativelypoor. This is because majority of candidates could not answer, indicate and interprete a givenquestions on patterns of settlements on map, the candidates that were examined in Geography failed to make a credit pass in Geography. The situation was the same in 2017, 2018 and 2019 where the majority of students who sat and attempted for June/July, 2017, 2018 and 2019 geography paper I, question number one on map reading could not properly indicate and name patterns of settlement such as nucleated, ring, linear and dispersed patterns of settlement. Likewise stated that, geography students failed to attempt questions on map reading because of inability to locate, indicate and differentiate the types and patterns of settlement as well as direction of flow of river from one settlement to another on map. Hence, the researcher used meta-heuristic strategy and taught studentssettlement concepts so as to improve theinterest, academic performance andretention abilityof students, based on the findings of the study, the instructional approach has improved the

students'interest, academic performance andretention abilityin acquisition of meaningful knowledge of settlement concepts amongsecondary Geography students in Minna Education Zone, Niger State.

1.1.1 Theoretical Framework

This study adapted the framework embedded on discovery learning theory proposed by Bruner (1960) which premised on the active nature of learning by discovery. The theory stated that, the greater the students involvement in the learning process, the greater the learning. This indicated that, practice in discovering for a learner to acquire information is a way that makes that information more readily available in problem solving.The theory was supported by the work of other learning theories and psychologists Jean Piaget and Seymour Papert (Mayer, 2004). Bruner's idea was very similar to those of earlier writers (For example, John Dewey) who argued that, practice in discovering for oneself to acquire information is a way that makes that information more readily viable in problem solving (Mgeni, 2013).

Tobia and Everson (2009) proposed model for meta-heuristic strategy. Meta-heuristic strategy is defined as the ability to monitor, evaluate, and make plans for one's learning. They designed a hierarchical meta-heuristicmodel. The model is organized into four ascending dependency levels. At the bottom appears the knowledge monitoring component. It is the ability of an individual to know what he/she knows and knowing what he/she does not know. At second level is the evaluation of learning. It holds criteria for determining the degree of satisfaction achieved according to former expectancies. At the third level is selection of strategies. It represents the attempt to set or adjust the course of action according to some guidelines. At the top of the hierarchy, the planning component is found. It defines the path of actions to be accomplished and the central focus of meta-heuristic strategy which believed that learning occurs as learners are actively involved in a process oflearning and knowledge construction as opposed to passively receiving information. The researcher adapted Tobia's

and Everson's (2009) meta-heuristic model and taught students settlement concepts in the study area because it isin line with Bruner's (1960) learning theory which premised on the active nature of learning by discovery. The theory stated that, the greater the students involvement in the learning process, the greater the learning of a material. This indicated that, practice in discovering for a learner to acquire information is a way that makes that information more readily available in problem solving.

Meta-heuristic is an instructional strategy that can be used in solving mathematical and scientific problems. According to Canas, Novak and Vanhear (2012) the method intends to train students in scientific inquiry and develop skills to learn, discover, understand or solve problems by themselves through observation, classifying, formulating hypothesis, experimenting, data collection, data analysis and making conclusion. The development of thinking skills is always the focus of scientific problem solving. The strategy showed that, all students have creative ability which can be further developed by utilizing the techniques of inquiry based learning and guided discovery which poster critical thinking, motivation and encourage participation of class members (Patil, 2013).Glover (1986) referred meta-heuristic strategy as a guide in solving problems. Meta-heuristic strategy in modern form is based on a variety of interpretation that constitutes "intelligent" search by use of adaptive memory-based programming. Also, this incorporate other strategies with the goal of guiding the search, based on combining flexibility and ingenuity focused on human intuition as a way of solving problems.

Meta-heuristic strategy is a framework that provides a set of guidelines to come up with the appropriate strategy for acquiring meaningful knowledge. The resulting method usually integrated exact procedures to solve sub-problems and guide a higher level heuristic (Raidl and Puchinger, 2008). According to Polya (2014) Meta-heuristic strategy is application of techniques which serve as to make the problem simpler to solve. It is a method of memory-

based learning strategies (Battiti and Brunato, 2014). Meta-heuristic strategy is an adaptive memory search method that utilizes the means to obtain improved learning procedures as in neural network (Dengiz, 2008; Cao, 2015). It is on this note that, the researcher usedmeta-heuristic strategy and incorporate the teaching method with Bruner's learning theoryalso taught students settlement concepts. Accordingto the findings of the study, the instructional strategy has improved students' interest,performance andretention in settlement concepts among Geography students in Minna Education Zone, Niger State.

1.2 Statement of the Problem

Chief Examiner's Report (2019) disclosed the consistent failure in Geography at SSCE level as at 2015-2019 academic sessions. The results calibrated that, about 60 to 70 percent of the candidates that were examined in Geography failed to make a credit pass in Geography as shown in Table 1.1. When comparing the results there was marginal decline in the performances of the candidates simultaneously. The researcher selected and taught studentssettlement concepts because of Chief Examiner's Report (NECO, 2019) indicated that, students' performances in questions related to settlement concepts are relatively poor. This is because majority of candidates could not indicate and interpret a given patterns of settlement on map. The situation was the same in 2017 and 2018 where the majority of students who sat and attempted for June/July, 2017 and 2018 geography paper I, question member one on map reading could not properly indicate and name patterns of settlement such as nucleated, ring, linear and dispersed patterns of settlement. Likewise stated that, geography students failed to attempt questions on map reading because of inability to locate, indicate and differentiate the types and patterns of settlement as well as direction of flow of river from one settlement to another on map. Abdulkarim (2013) attributed the students' poor academic performances to persistent use of conventional teaching approach such as the didactic method to disseminate knowledge of Geography to students. Therefore, there is need for Geography

teachers to shift from persistent use of conventional teaching method to experimental method, students-centred, active learning,hands-on and minds-on techniques, process-based instruction as well as metal-heuristic strategy that would enhance academic performance and retention ability of the geography students.

Limited use of instructional methods and materials by staff and students for teaching Geography, like using computers, globes, meteorological stations, water reservoirs, forest reserved were reported by Aderogba (2010) and Abdulkarim (2013) as the major challenges of teaching Geography at Nigeria's senior secondary schools level. In the study conducted by Abdulkarim (2011) observed that 85% of senior secondary schools in Kaduna State operates the teaching of Geography with obsolete and inadequacy of equipment/media for teaching the subject. Existing realities at senior secondary schools in Nigeria showed a dismal utilization of Geography equipment by the teachers and students.

The National Geography Curriculum is designed to cover the three domains of education; cognitive, affective and psychomotor skills of the leaner (NERDC, 2013; Obeka, 2010; Haliru, 2015). However, the report indicated that teachers dispensed and imparted only the cognitive skills to the detriment of other two skills. In essence, the attitudinal interest (affective) and psychomotor aspect of the course are neglected. This situation has resulted to the low rate of interest and inadequate academic values of geography studies by students (Mohammed, 2017). As indicated in Table 1.1

Table 1.1 Analysis of NECO Results for Geography Students from 2015-2019.

Years	Total	Total number of students that pass with credit (A1-C6)	Total number of students that pass with D7-E8	Total number of students that failed with F9
2015	711,689	163,438 (22.96%)	149,877 (21.06%)	361,620 (50.81%)
2016	674,686	153,613 (22.77%)	32,401 (4.80%)	460,333 (68.23%)
2017	703,316	345,921 (49.18%)	33,027 (4.70%)	317,648 (45.16%)
2018	671,991	206,905 (31.5%)	28,010 (4.17%)	432,239 (64.32%)
2019	431,230	112,489 (26.09%)	19,689 (4.57%)	297, 495 (68.99%)

Source: National Examinations Council, Niger State of Nigeria (2019).

Agbeyenku (2011) outlined the following factors affecting student's retention in relation to their academic performances in Geography as: thinking style of the individual learners, the age of the learners, nature of materials to be learnt, teacher's method of teaching. Hence a conservative teaching approach needs to be presented to learners in a way or method that touches their sub-consciousness which can trigger quick recalling of concepts being taught or learnt. One of the important aims of school instruction as observed by Aggarwal (2008) is to encourage the learners to acquire and to retain the knowledge imparted in school for future situations, use in school, life and in meeting out-off school life problems of the present and future. So, it is very essential to take proper steps to enable students retain and recall easily.

However, despite some of the findings and recommendations from other studies the poor academic performances of students still prevail in Geography. Therefore, it is hopeful that, the used meta-heuristic strategy would tackle the problems of poor academic performance and retention ability confronting Geography students in the study area. But not much work has been done to examine the effect of meta-heuristic strategy among secondary Geography students on academic performance and interest of students in learning settlement concepts of Geography in Minna Education Zone, Niger State. Therefore, the study found the use of meta-heuristic strategy improved the interest, performance and retention of Geography

students as regard to poor academic performance as well as low cognitive abilities in Minna Education Zone.

Based on these issues, challenges and problems identified, so, the researcher used meta-heuristic strategy and taught studentssettlement concepts in order to enhance the performanceandretention abilityof students, based on the findings of the study, the teaching method has improved students' interest, performance and retention in learning settlement concepts among Geography students in Minna Education Zone, Niger State.

1.3 Objectives of the Study

The general objective of the study is geared towards finding out the Effect of Meta-Heuristic Strategy on Interest,Performance andRetention in Settlement Concepts among Secondary Geography Students Minna Education Zones, Niger State. Specifically, the study sought to determine the following objectives:

1. determine the Effect of Meta-Heuristic Strategy on interest of co-educationstudents in learning of settlement concepts.
2. Find out the Effect of Meta-Heuristic Strategy on academic performance of co-educationstudents in learning of settlement concepts.
3. determine the Effect of Meta-Heuristic Strategy on retention ofco-education students in learning of settlement concepts.
4. Find out the Effect of Meta-Heuristic Strategy on interest of male and female co-education students in learning of settlement concepts.
5. Find out the Effect of Meta-Heuristic Strategy on interestin two different single schoolsof male and female students in learning of settlement concepts.
6. determine the Effect of Meta-Heuristic Strategy on academic performance of male and femaleco-education students in learning of settlement concepts.

7. determine the Effect of Meta-Heuristic Strategy on academic performancein two different single schools of male and female students in learning of settlement concepts
8. Find out the Effect of Meta-Heuristic Strategy onretention of male and female co-educationstudents in learning of settlement concepts.
9. Find out the Effect of Meta-Heuristic Strategy onretentionin two different single schools of male and female students in learning of settlement concepts

1.4 Research Questions

The following research questions were raised to guide the study.

1. What is the difference between the meaninterestscores of co-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method?
2. What is the difference between the mean academic performance scores of co-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method?
3. What is the differencebetween the mean retention scores of co-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method?
4. What is the difference between the meaninterestscores of male and female co-educationstudents taught settlement concepts using Meta-Heuristic Strategy?
5. What is the difference between the mean interest scores in two different single schools of male and female students taught settlement concepts using Meta-Heuristic Strategy?

6. What is the difference between the mean academic performance scores of male and female co-education students taught settlement concepts using Meta-Heuristic Strategy?
7. What is the difference between the mean academic performance scores in two different single schools of male and female studentstaught settlement concepts using Meta-Heuristic Strategy?
8. What is the difference between the meanretention scores of male and femaleco-educationstudents taught settlement concepts using Meta-Heuristic Strategy?
9. What is the difference between the mean retention scores in two different single schools of male and female students taught settlement concepts using Meta-Heuristic Strategy?

1.5 Null Hypotheses

The following null hypotheses were formulated and tested at $p \leq 0.05$ level of significance.

HO1: There is no significant difference between the meaninterestscoresof co-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method.

HO2: There is no significant difference between the meanacademic performance scores of co-education studentstaught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method.

HO3: There is no significant difference between the mean retention scores of co-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method.

HO4: There is no significant difference between the meaninterestscores of male and female co-educationstudents taught settlement concepts using Meta-Heuristic Strategy.

HO5: There is no significant difference between the meaninterest scores in two different single schools of male and femalestudents taught settlement concepts using Meta-Heuristic Strategy.

HO6: There is no significant difference between the mean academic performance scores of male and femaleco-education students taught settlement concepts using Meta-Heuristic Strategy.

HO7: There is no significant difference between the mean academic performance scores in two different single schools of male and female students taught settlement concepts using Meta-Heuristic Strategy.

HO8: There is no significant difference between the mean retention scoresof male and femaleco-education students taught settlement concepts using Meta-Heuristic Strategy.

HO9: There is no significant difference between the mean retention scores in two different single schools of male and female students taught settlement concepts using Meta-Heuristic Strategy

1.6 Significance of the Study

The study investigated the Effect of Meta-Heuristic Strategy on Interest, PerformanceandRetentionin Settlement Concepts among Secondary Geography Students in Minna Education Zone, Niger State.It is hopeful that, the findings of the study would be useful to Geography teachers, students, other teachers, curriculum planners, ministry of

education, professional bodies, association of Nigeria geographers (ANG), researchers and existing literatures in the following ways.

Geography Teachers: Geography teachers could hopefully appreciate the value of using meta-heuristic strategy in teaching Geography concepts apart from the numerous methods or approaches of teaching Geography to improve the students' poor academic performance. It is helped that, the findings would enhance the students' interest, retention as well as academic performance, though the use of meta-heuristic strategy can encourage positive interaction among students of different school settings.

Geography Students: Students comprehension of settlement concepts has enhanced upon as they learn the meta-heuristic that indicates thinking how to thinking, thinking to solve as well as thinking to reflect on the task poses which in return could improve learners' overall performances and interest in learning concepts of Geography as a whole.

Other Subject Teachers: The meta-heuristic strategy could also be employed or adapted in other science subjects. Learners would not forget the skills derived in a meaningful way. So, learners may use such meaningful knowledge later in life and to compete with their contemporaries across the global in modern age of science and technology. Other teachers could also appreciate the appropriate strategies to employ for the use of Meta-Heuristic Strategy in dissemination tasks to learners of different school types as the approaches permit students to show more engagement to learning new ideas also teachers could as well indicate commitment to impacting meaningful knowledge to students.

Curriculum Planners: Curriculum planners could use the findings of this study to recommend the use of meta-heuristic strategy in order to advance the frontiers of knowledge. The findings of the study would of benefit to resource persons, inspectors and supervisors of education, as they may assist in the areas of assessment, evaluation of procurement and usage

of appropriate pedagogies for impacting meaningful knowledge to secondary students of different school types in Niger State as well Nigeria as a whole.

Ministry of Education: Similarly, the educational agencies and principals of a given secondary schools might find the results of this study useful as much, so as to encourage and emphasize on the use of meta-heuristic strategy in delivery instructions to students during seminars, workshops, conferences and so on.

Professional Bodies: Professional bodies like STAN, NERDC, NTI, ICASE and Association of Nigeria Geographers (ANG) would use the findings of this study to organize workshops or seminars for teachers especially on how to use effective teaching strategy to enhance the retention ability and academic performance of students in order to achieve the objectives of teaching science.

Researchers: The findings of this study should be a basis for researchers who might develop interest to examine the effect of Meta-Heuristic Strategy on interest, retention and performance of senior secondary school Geography students in other concepts of Geography. In addition, it would prepare ground for interested researchers who could wish to conduct further research in other subjects such as; Biology, Physics, Chemistry, Integrated Science and Mathematics among others.

Association of Nigeria Geographers: The findings could also assist association of Nigeria geographers to understand and appreciate the role Geography plays in developing their day to day activities and know the appropriate way Geography should be taught.

Existing Literatures: It is hopeful that, the findings of the study would add new information to the existing literatures which other researchers can use.

1.7 Scope of the Study

The study examined the Effect of Meta-Heuristic Strategy on Interest,Performance andRetention in Settlement Concepts among Secondary Geography Students in Minna Education Zone, Niger State. The study was delimited to SSS II students offering Geography.

The study covered the following topic and sub-topics: types of settlements, urban and rural settlement, functions of settlement, pattern of settlement and factors that determine the pattern of settlement. These concepts were chosen from the National Geography Curriculum for Senior Secondary Geography (NERDC). They were also selected because, they deal with the students' immediate environmental or spatial patterns likewise, the learners were fully engaged during the instructional activities.

1.8 Basic Assumptions

The following were basic assumptions of the study.

i. Meta-heuristic strategy is capable of affecting interest, performance and retention.
ii. All the schools offered Geography as a subject and have qualified Geography teachers.
iii. The effect produced by the Meta-Heuristic Strategy on interest, performance and retention can be measured.
iv. The students that were involved in the study have covered the settlement concepts of the Senior Secondary School (SSSII) Geography.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter constituted review of related literature with emphasis on the views, opinions, and perceptions of scholars that excel in the field of Geography, science education and other related fields so as to put the study in meaningful context. The general overview of the study were carried out under the following sub-headings:

2.2 Geography as a Course of Study

2.3 Teaching Methods in Geography

2.4 Models of Meta-Heuristic Strategy in Geography

2.5 Meta-Heuristic Strategy and Academic Performance in Geography

2.5.1 Gender and Academic Performance in Geography

2.6 Retention and Academic Performance in Geography

2.7 Interest and Academic Performance in Geography

2.8 Overview of Similar Studies

2.9 Implication of Literature Reviewed for the Present Study

2.2 Geography as a Course of Study

Geography as a school subject is a multidisciplinary subject that cuts across a wide range of subject areas. Basically, the subject entails the study of the natural environment and its relationship with man, hence the nomenclature of physical and human Geography. The term Geography has different definitions each trying to portray the nature of the subject. Kofo

(2011) defined Geography as a distinct and dynamic science or social science discipline that deals with the study of man and his physical environment. It is also seen as study of aerial differentiation. Geography is concerned with the study and description of the earth's surface. Geography is offered both at senior secondary level and at university and other higher institutions. The core subjects at senior secondary school level as given by the (FRN, 2013) are as follows: Mathematics, English Language, one of Nigeria language, Physics, Chemistry and Biology, Literature in English, History and Geography, Agricultural Science.

Geography as a school subject is one of the important subjects at senior secondary schools level. The subject has particularly been enriched by numerous volumes of local studies dealing with what may be described as micro-region in contra-distinction to macro-region of years (Ajibade and Raheem, 2010). Geography deals with physical, human and practical aspects of man's environment and its relationships. All the aspects are studied by the senior secondary students who registered the subject.

Geography education is included in the secondary school system because of the importance of the subject in equipping students with necessary knowledge to help them understand both natural and human phenomena within their immediate environment and beyond. Geography generally helps children as well as adult to understand the concept of man versus his environment in his struggle to survive and overcome the problems militating against his progress. It also helps people appreciate the value of their natural resources, which when developed with care and diligence often help to improve their standard of living. Geography has a large role in government at local, state and national levels.

The aims and objectives of Geography education as given by NECO (2012) are to:

i. understand the concept of different characters and the spatial relationship of the features on the earth surface.

ii. understand the concept of man-environment relation, that is, to examine and explain the interaction of man with his physical and cultural environment.

iii. acquire the basic knowledge of the nature and function of physical and human environments and understanding of their inter-relationships on the resulting issues.

iv. organize and formulate principles according to acquired geographical concepts and apply these principles to interpret and analyse spatial problems in the immediate and wider environment.

v. develop skills and techniques for accurate, orderly and objective geographical investigations to be carried out both in the classrooms and in the environment.

In the area of curriculum reforms, recurring geographical themes such as global warming, climate change, population growth, pollution and their attendant effects on man have affected the objectives, content, scope and nature of Geography education. In view of this, Kofo (2011) stated that, regardless of benefits and disadvantages, the consequent impact on earth's warmth (global warming and climate change) on the environment and the syllabus of Geography taught require attention for sustainability.

i. teaching of Geography should provide a vehicle for the learner's development, to help him acquire the art of using knowledge or to learn something about his cultural heritage.

ii. provide necessary background to citizenship and to intimate the students into a particular mode of thought.

iii. offer a unique means of furthering inquiry and high intellectual growth in students:

iv. to help man to live, place himself in the world and to learn his true position and what his duties are.

v. to equip the students to understand other people and their environment.

vi. develop positive attitudes to race, culture, and to other peoples environments and places.

There is a growing concern about students' poor academic performance in Geography and this has necessitated conscious efforts geared toward improving the teaching and learning of Geography at all levels. The understanding of contemporary Geography science, application and learning from it, no doubt, is possible only with the teaching of Geography efficiently and accurately. This efficient and accurate teaching of Geography depends largely upon the appropriateness of instructional strategies employed by the teachers which, in turn, is determined by teachers' competence (Dignath, Biittner and Langfldt, 2008). One of these developments is the use of meta-heuristic strategy in teaching and learning of Geography. Since the success of students highly depends on their being aware of their own learning paths and their being able to direct their learning, Geography teachers must be able to diversify their methodologies to enhance students' academic performance. Corroborating this view, Aydin (2011) contended that, the teaching methods in which students are active and teacher's guidance is passive should be used in teaching Geography, identifying meta-heuristic strategy as such methods that emphasize students' activeness in the teaching-learning process. The methods can establish a relationship between students' knowledge and new information, observe their own learning and internalize the information by using what they learn in new areas.

Geography is an academic subject taught in senior secondary schools level (FGN, 2013). It is concerned with the study of the earth surface, its physical features, climates, products, people, and distribution of phenomena on the surface of the earth. It is the study of natural features and phenomena on the earth's surface and in the atmosphere which also focuses on locations, space relations and changes of physical phenomena on the earth's surface. In this view, Atere

(2006) ascertained that, Geography as a discipline is the study of man and his environment, that is, physical, political, economic and socio-cultural environments.

Geography is the study of evolving character and organization of the Earth's surface. It is about how, why, and where human and natural activities occur and how they are interconnected (Strahler and Strahler, 2006). Thus, Geography as an academic subject is geared towards teaching the interrelationships among phenomenon on the earth surface and those in the atmosphere (Abdulkarim, 2013). In line with the above, Atere (2006) ascertained that Geography as a subject explains the relationship between man and his environment. Hence, Geography as a discipline adopts a unique set of perspectives to analyze the world and its human and natural phenomena. These perspectives as observed by Strahler and Strahler (2006) include the spatial view point of geographers, the interest of geographers in the synthesis of ideas across the boundaries of conventional studies, and geographers' usage of tools to represent and manipulate spatial information and spatial phenomena.

Like many other areas of study, scholars (Strahler and Strahler, 2006; Atere, 2006; Abdulkarim, 2010) observed that Geography can be regarded as having a number of subfields, each with other subfields. Atere (2006) opined that the main subdivisions of the subject are: Physical Geography, Mathematical Geography, Biogeography and Human Geography. However, Strahler and Strahler (2006) organized these subfields into two broad realms: human Geography (which deals with social, economic, and behavioural process that differentiate places) and Physical Geography (which examines the natural processes occurring at the Earth's surface that provides the natural setting for human activities). According to these researchers, Physical and Human Geography is further subdivided into the following:

Table 2.1: The Scope of Geography Education as **it Relates to the Settlements**

Physical geography	Human geography
Geomorphology (study of land forms)	Historical geography
Climatology (study of climate, weather)	Cultural geography
Coastal and marine geography	Political geography
Biogeography (the study of the distribution pattern of plants and animals)	Population geography
	Settlements
Water resources'	Behavioural geography and environmental perception
Hazard assessment	Economic geography
Geography of soils	Agricultural land use
	Regional development and planning
	Transportation geography
	Medical geography
	Geography of recreation, tourism and sport

Source: Strahler and Strahler (2006).

Strahler and Strahler (2006) stated that, some branches of Geography blend both physical and human geography. For example, in answering questions related to hazard assessment such as what are the risks of living next to a river, and how do inhabitants perceive those risks requires. This study therefore focuses on settlement concepts of senior secondary school Geography. The concept is embedded under environment and its resources theme of Geography which can be found at SSI, SSII and SSIII level. However SS II level will be used for this research.

Table 2.2: Breakdown of Geography Syllabus at Senior Secondary Level.

THEME	TOPIC		PAGE
1 . Local Geography	1.	Town and villages	1-2
	2.	The Local government Area	3-4
2. The earth and the solar system	1.	The earth and other planets	5
'	2.	Earth's rotation and revolution	
	3.	Latitudes and Longitudes	6
	4.	The Earth's structure	
	5.	Rocks	7-8
	6.	Mountains	9-10
	7.	Lowlands	11-12
			13-14
			15-16
3. Environment and its resources	1.	The environment	17-18
	2.	The weather	19-20
	3.	Climate I	20-21
4. Regional Geography of Nigeria	I.	Nigeria; location and position	22-23
	2.	Physical setting of Nigeria	
	3.	Population of Nigeria	24
	4.	Resources of Nigeria	
			25-26
			27-28
5. Map reading and Interpretation	1.	Basic concepts in map reading	29-30
	2.	Map distances	
	3.	Map reduction and enlargement	31-32
	4.	interpretation of physical and cultural	
		Features	33
			34
6. Economic and Human Geography	1.	Transportation	35-36
	2.	Industry	37-38
1. The earth and the solar system	1.	Earth's external processes and landform	42-45
		Development	
2. Environment and its resources	].	Climate II	46
	2.	Climatic classification	47
	3.	Environmental resources	48
	4.	Renewable and non-renewable resources	49
	5.	Environmental problems	
	6.	Environmental conservation	49-50
			50-52
3. Regional Geography of Nigeria	1.	Agriculture	52
	2.	Transport and communication in Nigeria	53-54
	3.	Manufacturing industries in Nigeria	
	4.	Commercial activities in Nigeria	55
			56
4. Map reading and Interpretation	I.	Direction and bearing	57
	2.	Representation of relief forms	58
5. Economic and Human Geography	I.	Population	59
	2.	Settlements	60
	3.	Settlements interactions	61
	4.	Geo-political issues	62
1. The earth and the solar system	1.	Earth's internal processes	64-66
	2.	Denudation processes	
	3.	Weathering	67
	4.	Mass movement	67-68
			69
2. Environment and its resources	I.	Climatic change	70
3. Regional Geography of Nigeria	1.	ECOWAS	71
4. Economic and Human Geography	I.	Trade	72
	2.	Tourism	73
5. Introductory Geographic Information System	1.	Satellite Remote Sensing	
	2.	G1S application	74
			75

SOURCE: (NERDC, 2016).

2.2.1 Objectives of Teaching Geography in Nigerian Secondary Schools

The objectives of teaching Geography at secondary schools level were derived from national educational aims and objectives of the Federal Government of Nigeria (FRN, 2013). The National Aims and Objectives of Education in Nigeria are:

i. The inculcation of national consciousness and national unity.
ii. The inculcation of the right type of values and attitudes for the survival of the individual and the Nigerian society.
iii. The training of the mind in the understanding of the world around us.
iv. The acquisition of appropriate skills, abilities and competences both mental and physical as equipment for the individual to live in and contribute to the development of his society.

The objectives of teaching Geography therefore have been thought of in terms of what Geography can contribute to the realization of the aims of secondary education in Nigeria and include the following (Atere, 2006) are to:

i. give learners a sound knowledge of their immediate environment.
ii. develop in learners the ability to comprehend and explain natural phenomena.
iii. inculcate in learners' useful skills and outlooks this will enable them to make useful contribution to their community and nation at large.
iv. enable the learners appreciate problems of other peoples and in fact, to show empathy to them.
v. develop in learners the critical thinking ability, accuracy and objectivity for proper and logical investigation.
vi. foster in learners a sense of responsibility toward their own society.
vii. develop in learners a comprehension of the spatial relationship and various features on the surface of the earth.

viii. enable learners comprehend the habitation of man within his environment.

According to Atere (2006) stated what geography as a subject can contribute towards the realization of national aims and objectives as follows:

i. Geography teaching exposes learners to know more about the immediate environment and the globe at large; appreciate their environment and even realize the need for the judicious conservation of these resources which is a akin to the second national educational aims (inculcation of the right type of values and attitude).

ii. Through the teaching of Geography, learners could acquire certain essential skills such as the art of close observation of natural phenomena, accuracy in the recording and analysis of the collected data, and logical and critical thinking. These skills equip the learners for meaningful contribution to the development of their society, and these are in consonance with the fourth national educational aim.

2.2.2 The Study Area

Niger State is located between latitudes $8^0$20'N and $11^0$3'N and longitude $3^0$30'E and $7^0$20'E. the states is bordered to the north by Zanfara State, to the north-west by Kebbi State, to the south by Kogi State to south-west by Kwara State while Kaduna State and the Federal Capital Territory border the state to the north-east and south-east respectively. The state is covered by two major rock formations; the sedimentary and basement complex rocks. The sedimentary rocks to the south are characterised of sandstones and alluvial deposits. This sub-area also contains the extensive flood plains of the River Niger this has made the state to be of the largest and most fertile agricultural lands in the country. To the north is the basement complex characterised by granitic outcrops or inselbergs which can be found in the vast topography of rolling landscape. The state experiences two distinct seasons, the dry and wet seasons. The annual rainfall varies from about 1,600mm in the south to 1,200mm in the north. The duration of the rainy season ranges from 150-210 days or more from the north to

the south. Mean maximum temperature remains high throughout the year, hovering about 32^0F, particularly in March and June. The lowest minimum temperatures occur usually between December and January. The state has three major soils types which include the ferruginous tropical soils, hydromorphic soils and ferrosols. The most predominant soil type is the ferruginous tropical soils which are basically derived from the basement complex rock as well as from old sedimentary rocks. The Southern Guinea Savannah Vegetation covers the entire landscape of the state. Niger State had a total population of 3,950,249 people as at 2006 population census (Abubakar and Mamman, 2016).

2.2.3 Recognizant Survey of the Study Area

The Minna Education Zone is the terrain where the recognizant survey case study took place. Minna is also known as capital of Niger State. The research undertook the recognizant survey study within as well as outskirt of Minna and discovered that, the environment is characterized with different types and patterns of settlement ranging from rural and urban settlement that undergo primary and secondary functions of settlement. The researcher undertook the recognizant survey at the following areas; Minna, Chanchge, Bosso, Tudun Fulani, Tunga, Tungan Goro, Paikoro, Shiroro, Rafi, Munya etc. The specification of the recognizant survey for the types and patterns of settlement in the study area is calibrated in Table 3.1.

2.2.4 Settlement as Concepts of Geography

Settlement may be defined as a group of houses with people living in them. It is a unit or organised group of men, women and children making a living out of their surrounding environment. These units vary in size, complexity and stage of development (Areola, Ahmed and Adeleke, 2016). A settlement is a way of arranging settlements into a hierarchy based upon their population or some other criteria. The greater the population in a settlement, the large geographical area, the higher the status and the greater the availability of services. A

settlement is also referred to group of houses which can result to gregarious nature of human beings. According to social scientists, a settlement comes into existence when the people settle down at a place to collectively utilize the local resources (Singh, 2014). Therefore, in this study the teacher will teach students the following topics; settlements, rural settlement, urban settlement, functions of settlement, patterns of settlement and factors that determine the patterns of settlement.

2.3 Teaching Methods in Geography

Teaching strategy is a technique of transmitting knowledge and skills to learners. Each teaching strategies has interconnecting instructional teaching methods to be employed by teachers. This implied that, teachers should vary their teaching methods or techniques for effective teaching and learning. Geography teachers are therefore at liberty to use whichever methods they considered suitable to serve their purpose. The effective teaching of Geography could be measured by examining the methods of teaching applied in school examinations through the performance of students in school examinations (Adeyemi, 2008).

Strategies for teaching Geography as outlined by scholars range from the use of laboratory activities, lecture, discovery, inquiry, demonstration, problem solving, process approach, deductive and inductive methods, meta-heuristic strategy etc. Extensive studies on the efficacy of teaching method and their relative limitations on student's academic performance were outlined by Joshi (2008) and Okam (2009). Obeka (2010) opined that inquiry and demonstration methods are among the most effective strategies of teaching because students' cognitive achievement, interest and retention of environmental concepts of Geography are attained and facilitated effectively. Also added that discovery method enhances academic achievement of students which can be reinforced by the use of outdoor laboratory activities and media technology according to Usman (2010); Abdulkarim and Lawal (2012) respectively.

Studies by Obeka (2010); Abdulkarim (2010); Aderogba (2012) have identified challenges in teaching and learning Geography, the most difficult aspects of Geography, why students failed Geography, dearth of materials for Geography studies and others. Abdulkarim (2010) observed that 80% of senior secondary schools in Kaduna State operates the teaching of Geography with obsolete and inadequacy of equipment and laboratories (indoor and outdoor) for teaching the subject. Other hindrances observed were large class size, inadequacy of teachers and the use of faulty teaching strategies. Another challenge extended Abdulkarim (2010) also attributed to students' lack of interest in geography that was compounded by limited teaching aids and poor teaching techniques. Further posited reasons for poor performance in Geography that aside of their limited interest in the subject and the application of inappropriate teachers' methodology, some teachers lacked in-depth knowledgeof weather/settlement concepts of the subject matter. Furthermore, she reported that heads of schools did not encourage teachers to go for retraining neither did the Kaduna State ministry of education provide adequate funds for the re-training. The lecture method in this study is one where a teacher does most of the talking, while the students listen and take notes. (Abdulkarim, 2010; Aderogba, 2012). The investigatorusedmeta-heuristic strategy and taught settlement as concepts of Geography.

Scholars (Amosun, 2008; Joshi, 2008; Okam, 2009; Abdullahi, 2010; Usman, 2010; Obeka, 2010; Abdulkarim, and Lawal, 2012; Aderogba, 2012) opined that, there have been a variety of methods otherwise techniques for teaching the science subjects such as Geography. Most of these are in use and each of them provides something useful and courageous to a capable and enthusiastic teacher. None of the method is error proof; each of them provides is associated with a number of advantages and disadvantages. These methods otherwise approaches include: lecture method, inquiry method, laboratory technique, demonstration,

discussion method, project method, excursion method, meta-heuristic strategies among others.

Lecture Method: It is widely used method in Geography. In this method the teacher presents the lesson to students verbally while the students listen and write down the key point of the lesson, hence it is described as "talk and listen" approach to teaching. As teaching technique, lecture method is teacher-centred because a lot of telling is done by the teacher while the learners act as passive recipients of information. Unlike other teaching strategies, the lecture deprived the learners of opportunity to participate fully in the learning process for which reason the method has been criticized for developing passivity in the classroom (Hossam, 2012).

The use of lecture method as instructional strategy for teaching Geography, particularly at secondary schools level has raised a number of questions among researchers and educationists. Tshibalo (2003) investigated the use of lecture method in Geography to teach map work (map reading/practical geography) and concluded that the poor academic performance of students in map work was due to the use of lecture method as instructional strategy. Lecture method is less tedious, saves times and provides fascinating and aesthetically stimulating experience especially for the new students on topics of interest (Obeka, 2009). However, Joshi (2008); Okam (2009) opined that lecture method is teacher-centred with little or no participation of learners. Students remain perceive listeners. To overcome the problem of teaching and learning Geography, some scholars advocated the use of media/technology in teaching and learning (Abdullahi, 2009). However, as a result of inadequacies of materials, and insufficient funding, instructional media as computers, digital meteorological stations, Geography laboratories were reported to be limited in secondary schools.

Lecture method involves verbal presentation of ideas, concept and generalization of facts (Huigin, Kejun and Lui, 2013). Lecture method is also referred to as expository method because it is teacher-dominated and learner's passive method (Atere, 2006). It is also known as talk-and-chalk method in a situation when the teacher decides to write the summary of the points she/he has taught on the board (Atere, 2006; Joshi, 2008; Okam, 2009).' It is a method in which the teacher delivers pre-planned lesson to the students with little or no instructional aids. In using this method, the teacher talks about science while the learners read about science (Maikano, 2010). It is one of the science teaching approach that encourages rote learning and regurgitation of information without necessarily aiding understanding and this does not enhances academic achievement as observed by James (2000); Usman (2012); Bichi (2004) in Maikano (2010).

In fact, in the Geography teaching, lecture method will be more effective in a very large class situation in which the teacher combines the method with the effective use of instructional materials, questioning technique and other appropriate strategies that can be employed based on the classroom situation (Atere, 2006; Okam, 2009).

Joshi (2008) ascertained that, the lecture method serves four basic purposes, namely;

i. for motivating students to become excited and learn.
ii. to clarifying students' problems during classroom work.
iii. for reviewing classroom work in order to improve students' mastery.
iv. to expand ideas, knowledge or information in order to engender interests and mastery amongst students. In general, the approach becomes effective if the purpose is clearly understood.

Scholars (Joshi, 2008; Okam, 2009) have identified some merits and demerits of lecture method in teaching-learning processes as follows:

i. The lecture method is useful in imparting factual information in an efficient manner to convey facts, concepts and principles to students who have difficulty reading their texts.
ii. It is easy and convenient for the lecturer to deliver his prepared lectures without hustles of practical demonstration; also the lecturer hardly considers the possibility of students' participation.
iii. The lecture method, is perhaps, the most economical way of providing a large amount of information across to a large class; it is possible to handle a large number of students at a time and no laboratory, equipment, aids or materials might require.
iv. Good lecture can motivate, inspire and instigate a student towards creative thinking and helps to get thinking patterns of students become more focuses

In spite of the above, the lecture has its strengths as teaching technique. Maikano (2010) gave some of these strengths, namely: it helps teachers cover vast area at a limited time as it dealt with lengthy explanation; it was cheap and less expensive as it did not demand any significant financial expenditure; it helped the students to cultivate the skills of note-taking and it is good for adult classes and people of higher mental ability. Some of the limitations of lecture method include: it made the learners passive recipients of information/knowledge; it is didactic and teacher-centred; it is boring particularly in large-size classes and where it is lengthy; it does not promote positive student-teacher relationship; and it did not provide more accurate means of checking students' progress. Moreover, Obeka (2010) postulated that, the objectives of teaching science are; to acquire the knowledge of science, to acquire the processes of developing scientific skills, and acquisition of scientific knowledge and attitudes. Also, Lecture Method was not the best way to achieve the objectives of teaching science.

Field-trip Method: The importance of excursion as instructional strategy has been recognized by Geography teachers at all levels. Field work or excursion, as it was also called,

is one of the teaching procedures that made instruction real and memorable. Ajibade and Raheem (2010) described it as inalienable and corporate part of teaching and learning of Geography. Excursion referred to an organized visit to a place of interest outside the school in order to allow the students to see and do things for themselves. Excursion as an excursion taken outside the classroom for the purpose of making relevant observations and also for obtaining some specific information.

The purpose of the trip was to take the students beyond the confined area of the classroom, to give them an opportunity to see and observe for themselves the information explained by the teacher in the classroom. The field outside the classroom serves as the true laboratory for geographical experiments. This method (excursion) fostered good teacher-students relationship, makes learning more realistic and memorable and allows students to see the ways in which economic, social physical processes were integrated and interact in a particular place (Asante, 2012).

Demonstration Method: It is also method of teaching Geography. The method allowed the students to see the teacher actively engaged as a model rather than merely telling the information. Students learn mental or physical skills by performing those skills under supervision. Demonstration is therefore an instructional strategy in which the teacher did a lot of "showing and doing" activities while the students listen and observe the teacher. After the teacher has finished the performance of a particular activity, the students might be required to perform same activity in order to test their understanding. If the teacher showed a particular process, act of skills with no explanation accompanying it, this is known as "pure demonstration" (Krusse, 2011). Demonstration with commentary occurs if demonstration is accompanied with verbal explanation. In participative form of demonstration, students participate in the demonstration given by the teacher (Maikano, 2010).

While the lecture method made appeal to the sense of hearing, demonstration implied making appeal to the sense of sight and sense of hearing too. In geography classrooms, geography teachers use demonstration method to teach map reading and interpretation as well as Geographic Information System (GIS). In each of these areas, the teacher showed or explained to students a particular process involving the use of some instruments/tools or identification of certain geographical features. Demonstration aroused students' interest and made learning more meaningful and memorable to students. Some of the limitations of this method are that it is risky especially where students are required to make use of dangerous equipment or chemicals it is time-consuming and its success depends upon the availability of instructional materials (Ajibade and Raheem, 2010).

Discussion Method: It is also a method employed in Geography classrooms to present lessons. In discussion method, the teacher divides the class into groups; small group, large group or whole class group for the purpose of teaching and learning. The teacher usually gives the topic(s) of discussion to students in advance so that they could seek for information, organize it and present it during the discussion. The teacher must also ensure that all group members follow the discussion and concludes the findings after all group leaders have finished their presentations. The success of this method depends upon the teachers' ability to select relevant and real problem, guide the group in the course of discussion and treat everyone impartially (Kevog, Willian and Stanley 2013).

The bulk of advantages of this method are: It developed communication skills among learners, the students learn to share and respect other people's view points and develops confidence in the students. Some of the disadvantages of discussion method are: brighter students tend to monopolize the discussion at the expense of less bright ones, if not well-organized the discussion might degenerate into trivial issues and above all the method does not allow for wider coverage of syllabus.

Other methods of teaching Geography are; question and answer method, experimentation, laboratory method, dramatization and expository method (Adeyemi, 2008). It should be noted at this juncture that, most of the teaching methods described above, with exception of cooperative learning, have been criticized for being ineffective in geography teaching. There was an urgent need to search for alternative instructional methods that would enhance the teaching and learning of geographical ideas, fact, information and knowledge which in turn improve students' academic performances. In this study, the instructional method proposed for teaching geography in order to improve students' performance is the meta-heuristic strategy.

Project Method: It is a teaching method in which student learns through independent activity, though under the guidance of the teacher. The method was first propounded by Dewey through his ideas and views about pragmatism that visualized the curriculum or any subject area as an instrument which must be tailored to the service of the society. Teacher portrays a project as a plan of action which involves a task of problem which calls for constructive thought or action on the part of the students (Okam, 2009).

It is also used for teaching geography. The method refers to any individual or group activity involving the investigation and solution of problem planned and carried out to a conclusion by student or students under the guidance of the teacher (Kalgo, 2008). The project starts with problem identification and the identified problem could be of interest to students. The teachers' role was to guide the students. Where the investigation is being carried out by a group students, there was no guarantee that all the students in the group will participate.

According to Okam (2009) the project method is a way of promoting creativity and a spirit of enquiry among students. It involves doing something practical, concrete and realistic which is self-motivated, self-generated and self-directed by the learners themselves. The role of the teacher is to inspire and guide the learners in the process of carrying out the project. The

teacher should try as much as possible to encourage learners on projects that help to clarify concepts in geography. Atere (2006) cited the following as an examples in Geography where projects can be carried out: Interpreting and making or drawing maps; construction, modelling, drawing, painting, labelling, identifying, observing; collecting rocks, fruits materials and specimens of geographical interest; visiting factories, market places, zoos, museums and reporting one's experiences.

Laboratory Method: It is a tool at the disposal of science teacher to help students learn the knowledge content of science and developed their cognitive ability. It is a method that enables group of learners to engage in experimental activities for human enterprise likewise examining and interpreting natural phenomena using their mental capability. Laboratory method enables learners to observe the universe through sensory organs and internalising them to derive at universal statement by reasoning (Shabbir, Mohsin and Awan, 2013).School laboratory is an instructional facility used by the teacher and students interact with materials under controlled conditions as learners investigate nature in seeking answer to many problems and finding out scientific facts and information (STAN, 2013). However, Olajide (2009) defined school science laboratory as a facility for teaching science where inquiry learning takes place. In agreement with this, Usman (2012) posited that the school laboratory is an instructional facility used by the teacher to help students learn about science and how scientists investigate the world around them using materials, apparatus and instruments along with storage and working place is necessary. The method is expensive as it requires huge amounts of money for procuring all the necessary requirements, materials and resources (Mayer, 2008). In situations where many classrooms are used for effective laboratory work by students, their development may require work in the various laboratories. This development involves heavy expenditure in terms of salary and training programmes. The method makes heavy demands on students since it is expected that, each student should vary

by performing experiment. However, all students do not have the same capability and capacity for independent thinking, exploring, investigating and innovating in terms of the principles of science. The method is too costly in terms of time, as the observation and experimental verifications of the facts need time for proper execution. Beside, class management is a critical factor for successful laboratory activities. Maikano (2010) and Usman (2010) worked on indoor and outdoor laboratory activities and proved that the methods improved students' academic achievement and retention in ecology and integrated science.

Abdulkarim (2010) posited that, meteorological station is an outdoor laboratory for teaching weather concepts which facilitate the skill of measurement, recording, experimenting and making influences of geography data among students. Further opined that, the use of this outdoor laboratory has guided the collecting and processing of weather data on daily, monthly and annual basis. Meteorological station made the teaching of weather concepts easier for teachers, more interesting and meaningful to students. Schools without such facilities make the learning of weather phenomenon theoretical, boring and un-meaningful (Abdulkarim, 2010 and Aderoagba, 2010).

2.4 Meta-Heuristic Strategy in Geography

At the heart of metacognitive instruction is the concept of meta-heuristic strategy which was introduced in cognitive psychology more than thirty years ago (Goh, 2008). Meta-heuristic strategy has been one of the most concentrated concepts among researchers in the field of psychology. Many definitions have been proposed for it. Wang, Man, Gang and Zhang (2012) have conceptualized meta-heuristic strategy as one's knowledge concerning one's own cognitive processes and products or anything related to learners. Meta-heuristic strategy is also viewed as a construct that refers to thinking about one's thinking or the human ability to be conscious of one's mental processes. It has also been described as what one knows about

his or her cognitive processes and how he or she uses these processes in order to learn and remember (Pennequin, Olivier, Isabelle and Roger, 2010). Similarly, it is considered as the activity of monitoring and controlling one's cognition, knowledge about cognition and regulation of cognition (Ormrod, 2004). In summary, meta-heuristic strategy can be seen as all efforts a learner makes to monitor his or her knowledge, which is, remembering the entry behaviour of a given task, ability to recognize task demand and knowledge of appropriate strategy and self-regulation that is, continuous self-evaluation.

According to Wang, Man, Gang and Zhang (2012) meta-heuristic strategy describes one's knowledge about how he or she perceives, remembers, thinks, and acts. Metacognitive thought is an essential skill for learning. It ensures that the learner will be able to construct meaning from information. To accomplish this, the learner must be able to think about his or 'her own thought processes, identify the learning strategies that work best for him or her and consciously manage how he or she learns. Meta-heuristic strategy is essential to successful learning because it enables individuals to better manage their cognitive skills and to determine weaknesses that constructing new cognitive skills (Leopoid and Leutner, 2015).

Therefore, developing meta-heuristic strategy can brings learners an awareness of the learning process and strategies that lead to success. When learners are equipped with this knowledge, learners will understand their own thinking and learning process. Similarly, they are more likely to oversee the choice and application of learning strategies, plan how to proceed with a learning task, monitortheir own performance on regular basis. Thus, finding solutions to problems encountered, and evaluate them upon task completion.

Meta-Heuristic Strategy means individual’s knowledge relating to cognitive operations, thinking about thinking, mental activities and self-control, is used in the learning processes of remembrance, understanding, planning, managing and problem solving. Also set of actions carried out by the learners to know about the mental activities, methods of learning and self-

control that are used before, during and after learning for recalling, understanding, planning, managing, problem solving and other cognitive processes (Henson and Eller, 2004; Shihab, 2010). A mental activity distinguishes man from other organisms and uses mental images, knowledge, words, numbers, signs, gestures and expressions that replace things, people and situation and different events in which the person or learner is thinking in order to understand particular subject or a position such as settlement patterns (Yunus, 2010). A type of thinking focusing on compound scientific implications through integrated systems that clearly showing all relationships between concepts and topics to enable the learner grasp the overall picture of the contents of the systems (Obeid and Afaneh, 2013).

According to Manoufi (2012) meta-heuristic strategy includes the patterns of thinking that require retrieval of information previously acquired such as retrieval of information stored in memory and attention to the numbers in the previously educated laws. Also, thinking skills occur when a learner gets new information, sores it in memory, then such information interrelated or arranged and evaluated to achieve the goal, that is, the ability to make application, analysis, conclusion, realization of relations, proof and installation.

Researchers stressed that, the acquisition of meta-heuristic skills help the learners to understand and learn in a positive and effective manner, ease the acquisition of new habits of thinking and the acquisition of mental skills that enable independent self-learning and control thinking and to improve ability to understanding management, planning, problem solving (Beeth, 2003; Stacy, 2010). Due to the importance of developing the skills of meta-heuristic strategy, the researcher examined the effect of meta-heuristic strategy of interest, retention and performance among secondary geography students in learning settlement as concepts of Geography.

The strategy helps students to reorganised nearly in a professional manner, also breaks the process down into clear steps allowing students to monitor the process of their activity hence, meta-heuristic strategy contains the aspects of planning, anticipating and reflecting (Yusuf, 2014). Mevarech and Kramarski (2003) defined the acronym (meta-heuristic) as a shorthand, practicing, receiving and reducing difficulties, obtaining mastery, verification and enrichment. The method combined various didactical strategies; meta-cognitive questioning, cooperative learning and mastery learning (Veeman, 2010). The improve method specifically addresses four commonly distinguished meta-heuristic skills; orientating, planning, monitoring and evaluation. While working on the exercises, students are stimulated to ask meta-heuristic questions and reply to the latter, which trains them to reflect (ask questions) and organise the process of the solution

Meta-heuristic strategy is that which actively involves the students in meta-cognitive processes of planning, monitoring and reflecting which allows learners to show, tell, make meaning and acquire knowledge in process of learning (Blank, 2000). The students appear to lack the essential strategy required for this and evaluating their own performance, or keeping their motivation high. Without strategy structure, students are unlikely to develop effective learning strategies on their own (Van Gog, Paas and Kostons, 2010). Meta-heuristic learning as an active and constructive process whereby learners set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation and behaviour, guided by their goals and the contextual features in the environment. Meta-heuristic strategy is frequently encountered in the research on meta-cognition or self-regulated learning, again are sometimes used interchangeably (Zion, Michaelsky and Mevarech, 2005). This type of knowledge is a prerequisite for the independent use of learning strategies that enhance academic development and purposeful to attain a desired outcome, therefore, the learners require the will and skill to learn to master them (Sofowora and Egbedokun, 2010).

Meta-heuristic strategy involved the development of planning strategies which allows the allocation of study time. During the performance phase, the actual learning takes place. Here the monitoring strategy comes into play; the learner repeatedly checks whether he/she understands the material, for example by self-questioning. The last phase is that of self-reflection, during which the learner evaluates the learning process for attainment of meaningful knowledge (Zimmerman, 2002). Meta-heuristic strategy or Meta-cognitive approaches manage, direct and control the learning manner. These sorts of techniques include thinking regarding learning manner. Planning, monitoring and assessing learning. It is about high level thinking process. It involves conscious control over learning process (Rahimi, 2012). Meta-heuristic knowledge can be simply defined as knowledge about knowledge, knowledge about the use and control of domain of knowledge in an expert system. Also, known within a generalized framework consisting of three categories (Cou, 2008; David and George, 2015).

Coherence and consistency of assessment criteria across grade levels, based on the cognitive model describing the skill constructs, specific expected learning outcomes at different level can be aligned based on the skill development, progression. Bloom's taxonomy framework categorizes cognitive demand into six categories (Davis and Buckedahi, 2011).

1. Knowledge: Information retrieval
2. Comprehension: Understanding the meaning of information
3. Application: Using information to solve problems that have a best answer.
4. Analysis: Understanding parts of whole and the organization of the parts to make inferences or draw conclusion
5. Synthesis: Applying knowledge and skill to produce new ideas or representations of material.
6. Evaluation: Using information and knowledge to make judgement.

The intervening role as teachers set condition that promotes thinking in students. Thinking refers not only to the application of cognitive processes such as analysis, synthesis or evaluation to specific content, but also to the development of habits that identify opportunities to apply such thinking. Students need to develop the habit of thinking, so none of this happens in a vacuum, and all it requires to deliberate and focus training in school setting (Costa and Gamston, 2002; Lipton and Wellman, 2004). This assists students to gain deeper self-knowledge of their learning styles, strengths, interests and develop techniques to determine their readiness level in different content areas as well as develop a sense of their own identities as learners (Marzaon, Pickering and Pollock, 2000). Based on the points discussed, the researcher used meta-heuristic strategy and taught studentssettlement concepts so as to improve the interest, academic performance andretention abilityof students, according to the findings of the study, the instructional approach has improved students' interest, academic performance and retention ability, also ascertained attainment of meaningful knowledgeof settlement concepts amongsecondary Geography students in Minna Education Zone, Niger State

2.4.1 Models of Meta-Heuristic Strategy

A number of models have been proposed which are derived from different conceptualizations of meta-heuristic strategy. There are three general models that provide a theoretical framework for meta-heuristic strategy these are; Flavell's, Brown's and Tobia's and Everson's Model (Gama, 2004). Flavell's Model lays the foundation of the meta-heuristic theory and, for the first time, attempts to define the components of meta-heuristic and the interactions among these components. Similarly, Brown's Model was also presented because it makes an important distinction of two different categories of meta-heuristic strategy: knowledge of cognition and regulation of cognition. Finally, Tobia's and Everson's Model was presented as

they propose a modular model of meta-heuristic strategy, which was taken into account in the design of this study proposed model.

2.4.2 Flavell's Model of Cognitive Monitoring

In this classic article meta-heuristic strategy and cognitive monitoring, Flavell makes the first attempt to define the components of meta-heuristic strategy by creating a model of cognitive monitoring or regulation. His proposed model as summarised by London (2011) consists of four components: (a) metacognitive knowledge, (b) metacognitive experiences, (c) cognitive goals and (d) cognitive strategies. A person's ability to control a wide variety of cognitive enterprises depends on the actions and interactions among these components.

Meta-Heuristic Knowledge: Flavell stated that, meta-heuristic strategy knowledge consists primarily of knowledge or beliefs about what factors or variables act and interact and in what ways to affect the course and outcome of cognitive enterprises. He also identifies three general categories of these factors: the person category, the task category, and the strategy category. The person category comprises the general knowledge one has about how human beings learn and process information, as well as individual knowledge of one's own learning processes. For-example, the realization that one is better at calculus than at algebra. The tasks category considers the information available to solve a problem as well as information about the type of processing demanded of the specific cognitive tasks. This category takes cognizance of the way the information is presented. The strategy category consists of knowledge about which strategies are likely to be effective for achieving goals or sub-goals in various cognitive tasks. It also includes the conditional knowledge about when and where it is appropriate to use such strategies.

Meta-Heuristic Experiences: These are conscious cognitive or affective experiences that accompany a cognitive action. It functions to monitor strategic tasks related to decision making and cognitive processing as they take place. The feelings of familiarity, difficulty,

and confidence are some examples of Meta-heuristic experiences that contribute to the use of meta-heuristic strategies. For example, when a learner suddenly perceives that he or she does not understand what the teacher said, or when he or she experiences a feeling certain task or question is difficult to understand, remember, or solve.

CognitiveGoals: Cognitive goals describe the path one chosen to manage the cognitive strategies refer to the utilization of specific techniques that assist in achieving cognitive goals.

Cognitive Strategies: The cognitive strategies premised that, students use influence how they will perform in school, as well as what they will accomplish outside of school strategy used can be influenced both by knowledge of what the strategy is and how to use it, and by belief in the effectiveness of the strategy (Moghtaderi and Khanjani, 2013). One reason why students may not use an effective strategy is that they do not know about it.

2.4.3 Brown's Model of Meta-Heuristic Strategy

Brown has described meta-heuristic strategy as an awareness of one's own cognitive activity; the methods employed to regulate one's own cognitive processes; and a command of how one directs, plans, and monitors cognitive activity (London, 2011). He divides meta-heuristic strategy into two broad categories: (1) knowledge of cognition, as activities that involve conscious reflection on one's cognitive abilities and activities; and (2) regulation of cognition, as activities regarding self-regulatory mechanism; during an on-going attempt to learn or solve problems, According to Brown, these two forms of meta-heuristic strategy are closely related, each feeding on the other recursively, although they can be readily distinguishable.

Knowledge ofCognition: Knowledge of cognition refers to what individuals, know about their own cognition and includes three different kinds of meta-heuristic strategy knowledge: (a) declarative, (b) procedural, and (c) conditional declarative knowledge refers to knowing "about" things and Includes knowledge about oneself as a learner and about the factors that influence learning. Procedural knowledge refers to knowledge about the execution of

procedural skills. Conditional knowledge refers to knowing the "why" and "when" aspects of cognition and can be thought of as the declarative knowledge and about the relative utility of cognitive procedures. Knowledge of cognition allows individuals to plan, sequence and monitor their learning in a way that directly improves performance.

Regulation of Cognition: Regulation of cognition is thought to refer to processes or mechanisms that help control and monitor thinking, performance, and subsequent learning, These processes include planning activities (predicting outcomes, scheduling strategies, and various forms of vicarious trial and error,) prior to undertaking a problem; monitoring activities (monitoring, testing, revising, and re-scheduling one's strategies for learning) during learning; and checking outcomes (evaluating the outcome of any strategic actions against criteria of efficiency and effectiveness). Students who use self-regulated strategies are intrinsically self-motivated and prove to be autonomous learners (Cleary and Chen, 2009).

These types of learners are motivationally and behaviourally active participants in their own learning process.

2.4.4 Tobia'sand Everson'sHierarchical Model

Tobia and Everson (2009) proposed a meta-heuristic strategy. Meta-heuristic strategy is defined as the ability to monitor, evaluate, and make plans for one's learning. They designed a hierarchical meta-heuristic strategy model. The model is organized into four ascending dependency levels. At the bottom appears the knowledge monitoring component. It is the ability of an individual for knowing what she knows and knowing what she does not know. At second level is the evaluation of learning. It holds criteria for determining the degree of satisfaction achieved according to former expectancies. At the third level is selection of strategies. It represents the attempt to set or adjust the course of action according to some guidelines. At the top of the hierarchy, the planning component is found. It defines the path of actions to be accomplished under the strategy's criteria to carry out the pending learning

goals. The investigator adapted Tobia's and Everson's (2009) meta-heuristic model (flowchart) and taught students settlement concepts in the study area because of its synergy which is in line with Bruner's (1960) learning theory which premised on the active nature of learning by discovery. The theory stated that, the greater the students involvement in the learning process, the greater the learning. This indicated that, practice in discovering for a learner to acquire information is a way that makes that information more readily available in problem solving. Accordingto the findings of the study, the instructional strategy has improved students' interest,performance andretention in learning settlement concepts among Geography students in Minna Education Zone, Niger State.

2.5 Meta-Heuristic Strategyand Performance

Meta-Heuristic Strategy plays an important role in education for it helps learner to be capable of developing a plan, monitoring and evaluating how effective it is. That means meta-heuristic strategy helps the learner to be more involved in the learning process (Kocak and Bayaci, 2010). A lot of studies have reported that there is a difference in the meta-heuristic strategy of effective learners and ineffective learners. The effective users of meta-heuristic strategy are more strategic, more likely to use problem solving heuristics and better at predicating their test score (Uwazurike, 2010). Researches have examined the relation between meta-heuristic strategy and academic achievement. They show that students with high academic achievements demonstrate high level of meta-heuristic awareness (Coutinho, 2007; Moga, 2012), and that students with good meta-heuristic strategy demonstrate good academic performance compared to students with poor meta-heuristic.

Meta-heuristic strategies are sequential processes that one uses to control cognitive activities and to ensure that a cognitive goal, for example understanding a text or problem situation, has been met. These processes help to regulate and oversee learning. It consists of planning and monitoring cognitive activities, as well as checking the outcomes of those activities

(Shannon, 2008). In a proposition to facilitate students in learning activities, many researchers have outlined a variety of Meta-heuristic strategies that needed to be taught. It is widely agreed by these researchers that these strategies needed to be explicitly taught. Desoete (2007) also argues that teaching such strategies has twin benefits in that; (a) it transfers responsibility for monitoring learning from teachers to students themselves, and (b) it promotes positive self-predictions and motivation among students. In this manner, meta-heuristic strategy provides personal insight into one's own thinking and fosters independent learning.

Similarly, varieties of studies have also shown that there is a relationship between meta-heuristic and teaching performance. Teachers with high level of metacognitive awareness were more active in the teaching process. Most studies in this area used training programmes and examined the impact of these programmes on teaching performance between two groups (control group-experimental group which has been taught using meta-heuristic strategy). The results have shown that experimental groups were more active in the teaching process, have confidence, interacted more socially with their students. Teachers also used different and suitable teaching strategies and have the tendency to use and practice thinking skills in their classes (Gopinath, 2014; Abdellah, 2015). These studies showed there is positive influence for training on Meta-heuristic strategies and students with poor meta-heuristic strategy may benefit from these training to improve meta-heuristic strategy and academic performance.

Academic performance in geography is the inhibition of knowledge attained or skills developed by students in the subject t usually designed by test score assigned by teachers. It is an indication of the types of learning and its environment in a teaching and learning process. According to Aydm and Coskun (2011) the score in examinations and the passing notes in class usually determine the performance of the students about the course. It can also

be in the final year examination conducted by examination bodies such as WAEC, NECO and NABITEB (Aderogba, 2012)

NECO as an examination body has outlined some weaknesses resulting to poor academic performance for example, in June/July concluded 2015-2019. Geography paper I question member one on map reading that dealt with some aspects of locating the settlement as well as direction of flow of river in some settlement on map. The NECO chief examiner's report on this question disclosed that, many of the students who attempted it could not correctly name and indicate patterns of settlement and direction of river in settlement on map. Also, Chief Examiner's report (NECO, 2019) indicated that, students' performances in questions related to settlement concepts are relative poor. This is because majority of candidates could not indicate and interprete a given settlement pattern on map. The situation was the same in 2017, 208 and 2019 where the majority of students who sat and attempt for June/July 2017, 208 and 2019 geography paper I, question member one on map reading could not properly indicate and name patterns of settlement such as nucleated, ring, linear and dispersed patterns of settlement.

Aderogba (2012) has identified several factor influencing students' academic performance in geography course such as; class size, laboratories, instructional strategies, textbooks, professional qualification of teachers, teachers a tributes, students attributes, peer groups, parental and home background, and school environment among others. Relwani, Akahomen and Gbakeji (2014) lamented that, effective teaching is a significant predictor of students' academic performance therefore, effective teachers should produce students of higher academic performance. Shakir (2014) explained academic performance as levels of progress ac hived by students. It can also be defined as what a learner does or achieve at school. It is common practice to promote students from a lower class to a higher class on the basis of

his/her academic performance it help in declaring students success, choosing students for various courses and selecting students for different jobs.

Emaikwu (2012) referred academic performance as an individual's academic attainment after a specified course of instruction. It is an individual's status in a specific content area after the individual has undergone tutoring in a programme. Performance test can either be teacher-made or students at the end of each term or semester after series of lessons are given is described as teacher-made or un-standardized test. Students inability to accurately observe objects, measure, indicate, manipulate, draw and even rearranging objects from reason for poor academic performance in subject attain (Eze, 2011).

Meng and Idris (2012) lamented that, a child introduced to any knowledge using concrete manipulative receive a permanent and irreversible knowledge and ends up having long term memory of what they have been taught. Jekayinfa (2014) observed that, envelopment in which a child lives has significant influence in the development of child cognitive abilities. Also, noticed that, negative learning environment hinders learning likewise affect academic performance of a child. Michigan (2013) paraphrased that; students' performance is greatly affected by the area in which a student lives. Reasons for the variations in performance are; geographical location, resources, availability of technology and quality of teachers.

Bell (2015) defined academic performance as how well a study meets standards set out by government and the institution itself. According to Steinmayr, Weidinger and Wirthwein (2015) academic performance is the outcome that indicates the extent to which a person has accomplished specific goals that were the focus of activities of instructional environments specifically in school, college and university. In this study, academic performance is considered as an outcome of educational programme that shows the extent to which a student

has achieved his/her educational goals after being subjected to examination. It can also be considered as a means for making a difference locally, nationally and globally.

Sunshine, Lawrence and Juan (2015) asserted that academic performance is one of the major factors considered by employers in employing works. Irfan and Shabana(2012) stated that, there are factors that can lead to low students' academic performance, in tertiary institutions such as; lecturer's teaching method (in appropriate), to much students enrolment (large class size), poor study habits, inadequate of teachers interest in the job, poor health and nutrition and low educational attainment among others. Based on the points discussed, the researcherused meta-heuristicstrategy on academic performance among secondary Geography students in learning settlement concepts and examined that, theinstructional method hasimproved the students'academic performance in acquiring meaningful ideas of settlement concepts among secondary Geography students in Minna Education Zone.

2.5.1 Gender and Academic Performance in Geography

Academic performance in students' learning has been a matter of concerned in the present day research. Ogundukun and Adeyemo (2010) defined academic performance as the display of knowledge attained or skills developed by students in the school subject. It is the level of performance in the subject as exhibited by an individual. Academic performance is the exhibition of knowledge attain or skills developed by learners in the school subject usually designed by test scores or by marks assigned by teachers which can be low or high.

In agreement with the above, Poopola (2010) ascertained that, academic performance is an expression used to present student scholastic standing and which is a function of a various factors, such as method of teaching, teachers qualifications, child's home background, school environment, attitude, interest among others. The concept of "gender" in teaching and learning process has attracted the attention of many psychologist, biologists, and researchers as a result of which a lot of literatures exist on different aspects of the concepts.

Several researches conducted by scholars on the effect of academic performance on gender in science education significant differences between boys and girls (Bichi, 2002;Obeka, 2009; Usman, 2010) while others opined no difference between gender on academic performance (Usman, 2010). Alpha (2007) researched on gender disparity on performance in mathematics of senior secondary school, opine that performance of boys was higher than that of girls. In support of this Usman (2010) worked on relationship between students' academic achievement in Biology using XISTEP mode of teaching revealed that senior secondary male biology students perform well in any rigorous work than their female counter part.

In a similar vein, Obeka (2009) conducted a research on EPODEWALAD and Power Simulation Games of Geographic and Environmental Education. His findings among others revealed that, gender was a significant factor in students' performance in environmental education concepts of geography with male students performed better than their counter parts. Bichi (2002) worked on effects of gender on historically enriched curriculum on academic performance in evolution concept using senior secondary biology students. His finding revealed disparity among gender in support of girls.

Ochu and Atagher (2011) findings which have demonstrated differences due to gender in various academic achievements have become popular and generally accepted by scholars. Females tend to score higher on verbal test and always do better on coding tests, which call for short memory, speed and daftness. The males on the other hand, invariably achieved higher score on arithmetic, although there was no enough evidence that males and females differ in average intelligence.

Oloyede (2011) in his findings showed that there was no significant difference between the academic performance of male and female students taught chemistry with pictorial and written organizers. The non-significant difference in the achievement of male and female chemistry students agreed with the findings of Nsofor (2010) who reported that both male

and female could do well in science if exposed to similar learning conditions. Bacchus (2004) in his analysis of the two genders believe that woman's tendencies were toward the emotional and psyche, whereas mans' tendencies were towards intellectualism and materialism. Obeka (2009) conducted a research on EOODEWALAD and Power Simulation Games on Geographical and Environmental Education. His findings among others revealed that gender was a significant factor in students' achievement in environmental education concepts of Geography with male students performed better than their female counterparts. Nuruddeen (2013) disclosed that, the influences of students' gender in their academic achievement had been a concern to researchers in education, yet no consisted result had emerged. These situations therefore sustain the curiosity of researchers, making it necessary for the need to understand how academic achievement was influence by gender on instructional package. According to Ogunojemite and Omodara (2013) revealed that, there was no significant difference in the impact of mass media among male and female adult which shows that there was poor relationship between the usage of media by both gender.

The work of Maikano (2007) calibrated that, there was no significant difference in the academic performance of male and female students taught ecological concepts using the outdoor laboratory instructional strategy. Maikano (2016) supported this assertion in his study on entry qualification and performance. The result showed that, male and female students admitted with the same entry qualification have no difference in their performance. Also, Usman (2016) opined that, teaching methods (outdoor and indoor) enhances academic achievement of students in integrated science concepts in spite of their gender. It is evident that, poor academic performance of secondary school students in Nigeria affects all subject areas, Geography inclusive. The major challenge is how to effectively teach the students in order to improve their academic performance. The task of improving the performance of secondary school students presents a complex challenge to teachers who are key players in

meeting the diverse learning needs of every student in the classroom. The search for instructional strategies to help teachers meet this challenge has attracted much attention from many researchers in the recent past. Teachers' methodologists have been linked to academic performance of students. Various instructional strategies have been recommended for uses which have wider applicability across different subject areas and have positive effects on academic performance.

Another recommended method is meta-heuristic strategy by (Chin and Brown, 2000; Cole, 2008; Stacy and Shihab, 2010; Myers, 2014). However, implementing meta-heuristic strategy to improve the academic performance of students requires careful preparation on the part of the teacher and the students. The teacher needs to ensure that, all the key elements of meta-heuristic strategyis put in place.

The effect of gender on learning outcomes in sciences is still on issues of debate among educators as a result of conflicting results from studies that focus on gender and performance. Researchers have come up with different findings on the effect of gender on learning outcomes. While some found no significant differences based on gender, Morribend (2004); Chukwuka (2005); Ogunleye (2002); Raimi (2003) individually reported that, males perform better than their female counterparts in science subjects.

Some researchers reported significant difference in performance in favour of males while other did not (Ivowi, 2003; Duyilemi, 2004). Hence, the need for further studies on the effect of gender on leaning outcomes of pre-service teachers especially in the area of science learning; such findings would provide information on appropriate strategies for both sexes. Solomon (2004) in his study of gender differences and students performance in secondary school Biology, found out that boys performed better than girls in all schools taken as a group and a single sex school as shown by their mean score (52.2 for boys and 49.8 for girls).

Research on gender and gender related were inconclusive. Alfa (2007) reported that, most researchers found boys performing better than girls especially in order knowledge; a few other found girls out performing while others established no significant differences especially during early education. Also, the largest differences between boys and girls achievement lied on the affective domain that is attitude. Bichi (2004) supported that, boys performed well in any rigorous work while girls showed to settle for less rigorous work girls perform better than boys in problem solving type activities.

Huber and Moore (2011) stressed that, instructional materials and strategies were important in enhancing women participate in science especially when they were introduced to them at tender age through manipulative toys that allow making connections between object and numbers. Similarly, Penick (2009) opined that, lack of instructional materials is a factor responsible for woman's backwardness in science literacy. Thus, Olagunji (2001) opined that, allowing girls to participate in activity based learning should encourage their performance. So, addressing the issues, the investigator had categorically investigated the effect of meta-heuristic strategy on interest, performance and retention in settlement concepts among secondary Geography students in Minna Education Zone, Niger State. Hence, the findings of the study portrayed that, the exposure of students to the instructional approach had positive effect on interest, academic performance and retention of both male and female students in learning settlement concepts of Geographyin Minna Education Zone. As a result of that, the teaching method is gender friendly.

2.6Interest and Academic Performance in Geography

Learning is all about absorption, processing and retaining. That is why; it is going hand in hand with interest, because you could never involve yourself on that thing that you may not have interest on it. Leon (2015) disclosed that, the introduction of novelty into the teaching-learning process creates interest in the individual when the teacher presents the subject matter

in a variety of ways to maintain the curiosity that arouse the interest of the students. Agbenyeku (2011) reported that, not only the down ward trend in the performance in science subjects but also the result getting lower in approaching solving problems also the fair of failure also shift interest of students away from studying geography.

Obeka (2010) defined interest as the course of certain actions which acts as motivations that propels to act in certain ways and as the effect of an activity from which a child is learnt to pay attention as the lesson goes on if he or she is interested in the particular lesson and the method of learning. It is a type of attitude when share in some characteristics of cognitive, affective and psycho or components. Aggarwal (2008) defined interest as a feeling that prompts us to spontaneous activity. It is the motivating force that impels us to attend to a person, a thing, or an activity as well as effective experience that has been stimulated by the activity itself. Interest is also aroused in studies, games, literature and good conduct, the child will consider no sacrifice and great effort to attain proficiency. Thus, interest could be the cause of activity and the result of participation in activity.

Mangal (2010) observed that, interest is the key factor and driving force that helps us in paying attention as well as remaining engaged in our so attended activities. It is the great motivating force and reservoir of one's inner potential capable of moulding and shaping one's behaviour and personality make-up in a particular field. Interests are not permanent and fixed. They changed as a result of maturation, learning and other internal environmental factors. Based on conditions mentioned above, the investigator will adopt the use of meta-heuristic strategy on interest of students in learning settlement as concepts of Geography in order to examine whether or not, that interest is motivating force capable of shaping and broadens learners' behaviour.

Obeka (2010) observed that, in spite of zeal, determination and sincere interest, some students' interest and ability could be clambered by the use of inappropriate teaching method

such as the traditional lecture. Other factors affecting interest in learning as pointed by Aggarwal (2008); Mangal (2010) were; personal factors (socio-economic status, learners mental health and development, his age, sex, child's ideals, motives and wishes): environmental factors (education and training, cultural status, opportunities to the child for exploring interests). Interest is now recognized to be a critical cognitive and affective motivational variable that guides attention, facilitates learning in different content areas and for learners of all ages and develops through experiences (Renninger and Hiddi, 2011).

Interest of the learner could be measured. Bredderman (2014) posited that, scholars attention on knowing the interest of an individual can be attributed to four factors; interest is an impelling factor; his relationship with abilities; his indicating probability of the actual work relating to a subject; and measurement may suggest alternative fields-academic and vocational which the students have not yet seriously considered. Scholars (Aggarwal, 2008; Mangal, 2010; Renninger and Hiddi, 2011) have identified variety of methods by which interest could be measured. Result of studies on EPODEWALAD and Power Simulation Games of Geographical and Environmental Education by Obeka (2009) showed that, students taught using EPODEWALAD simulation displayed greater interest in the environmental concept of geography than lecture group. The use of technology increased students' interest and attention towards statistical concepts.

It made learner sees where it could be more interesting. It is a less boring way of learning. It is interesting to see how statistics could work (Neumann and Hood, 2011). In this study, interest is considered as a variable to be measured in both control and experimental groups. Based on above explanations, the investigator adapted the use of meta-heuristic strategy on interest of secondary Geography students in learning settlement concepts of Geography. Consequently, the findings of the study indicated that, interest is motivating factor capable of

shaping and broadens learners' behaviourin acquiring meaningful knowledge of settlement concepts of Geographyin Minna Education Zone

2.7 Retention and Academic Performance in Geography

Retention is defined as a preservative factor of the mind. The mind acquired the material of knowledge through sensation and perception. These are to acquire materials in the mind need to preserve information and images for knowledge to develop. Whenever a simulating situation occurs retained images are received or reproduced to make memorization possible Maikano (2016). Agbeyanku (2011) explained that, retention of concept learnt would help in reflective thinking and the use of the retained concepts be used in creative way to solve day to day problem. Goldstain (2010) associated retention with long term memory, according to him retention focused not only on its functionality but on its duration as well because long term memory was involved with the long storage of manipulation and efficient processing of information. Martinez (2000) conceived retention as a process in which information was encoded, saved and retrieved. Encoding or registration allows information that is from outside world to reach our senses on the form of chemical and physical stimuli, it involves receiving, processing and containing of received information. Thestudy usedmeta-heuristic strategy on retention among secondary Geography students in learning settlement as concept of Geography in order to examine whether the instructional strategyis capable of enhancing the students' retention ability that would ascertain a meaningful learning.

Retention is seen by Beer (2010) as tool employed by learners to assist them perform efficiently and effectively in all aspect of life and particularly in the school. This essential tool was needed by learners to maintain and manipulate information in the mine for a brief and long period of time. Retention was the ability to actively hold information in the mind needed to the complete task such as active thinking comprehension and learning. Retention and performance in science and technology was an important need that is becoming highly

felt by the Nigerian populace. Mburu (2013) suggested that, retention was related to academic performance on the domain of physical sciences and used academic performance enhanced by a number of abilities, storage, capacities, processing efficiency, the ability to combine storage and processing the ability to inhibit irrelevant information, the quality of knowledge representation and the ability to use efficient strategies in the face of interfering processes and distraction.

The level of retention is determined by the nature of material coded (Bichi, 2006; Agbeyenku, 2011). This appropriate coding of incoming information provides the index that may be consulted so that retention takes place without an elaborate search in the memory (Bichi, 2002). Retention took place when learning is coded into memory, that understanding and retention are products of meaningful learning. So when teaching is effective and meaningful to the student, it inclines to build and maintain memory for a task (Suleiman, 2015). Memory is characterized by a large capacity; it could hold and accept a large amount of new information at one time the capacity of the memory makes it convenient to assimilate a large chunk of information simultaneously (Riordan, 2008). Learners at school need this memory on a daily basis for variety of task and may assist in remembering task, irrelevant information and improve performance on cognitive task. Agbeyenku (2011) outlined the following factors affecting student's retention in relation to their academic performances in sciences as:

i. Thinking style of the individual learners
ii. The age of the learners
iii. Nature of materials to be learnt
iv. Teacher's method of teaching.

Hence, conservative concepts need to be presented to learners in a way or method that touches learners' sub-consciousness which can trigger quick recalling of concepts being

taught or learnt. One of the important aims of school instruction as observed by Myers (2016) is to encourage the learners to acquire and to retain the knowledge imparted in school for future use in school life and in meeting out-off school life problems of the present and future, hence, it is very essential to take proper steps to enable students retain and recall easily. Retention is the ability to retain and later recall information or knowledge gained after learning Bichi (2006). The term can be regarded as the process of relegation of the past experience in the sub-conscious mind of the individual in the form of mental experience (Aggarwal, 2008). It is one of the four main elements of memory (others are learning, recall and recognition). However, Mangal (2010) reported that, these four elements have been replaced by three distinct stages (encoding, storage and retrieval). The storage stage is concerned with the power of retention of encoded information.

Educational psychologists have used retention as one of the criteria for distinguishing between short term and immediate memory. Hedges & Woodworth (2010) ascertained that, in immediate memory, the retention time was less than one second while in short term memory the period of retention could be extended to a quite a longer duration as a result of the proper efforts and rehearsal by learners. Retention of learned materials could be measured. A good memory and retention lead to meaningful learning leading to production of a series of changes within our entire cognitive structure, modifying existing concepts and forming new linkages between concepts as observed by Ausubel (1968). Meaningful learning is lasting and powerful over rote learning because the later was easily forgotten and not easily applied in new learning or problem solving.

However, many researchers have also investigated and defined several variables that affect knowledge of retention. Obeka (2010) stated that, these variables include the type and content of tasks to be learned, amount of original learning, instructional strategy used and length of retention interval. It is not uncommon for geography students to learn material, take

examination and forget the material there after.Hence, the researcher used meta-heuristic strategy and taught studentssettlement concepts so as to improve the retention abilityof students, based on the findings of the study, the instructional approach has improved students' retention ability and ascertained acquisition of meaningful knowledgeof settlement concepts amongsecondary Geography students in Minna Education Zone, Niger State..

2.8 Overview of Similar Studies

The study investigated the Effect of Meta-Heuristic Strategy on Interest, Performance and Retention in Settlement Concepts among Secondary Geography Students in Minna Education Zone, Niger State. Basically, various studies/researches had been conducted in this country or elsewhere in the world, which are either directly or indirectly related to the study. The researcher examined and looked at some of these studies one after the other. Therefore, link these studies with present study to indicate the uniqueness of the current study.

Some studies reviewed have used meta-heuristic strategy in various subject areas such as Biology, Chemistry, Physics, Integrated Science, Geography and Geology. However, in the field of Geography particularly on the settlement concepts no much works have been carried out on the Effects of Meta-Heuristic Strategy on Interest, Retention and Performance in Settlement Concepts among Secondary Geography Students in Minna Education Zone, Niger State. This informed the investigator choice of the study.

Lawan (2017) studied the impact of heuristic instructional strategy on self-efficacy, anxiety and academic performance in ecology among secondary school students of varied class-sizes. The study employed pretest and posttest experimental and control group design. The population of the study consists of 4,301 SSII students under Dala Education Zone. A sample of 250 students selected from 4 schools out of 21 in the zone was used. The schools were randomly sampled after a pretest that ascertained that learners were academically equivalent.

The schools were randomly assigned into experimental and control groups containing separate male and female schools. One intact science class was used from each school and the students were randomly divided into small and large class-sizes. The experimental groups were taught ecology concept using the heuristic model while the control groups were taught the same concept using conventional lecture method. The groups were posttested using three instruments for data collection. Ecology Performance Test (EPT) of 40 objective test items with reliability coefficient of 0.81 was developed. The Ecology Self-efficacy Instrument (ESEI) developed on a five point likert's scale with reliability coefficient of 0.67 and Students Anxiety Questionnaire (SAQ) develop on a five point likert's scale with reliability coefficient of 0.73 was adapted and adopted respectively. The data collected was analyzed to answer the research questions and the null hypotheses tested. The research questions were answered using descriptive statistics. The null hypotheses on performance were tested using the One way Analysis of Variance (ANOVA) and independent t- test statistics while those on self-efficacy and anxiety were tested using Mann-Whitney U test at p=0.05. The results revealed that there is significant difference in the academic performance of the experimental and control groups in favor of experimental groups. The study concluded that instructional strategies adapted by teachers affect students' academic performance and heuristic instructional strategy is a viable innovation to the enhancement of students' academic performance, self-efficacy and hence reduce anxiety in large class of ecology concept. It is also gender friendly. It recommends that teachers should incorporate the use of heuristic teaching in their instructions. The previous study has not investigated on a variable which is interest and retention. After all, this has notified the current study to fill some gaps that prevail between the two studies. The previous study usedOne way Analysis of Variance (ANOVA), independent t-test statistics and Mann-Whitney (U-test) to analysed the data whereby the current study used independent t-test statistics and Mann-Whitney (U-test) to

analysed the data.The previous study took place at Dala Education Zone, Kano in 2017whereby the present study was conducted in Minna Education Zone, Niger State in 2019. As a result of the literature reviewed, the researcherused meta-heuristicstrategy and taught students settlement concepts. And determined that, according to the findings of the study, the instructional strategy hasimproved the students' interest and retention abilityinterns of acquisition of meaningful ideas of settlement concepts among secondary Geography students in Minna Education Zone.

Zakariya (2017) investigated the Impact of Metacognitive Strategy on Attitude, Retention and Performance in Calculus among Colleges of Education Students in North-central Zone, Nigeria. The study adapted a Pre-test, Post-test, post-post-test quasi-experimental design. The study used 135(83 males and 52 females) NCE II calculus students from two colleges of education, North-Central Zone, Nigeria. The experimental group consisted of 65 (42 males and 23 females) students, while the control group consisted of 70 (41 males and 29 females) students. The researcher developed and, validated four instruments. These include: Calculus Pre-test (CPT), Calculus Achievement Test (CAT), an eight item theory questions with reliability coefficient of 0.78. Metacognitive Teaching Strategy (MTS) and Attitude Toward Calculus Inventory (ATCI), a thirty item adopted on a five point Likert-type scales with reliability coefficient of 6.72. The experimental period lasted for six weeks during which the control group was taught using lecture method while the experimental group was taught using Metacognitive Teaching Strategy. Seven research questions were answered and their corresponding seven research hypotheses were tested. The research questions were answered using descriptive statistics of mean and standard deviation; Hypotheses testing were done using inferential statistics of t-test for equality of means of independent sample, Mann-Whitney U test and Spearman's rank correlation test at $p < 0.05$, level of significance. There was a significant difference between the post-test mean scores of the experimental and

control groups in favour of the experimental group. There was a significant difference in attitude change between the experimental and control groups. However, there was no significant difference in attitude change of the subjects in the control groups. There was a significant difference in the retention ability between the experimental and the control groups. While, there was no significant difference in retention ability of the subjects in the control groups. Strong and positive relationship exist between attitude and performance. It is recommended that lecturers should use metacognitive teaching strategy in teaching mathematics. Although, the previous study used performance and science skills acquisition while the present study used interest and retention in addition so as to examine the vacuum that exists between them. The previous study used independent t-test statistics and Mann-Whitney (U-test) to analysed the data whereby the current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data.Based on the overviewed of the study, the researcher used meta-heuristic strategy and taught studentssettlement concepts so as to improve the interest and retention abilityof students, based on the findings of the study, the instructional approach has improved students' interest and retention ability, again ascertained attainment of meaningful knowledgeof settlement concepts amongsecondary Geography students in Minna Education Zone, Niger State.

Ulrike, Thomas, Nathen and Anne (2012) explored students' learning-related cognition prior to an in-class performance with focus on Meta-Heuristic Strategy in Mathematics in Germany. A sample of 70 students from population of 500 students were used. Two research questions with their corresponding hypotheses were used. Data were collected using Personal Digital Assistant (PDA). ANOVA was used to analyse the data. The result in indicated that, experimental group performed significantly greater than the control group. The previous study has not examined on interest and retention. This has given the researcher some clues about the gaps that exist between the previous and current study in which the investigator

verified upon. The previous study usedANOVA to analysed the data whereby the current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data. The former study was conducted inGermany 2012 insubject area of Mathematics, hence, the present study was conducted in Minna Education Zone, Niger State in 2019.Therefore, the investigator determined the effect of meta-heuristic strategy on interestand retention of students in learning settlement concepts of Geography. As a result of that, the findings of the study indicated that, interestand retention are motivating factors capable of shaping and broadens learners' behaviourinterns of acquiring meaningful knowledge of settlement concepts of Geographyin Minna Education Zone.

Surah(2018) studied the effectiveness of using metacognitive prompts in improving scores on a genetic test among high school students in Western Kenya. The study used quasi-experimental control group design involving 2x2x3 factorial matrix also investigated the interacting effects of metacognitive prompting and self-efficacy beliefs while controlling for gender. A total of 2,139 form four (grade 12) students from intact classes participated in the study that was carried out in 17 high schools. Three validated instruments: Metacognitive Prompting Questionnaire (MPG), Self-efficacy Questionnaire (SEQ) and Genetics Test (GT) were used for data collection. Data were analysed both descriptively (means and standard deviation) and inferentially through a 2x2x3 Analysis of Covariance (ANCOVA). Findings showed that testing method (metacognitive prompting versus conventional) and self-efficacy beliefs had statistically significant main effects on students genetics test score ($F(1,2132) = 4.568$, $p = 0.033$) and ($F\ (1,2132) = 963.740$, $p < 0.001$) respectively. This implied that use of metacognitive prompts had superior effects. It also implied that students who are highly efficacious do better on tests than students with low self-efficacy. There were no significant 2-way and 3-way interaction effects of variables on genetics test score. These findings have implications for Biology teachers who are implored to adapt the use of metacognitive

prompts during testing and to promote self-efficacy beliefs among students. The former study has not verified on interest and retention its study. So, this informed the researcher to investigate on the spaces that prevail between the former and the current study. The previous study usedAnalysis of Covariance (ANCOVA) to analysed the data whereby the current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data.The former study was conducted at Western Kenya 2008 insubject area of Biology, hence, the present study was conducted in Minna Education Zone, Niger State in 2019.Based on the overviewed of the study, the researcher used meta-heuristic strategy and taught studentssettlement concepts so as to improve the interest andretention abilityof students, according to the findings of the study, the instructional approach has improved students' interest and retention ability, alsoascertained attainment of meaningful knowledgeof settlement concepts amongsecondary Geography students in Minna Education Zone, Niger State.

Najafzadeh(2018) investigated the relationship between metacognitive strategies on academic enthusiasm and academic resiliency in second elementary school and first period high school students. A total of 3,979 students in the plain of Rokh were selected, using Cochran formula and cluster sampling 350 students were selected. Students responded to the metacognitive, study enthusiasm and resiliency questionnaires. The results showed that metacognitive and resiliency strategies could significantly predict 53.1 percent of variations in resiliency variables. It was also observed that the dimensions of metacognitive strategies, self-consciousness, positive beliefs, uncertainty and negative beliefs had the ability to predict resiliency, and the dimension of controlling the thought could not significantly increase the predictive value, as well as all aspects of the academic resiliency has the ability to predict the resiliency variable. The previous study has not analysed on interest and retention. Basically, this resulted to differences between the previous and current study which the investigator

researched on. The previous study usedCochran formula to analysed the data whereby the current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data.The previous study took place in Rokh whereby the current study was conducted in Minna Education Zone, Niger State in 2019. Therefore, the researcher used meta-heuristic strategy and taught studentssettlement concepts so as to enhance the interest andretention abilityof students, based on the findings of the study, the teaching method has improved students' interest and retention ability, also acquired meaningful skillsof settlement concepts amongsecondary Geography students in Minna Education Zone, Niger State.

Coskun (2018) examined the University Students' Meta-Cognitive Thinking Skills. The research used descriptive study in the screening model. The study was carried out with 407 students from the faculty of physical education at Kahramanmaras Sutu, Oman University Turkey. The sample was collected by convenience sampling method. Personal Information Form and Metacognitive Thinking Skills Scale were used as data collection tools. The data were analysed with the use of SPSS 15.0. The finding showed that, there was increased in the level of metacognitive thinking skills. Also, the finding showed that, the students taught using metacognitive thinking skills in education performed significantly better than those taught without metacognitive thinking skills. Hence, the study recommends the use of metacognitive strategy in teaching of science subjects. The previous study has not examined on interest, performance and retention. This has given the research some clues about the vacuums that appear between the former and current study in which the investigator checked upon. The current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data.The former study was conducted at Kahramanmaras Sutu, Oman University Turkey 2018 insubject area of Physic education, hence, the present study was conducted in Minna Education Zone, Niger State in 2019.Based on the points explained, the researcherused meta-heuristicstrategy and taught students settlement concepts. Again, examined that,

theinstructional method hasimproved the students' interest, academic performance and retention abilityin acquiring meaningful ideas of settlement concepts among secondary Geography students in Minna Education Zone.

Mouna and Mousa (2012) determined the impact of using heuristic teaching approach for teaching mathematics lo tenth grade students at King Abdullah School in Irbid Jordan. To achieve the goals of the study, pretest and posttest were constructed to measure students' performance in mathematics. The sample for this study consisted of 142 students, 69 male and 73 female students'. The subject of the study was distributed into an experimental group and a control group. The experimental group was taught mathematics using the heuristic approach while the control group was taught mathematics using the traditional lecture method of teaching. The subjects were 34 male students for the experimental group and 35 male students for the control group, while the female students for the experimental andcontrol group were 37 and 36 respectively. Those subjects were distributed into two purposefully selected sections in the school. Descriptive statistical analyses were used (means and standard deviation) for the pre and post- test for both the experimental and control groups, t-test and Two way ANOVA were used to make comparison between the experimental and control groups. The findings of the study indicated that there were statistically significant differences in the pre-post between the control and the experimental groups in favour of the experimental groups, and there was no statistically significant difference in the students' performance due to gender. Finally the researcher propose some recommendations that science teachers should adopt using heuristic teaching approach as it enhanced students' performance in sciences and mathematics. The previous study has not investigated on variable which are interest, retention and performance. This has notified the current study to fill some gaps that appear between the two studies.The previous study used t-test and Two way ANOVA to analysed the data whereby the current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data. The previous study took place at King Abdullah School in Irbid, Jordan whereby the present study was

conducted in Minna Education Zone, Niger State in 2019.Based on the literature reviewed, the researcherused meta-heuristicstrategy and taught students settlement concepts. And determined that, according to the findings of the study, the instructional strategy hasimproved the students' interest, academic performance and retention abilityinterns of acquisition of meaningful ideas of settlement concepts among secondary Geography students in Minna Education Zone.

Usman (2012) conducted study to find out the effectiveness of heuristic teaching and lecture method on performance and anxiety in varied class-sizes. The study adopted quasi-experimental design. A total sample of 140 students consisting of 66 males and 77 females were selected by a random sampling technique from a population of 680 SSII chemistry students drawn from all the 13 coeducational secondary school in Ife south Local Government area of Osun State, Nigeria. The data collected were analysed using Analysis of Variance (ANOVA) and the result of the findings showed that heuristic learning strategy was the most effective in enhancing students' performance in chemistry in all classes (large, medium and small) compared 10 controls. The result also showed that anxiety was drastically reduced in experimental groups than control. The former study was conducted in Chemistry and has not studied on interest and retention in the study. So, this informed the researcher to check on the gaps that exist between the former and the current study.The previous study used Analysis of Variance (ANOVA) to analysed the data whereby the current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data.The former study was conducted in Ife south Local Government area of Osun State 2012 insubject area of Chemistry whereby the present study was conducted in Minna Education Zone Niger State in 2019. As a result of that, the researcher used meta-heuristic strategy and taught studentssettlement concepts in order to increase the interest andretention abilityof students, based on the findings of the study, the pedagogical approach has improved students' interest and retention ability, also ascertained meaningful

knowledgeof settlement concepts amongsecondary Geography students in Minna Education Zone, Niger State.

Teoh, Parmjit, Cheong and Kor. (2013) investigated the heuristic approach experience in solving mathematical problems to tenth grade students in Shah Alam Selango University, Malaysia. Pretest and posttest were constructed to measure students' performance in problem solving in mathematics. The sample for this study consisted of 90 students. The subject of the study wasdistributed into an experimental group and a control group. The experimental group was taughtproblem solving in mathematics using heuristic approach while the control group was taught mathematics using the traditional lecture method of teaching. The subjects were 45 students for the experimental group and 49 for the control group. Descriptive statistical analyses were used at the pre and post-test for both the experimental and control groups, t-test and two way ANOVA were used to make comparison between the experimental and control groups. The findings of the study indicated that there were statistically significant differences in the posttest between the control and the experimental groups in favour of the experimental group. Finally, the researcher proposed some recommendations that science teachers should adopt using heuristic teaching approach as it enhance students' performance in sciences and mathematics.The previous study used t-test and two way ANOVA to analysed the data whereby the current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data.The previous study was conducted in Malaysia 2013 insubject area of mathematics while the current study was conducted in Minna Education Zone Niger State in 2019. Also, the study had not examined on interest and retention in which the present study had found out and verified on the spaces that exist between the two studies.Consequently, the investigator adapted meta-heuristic strategy and taught studentssettlement concepts in order to enhance the interest andretention abilityof students, based on the findings of the study, the teaching method has increased students' interest and retention ability, also received meaningful

knowledgeof settlement concepts amongsecondary Geography students in Minna Education Zone, Niger State.

In another study reviewed from work of Badi and Chukwu (2013) whom investigated the efficacy of heuristic strategy and gender on students' achievement in Ecology concept in Aguata Education Zone of Anambra State, Nigeria. Two research questions and three hypotheses guided the study. The study adopted Quasi-experimental design. Specifically the design is pretest-posttest non-equivalent control group design. The instrument used is Ecology Achievement Test (EAT). The population of the study comprised1731 SS11 students. The sample size for this study was 228 SS11 students from two co-educational secondary schools in the zone. Mean and standard deviation were used to analyse the research questions while the hypotheses were tested at p=0.05 level of significance using Analysis of Covariance (ANCOVA). 'The results among others showed that students taught ecology using heuristic strategy performed significantly higher in EAT than those taught ecology using the conventional lecture method. The result further indicated that male students slightly performed better than female students.The previous study has not examined on some variables which are interest and retention Again, the former study left two important dependent variables which are interest and retention.The previous study used Analysis of Covariance (ANCOVA)to analysed the data whereby the current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data. The previous study took place in Anambra State 2013 in subject area of Biology Nigeria whereby the current study was conducted in Minna Education Zone Niger State in 2019.So, the investigator used meta-heuristic strategy and taught studentssettlement concepts in order to enhance the interest andretention abilityof students, based on the findings of the study, the teaching method has increased students' interest and retention ability, also received meaningful knowledgeof settlement concepts amongsecondary Geography students in Minna Education Zone, Niger State.

Okechukwu and Umeh (2014) examined the effects of heuristic method of teaching on students' performance in algebra. The study employed a non-equivalent control group quasi experimental design. The study was carried out in North-Western Zone of Anambra State, Nigeria. 2 schools were randomly selected out of 8 schools in the zone used for the study. A total sample of 45 students consisting of 25 males and 20 females were selected by a random sampling technique from a population of 102 students. The treatment group was taught topics in theory of indicesusing heuristic method while control group was taught the same topics using Conventional Approach. At the onset of the experiment pre-test (Algebra Performance Test) was administered to the students in the two groups while at the end of the treatment session that lasted eight weeks the same Algebra Performance Test was administered to the students as post-test. Three research questions and three Null hypotheses guided the study. The research questions were answered using mean and standard deviation while the Null hypotheses were tested at an alpha level of 0.05 using Analysis of Covariance (ANCOVA). The Results of the study show that the heuristic approach is superior to the conventional approach in fostering students' performance in linear algebra. The study further showed that male students taught linear algebra using the heuristic method performed better than their female counterparts and that there is no interaction between method and gender on students' performance in linear algebra.The previous study used Analysis of Covariance (ANCOVA) to analysed the data whereby the current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data.The previous study took place in North-Western Zone of Anambra State 2014, Nigeria whereby the current study was conducted in Minna Education Zone Niger State in 2019.The previous study has not examined on some variables which are interest and retention. In short, this has given the current study a clue to investigate on these bridges that prevail between the current and previous study. Hence, the researcher adapted meta-heuristic strategy and taught studentssettlement concepts so as to improve the interest

andretention abilityof students, based on the findings of the study, the instructional method has increased students' interest and retention ability, also acquired meaningful skillsof settlement concepts amongsecondary Geography students in Minna Education Zone, Niger State.

Wole (2011) studied the effect of heuristic and expository instructional methods on attitude and self-efficacy among biology students. The study adopts quasi design. The population of the study was 326 SSI students. The sample for this study consisted of 240 SSI biology students drawn from six schools in Oyo south, Oyo state, Nigeria. The subjects of the study were distributed into an experimental and control groups. The experimental group was taught biology using heuristic approach while the control group was taught same concept using the traditional lecture method of teaching. The subjects were 130 students for the experimental group and 110 for the control group. A 40-item Scientific Attitude Questionnaire with a five-point scale and 20-item self-efficacy scale questionnaire was developed. It was found out that, the experimental groups i.e. those taught using heuristic method had a significantly more favourable attitude to biology and with high self-efficacy than the control group, in addition the study revealed a non-significant difference in attitude and efficacy between male and female students exposed to the two teaching methods.The current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data.The former study was conducted in Oyo State 2011in subject area of Biologywhile the current study took placein Minna Education Zone Niger State in 2019. Moreover, the study was not carried out on interest, retention as well as performance but was carried out on attitude and self-efficiency. Consequently, this notified the investigator on the vacuums that appear between the current and the previous study. Based on the literature reviewed, the researcherused meta-heuristicstrategy and taught students settlement concepts. And examined that, according to the findings of the study, the instructional strategy hasenhanced the students' interest,

academic performance and retention abilityinterns of acquisition of meaningful ideas of settlement concepts among secondary Geography students in Minna Education Zone.

In another study from Zakaria, Solfitri, Doud and Zainal Abidin (2013) who investigated the efficacy of heuristic learning on students mathematics achievement in secondary school students in Pakanbaru, Indonesia. The sample of this study consisted of 61 form three students. A pretest was giventreatment. After treatment a post test was administered to both groups. Two types of instrumentswere used to collect data. The Mathematics Achievement Test and Open-ended Questions were used for heuristic learning. The pre and post test data were analysed using t test. Content analysis was used for the open-ended questions on heuristic. The result showed that there was a significant difference of mean in student's mathematics achievement between the heuristic group and the traditional group. Content analysis data revealed that students in the heuristic group were able to increase their understanding and to develop their self-confidence.Although, the former study left out some variables which are interest and retention. Thus, this calibrated the differences that exist between the former and the current study which the investigator researched on.The previous study was conducted in Pakambaru, Idonesia 2013 in subject area of mathematics and determined on performance whereas the current study was conducted in Minna Education Zone, Niger State in 2019. So, based on the overviewed of the study, the investigator used meta-heuristic strategy and taught studentssettlement concepts in order to enhance the interest andretention abilityof students, based on the findings of the study, the teaching method has increased students' interest and retention ability, also received meaningful knowledgeof settlement concepts amongsecondary Geography students in Minna Education Zone, Niger State.

Young, Tiz and Young (2017) examined the Meta-Analysis of the Effects of Out-of-School Time on the Student Interest in STEM. This study was guided by the following research questions: (1) How effective is OST as a means to foster student interest in STEM? (2) How

does the effectiveness of OST differ by program and study characteristics? A total of 19 independents effect sizes were extracted from 15 studies investigating the effect of out-of-school time (OST) on STEM interest. Included studies were representative of K-12 settings in the United States from 2009-2015. Specifically studies were included if they directly assessed the effects of OST on STEM interest, and provided sufficient data to calculate an effect size. The status of publication was not a constraint on this investigation, thus grey literature was included along with journal articles to provide a more representative sample of studies. The results suggest that out-of-school time has a positive effect on student interest in STEM. Furthermore, the variation in these effects is moderated by program focus, grade level, and the quality of the research design. The effects of out-of-school time on STEM interest are synthesized, and implications for teaching and practice are provided. The previous study has not examined some variables which are performance and retention. Basically, this has given the current study clue to investigate on those bridges that appear between the current and previous study.The current study also used independent t-test statistics and Mann-Whitney (U-test) to analysed the data. The previous study was conducted at United States from2009-2015 whereas the current study was conducted in Minna Education Zone Niger State in 2019.Based on the literature reviewed, the researcher adapted meta-heuristicstrategy and taught students settlement concepts. And determined that, according to the findings of the study, the pedagogical approach hasimproved the students'academic performance and retention abilityinterns of acquisition of meaningful skills of settlement concepts among secondary Geography students in Minna Education Zone.

2.9 Implication of Literature Reviewed for the Present Study

Meta-heuristic strategy is a technique of acquiring skills for students studying Geography which has to do with ways of learning new skills. This is because, through the processes learners gain first-hand experience which as to do with hands-on and minds-on as well as

self-centred approach. Meta-heuristic strategy often associated with pedagogical approaches that promote active learning by doing, which can help students develop self-directedness in learning to demonstrate good understanding of learning approach. These assist students to gain deeper self-knowledge of their learning style, strength, interest and develop techniques to determine their readiness level in different content areas as well as sense of their own identities as learners (Guglinelmino, 2013; Havenga, 2015; Gezer-Templeton, 2017).

From the reviewed of researches in chapter two of this study, it showed that, the researchers did not compare the academic performance, retention and interest ability of students in learning settlement concepts of Geography using meta-heuristic strategy. Therefore, the study was carried on the effect of meta-heuristic strategy on interest, performance and retention in settlement concepts among secondary Geography students in Minna Education Zone, Niger State. Based on the literature reviewed and findings of the study, theresearcher had made some recommendations among which is, the teaching strategy should be used in teaching settlement concepts for senior secondary school Geography students.

By implication, apart from inappropriate methodologies employed by some senior secondary school teachers, gender disparities and poor students' academic performance in Geography are among the major issues, challenges and problems identified in the literature reviewed. The need to improve students' interest, academic performance and retention make it expedient to search for better and more improved methodology for teaching Geography. In this regard, meta-heuristic strategywas found to be effective in such subject areas as Medicine, Mathematics, Chemistry, Integrated Science, Biology, Geology, Social Studies, Agricultural Science, Economics and Geography among others. It is also discovered that, there are no much studies conducted to investigate the effect of meta-heuristic strategy on interest, academic performance and retention in settlement concepts among senior secondary Geography students in Minna Education Zone, Niger State. In addition,the study has

examined the extent in which the teaching approach had influenced the interest, academic performance and retention ability of students in learning settlement concepts of Geography in the study area. Again, the findings of the study portrayed that, the exposure of students to the instructional approach had positive effect on interest, academic performance and retention of both male and female students in learning settlement as concepts of Geographyin Minna Education Zone. As a result of that, the teaching method is gender friendly. Thestudywas quite unique from other studies reviewed, because it involved the use of interest, academic performance and retention unlike other studies that used only performance or interest. The topic taught was settlement concepts and the study paraphrased on Geography of the study area which is Minna Education Zone, Niger State

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter deals with procedures which were employed for conduct of the study. The methodology was explained under the following sub-headings.

3.2 Recognizant Survey for the Study Area

3.3 Research Design

3.4 Population of the Study

3.5 Sample and Sampling Technique

3.6 Instrumentation

3.6.1 Validation of the Instruments

3.6.2 Pilot Testing

3.6.3 Reliability of the Instruments

3.6.4 Items Analyses

3.7 Administration of Treatment

3.8 Data Collection Procedure

3.9 Procedure for Data Analyses

3.2 Recognizant Survey for the Study Area

The Minna Education Zone is the terrain where the recognizant survey case study took place. Minna is also known as capital of Niger State. The researcher undertook the recognizant survey study within as well as outskirt of Minna and discovered that, the environment is characterized with different types and patterns of settlement ranging from rural and urban settlements that undergo primary and secondary functions of settlements. The researcher undertook the recognizant survey of the study at the following areas; Minna, Chanchaga, Bosso, Tudun Fulani, Tunga, Tungan Goro, Paikoro, Shiroro, Rafi, Munya etc. The specification of the recognizant survey for the types and patterns of settlements in the study area is calibrated in Table 3.1

Table 3.1: Specification of Recognizant Survey for Settlement in the Study Area

Study Areas	Types of Settlement	Patterns of Settlement
- Minna, Chanchaga, Bosso, Paikoro, Tunga, Shiroro, Kuta.	Urban settlement	Nucleated urban areas
- Maitumbi, Mandela, Maikunkele, Tungan Goro, Tudun Fulani, Munya, Rafi, Gidan Gwanu, Kpakungu.	Urban settlement	Ring urban areas
- Gidan Mangoro, Beji, Garatu, Kpago, Sarikin Pawa, Fuka, Kwakuti, Tungan Malan, Kaffin Koro, Pina, Kuchi, Gurusu, Gurmana, Mandela.	Rural settlement	Linear rural areas
- Shanu, Gbaiko, Shatta, Mantu, Kampala, Pyata, Adunu, Farin-Doki, Tungan Amale, Gwam, Tatiko, Chimbi, Jabo-Jere, Shakwatu.	Rural settlement	Dispersed rural areas

Survey of the Study Area, (2019).

3.3 Research Design

The research design employed for the study was Quasi-experimental design, particularlythe pretest, posttest and post-posttest control groups design.The study consists of experimental and control groups. The non-equivalent control group design involving twogroups were used,

that is, Experimental Group (EG) and Control Group (CG). The Experimental Group (EG) was taught using model of Meta-Heuristic Strategy as treatment (X_1) while the Control Group (CG) was assigned to conventional method (X_0) that is, without treatment. An intact class was used for both experimental and control groups. The two groups were exposed to a pre-test ($O1_A^I$) named Settlement Concepts Performance Test (SCPT) and Settlement Inventory Interest Questionnaire (SIIQ). This is to verify the equivalence in terms of level of ability among the students such as; gender, age and ability level in learning settlement concepts of Geography. All the two groups were taught the same settlement concepts for a period of six weeks. Thereafter, a post-test ($O2_A^I$) was administered to the sample using similar items of SCPT and SIIQ to determine the effects of instructional strategy between and within the students on learner's academic performance and interest in learning settlement concepts of Geography. Based on students' retention ability, post-posttest ($O3_R$) was administered to the students two weeks later to examine the level of retention ability of students on settlement concepts. The research design notation is graphically illustrated in Figure 3.1:

$$EG_1 \longrightarrow O1^I_A \longrightarrow X_1 \longrightarrow O2^I_A \longrightarrow O3_R$$

$$CG_2 \longrightarrow O1^I_A \longrightarrow X_0 \longrightarrow O2^I_A \longrightarrow O3_R$$

Figure 3.1: Research Design

EG = Experimental Group

CG = Control Group

X1 = Treatment (Teaching using Meta-Heuristic Strategy)

Xo = No-Treatment (Teaching using Lecture Method)

O1 = Pretest Administration

O2 = Posttest Administration

O3 = Post-Posttest Administration

A = Academic Performance

I = Interest

R = Retention

3.4 Population of the Study

The target population of the study was gotten from the whole government own senior secondary schools that is, students of (SSII) those offering Geography in Niger State. Niger State is located in the North Central Geo-Political Zone of Nigeria. It has twenty-five (25) local government areas, with three (3) senatorial zones comprises of Niger South (Zone A, with two education zones; Bida and Kutigi), Niger East (Zone B, with two education zones; Minna and Suleja) and Niger North (Zone C, with three education zones; Kontagora, Borgu and Rijau). The state has seven (7) education zones. The data collected from Niger State Ministry of Education Minna indicated that, there are 273 senior secondary schools (SSS) in the state with a population of 93,900 students, consisting of 55,631 male and 38,269 female students. The state has the following seven education zones with their respective number of local government each under their jurisdiction; Bida Education Zone has four LGAs, Kutigi Education Zone has four LGAs, Minna Education Zone has five LGAs, Suleja Education Zone has four LGAs, Kontagora Education Zone four LGAs, Borgu Education Zone has two LGAs and Rijau Education Zone has two LGAs. The sequential details of the population were presented in Table 3.1 based on senatorial zones, education zones and respective local government area.

Table 3.2: Population of the Study

Senatorial Zones	Education Zones	L.G.A.	No of Schools	Types of School				Co-education (Mixed)	Population	
				Boarding		Day				
				M	F	M	F		Male	Female
NigerSouth (Zone A)	Bida Education Zone	Bida	8	1	1	2	-	4	5260	2989
		Lapai	18	1	-	1	1	15	5061	2670
		Agaie	9	1	1	3	-	4	2967	1733
		Katcha	11	-	-	-	-	11	2106	1898
		Gbako	9	1	1	-	-	7	1978	970
	Kutigi Education Zone	Lavun	16	1	-	-	1	14	2791	1987
		Edati	10	-	-	1	-	9	1787	1291
		Mokwa	15	2	-	1	1	11	3135	2010
Niger East (Zone B)	Minna Education Zone	Chanchaga	10	1	1	1	3	4	5183	4741
		Bosso	19	1	1	-	-	17	3581	2872
		Paikoro	19	1	-	-	3	15	3385	2540
		Shiroro	20	1	1	-	1	17	2922	1743
		Rafi	14	1	1	-	1	11	1829	951
	Suleja Education Zone	Suleja	18	-	-	2	4	12	2307	2805
		Gurara	13	1	1	-	-	11	2561	1089
		Tafa	7	-	1	-	-	6	1067	953
		Munya	5	-	-	-	-	5	394	267
Niger North (Zone C)	Kontagora Education Zone	Kontagora	10	2	1	1	2	4	2790	1670
		Mashegu	4	1	-	-	-	3	549	104
		Wushishi	4	1	-	-	-	3	690	429
	Borgu Education Zone	Borgu	13	1	1	1	1	9	1470	1356
		Agwara	5	-	-	1	-	4	347	211
	Rijau Education Zone	Rijau	3	-	1	-	-	2	482	228
		Magama	7	2	-	-	-	5	392	329
		Mariga	6	-	-	1	1	4	597	438
Total	7	25	273	20	12	15	19	207	55631	38269

Source: Test and Statistics Section, Zonal Education Office, Minna (2019).

3.5 Sample and Sampling Technique

A sample size of 140 senior secondary school students (SSS II) offering Geography was derived from four (4) government owned secondary schools, that is, two co-education schools constitute the sampled schools for the study which is in line with Sambo's (2008);Musa (2012); Thomas and Israel's (2014) recommendation that, a sample size of minimum number of 30 is viable for a study.

The Multi-stage stratified random sampling procedure was used in selecting the sample schools for the study. The first step was done by grouping the schools into clusters of three senatorial zones. The second step was done by grouping the school into clusters of seven education zones including the number of schools in each of the education zones and their respective local government areas. The third step was carried out by writing the names of the seven education zones on pieces of papers which are dropped inside polythene bag and shaking thoroughly, whereby the four education zones of Minna, Sulaja, Bida and Borgu were selected from the seven education zones via stratified random sampling technique. The fourth step was done by writing the names of these nominated four education zones on pieces of papers for second time which are also put into polythene bag and shaking severally again, therefore, Minna Education Zone is finally selected through random sampling method.

The Minna Education Zone that emerged as education zone for the study formedthe study area. The education zone constitutes 82 senior secondary schools having a total enrolment of twelve thousand, eight hundred and forty seven (12,847) students. Four (4) co-education schools were selected using stratified random sampling technique by balloting from 82 schools in Minna Education Zone.

The first stage of balloting was done by writing the names of 82 schools on pieces of papers and dropped inside polythene bag and shaking thoroughly, therein ten (10) schools comprising of ten (10) co-education and six (6) single schools were selected through stratified random sampling technique. The second stage of balloting was done by writing the names of these ten schools on pieces of papers and put into polythene bag, shake severally again, therein two (2) schools co-education and two (2) single schools were finally chosen.

Since, the investigator has experimental group and control group, therefore, simple random sampling technique employing simple coin tossing was used to assign the two (2) co-

education schools into experimental and control groups respectively. At the end of this exercise SSS II intact classes of Geography students from two (2) co-education and two (2) single schools formed the sample for the study. The schools chosen as sample for the study were represented in Table 3.2 with letters A-D representing the name of schools.

Table 3.3 Sample for the Study

Variable	Name of School	Type of School	Location	Male	Female	Sample
Experimental	A	Co-education	Bosso	40	37	77
	B	Single	Minna	31	-	31
	C	Single	Bosso	-	30	30
Control Group	D	Co-education	Minna	36	27	63
		Total		107	94	201

3.6 Instrumentation

Two instruments were developed by the researcher to generate data for the study, which were Settlement Concepts Performance Test (SCPT) and Settlement Inventory Interest Questionnaire (SIIO).

The Settlement Concepts Performance Test (SCPT) contained forty (40) objective items for performance test which were adapted from pass question papers of SSCE and NECO from 2010-2018. The instrument was developed based on the topic taught. The items put into consideration the following Bloom's Taxonomy of Education (Knowledge, Comprehensive, Application, Analysis, Synthesis and Evaluation).

The forty (40) items performance test were adapted from SSCE and NECO pass questions of (2010-2018) by the researcher to determine the academic performance and retention ability of students on settlement concepts. The instrument was derived on settlement concepts using the National Geography Curriculum for Senior Secondary Geography (NERDC).The SCPT comprised of forty (40) objectives multiple choice items each with four alternatives (A-D). The students were instructed to select the correct answers and each correct answer is assigned

one mark while the overall mark is forty (40) marks. The items covered all the six sub-topics on settlement concepts in order to assure equivalent distribution of the items across the sub-topics. Furthermore, the items are formulated to evaluate mainly the three learning outcomes or behavioural objectives which are cognitive, affective and psychomotor domains. The weighting is assigned to each processes primarily based on the area of coverage, work load and the time involved. See Appendix A.

The Settlement Inventory Interest Questionnaire (SIIQ) comprised of twenty (20) items on interest inventory questionnaire that were adapted from Mohammed (2017) on Geography Interest Questionnaire (GIQ) which contained twenty (20) items interest inventory questionnaire on landform processes of Geography and Asogwa (2018) to assess the interest ability of the students, before and after the treatment on settlement as concepts of Geography. The items were developed using the Likert's (1973) 5-point rating scale. These are Strongly Agreed (S.A=5), Agreed (A=4), Undecided (U=3), Disagreed (D=2) and Strongly Disagreed (S.D=1) respectively. Each option carried weight in the order of priority from 5-1 in positive interest responses and from 1-5 in negative interest responses. The students were asked to freely indicate their interest on settlements by simply ticking one from the five options that suit their interest. From the items, maximum score is 100, minimum score 20 and average score is 60. The score of 60 and above signified positive interest so reach a retain region while the score below 60 showed negative interest towards settlement concepts therefore, attained rejection region. See Appendix E.

Table 3.4: Items Specification for SCPT Construction

S/N	Topics	Weight %	Knowl. 17.5%	Comp. 15%	App. 20%	Anal. 15%	Synth. 10%	Eval. 22.5%	Total 100%
1	Settlement	22.50	2	1	2	1	1	2	9
2	Rural settlement	12.50	1	1	1	1	0	1	5
3	Urban settlement	12.50	1	1	1	1	0	1	5
4	Functions of settlement	15	1	1	1	1	1	1	6
5	Settlement patterns	20	1	1	2	1	1	2	8
6	Factors that determine settlement patterns	17.50	1	1	1	1	1	2	7
	Total	100	7	6	8	6	4	9	40

Source: (Adapted from Davis and Buckendahl, 2011; Obeka, 2012).

Keys:

Knowledge: Information retrieval.

Comprehension: Understanding the meaning of information.

Application: Using information to solve problems that have a best answer.

Analysis: Understanding parts of whole and the organization of the parts to make inferences or draw conclusion.

Synthesis: Applying knowledge and skill to produce new ideas or

Evaluation: Using information and knowledge to make judgement.

Table 3.5: Items Specifications

S/No	Topics	Number of Items	Total
1	Settlement	2,5,9,11,13,18,20,28,33	9
2	Rural settlement	1,10,25,31,35	5
3	Urban settlement	7,21,23,27,30	5
4	Functions of settlement	4,6,15,19,29,32	6
5	Settlement patterns	3,12,14,16,22,24,26,34	8
6	Factors that determine settlement patterns	8,17,36,37,38,39,40	7
		Total	40

3.6.1 Validation of the Instruments

In order to determine the extent to which the instruments designed for data collection can measure the interest, retention and performance of students in Geography. The Settlement Concepts Performance Test (SCPT) and Settlement Inventory Interest Questionnaire (SIIQ) draft were scrutinized by the three (3) members of supervisory team for the study whom are panel of experts with a qualification of PhD (that is, two people withPhD qualification) and rank of Professor (that is, three people withrank of Professor) in the field of Geography and science education at Department of Science Education, Institute of Education and twoPhD qualification holder in Department of Geography in Ahmadu Bello University, Zaria. In addition, they established the appropriate clarification and content validity of items in the test and in the questionnaire. The validators perused through the instruments and point out mistakes in terms of spelling errors, appropriate settlement terms to be used based on the students' level and made recommendations on use of appropriate terminology of settlement concepts which the researcher also put their suggestions into proper consideration and effect the corrections as observed by specialists/authority(See Appendix G).

3.6.2 Pilot Testing

The Settlement Concepts Performance Test (SCPT) and Settlement Inventory Interest Questionnaire (SIIQ) were pilot-tested on a sample of students having all the characteristic of the group in a different school not included in the selected sample for the study that was used. Forty (40) items of SCPT and twenty (20) items of SIIQ were administered on 30 SSII students of Government Day Secondary School, Minna which was not part of the sample schools but part and parcel of the population of the study. The essence of the pilot testing is to find out how the respondents could react to the instruments which are to:

v. obtain reliability coefficient of the instruments.

vi. determine the appropriateness of the items of the instruments.

vii. find out the administrative and logistic problems that may hinder the main study.

viii. verify the characteristics of the instruments' items analyses.

ix. ascertain the appropriateness of the wording of the two instruments.

x. examine the appropriate or exact length of time required to answer items in the two tests separately.

3.6.3 Reliability of the Instruments

Pilot testing for reliabilities of the research instruments was conducted using Settlement Concepts Performance Test (SCPT) and Settlement Inventory Interest Questionnaire (SIIQ) on thirty (30) SSS II Geography students of Government Day Secondary School Minna whom are not part of the sample for the study but part of the population of the study. The researcher with the help of Geography teachers in the school administered the instruments which lasted for one hour. Instructions on how to answer the questions were read and explained to the students by the researcher. This was done in order to ensure that, the students answer the questions on the instruments carefully. Problems and difficulties arising from the pilot testing were carefully noted and put into strong consideration so as to improve upon the final instruments. A test-retest method of pilot testing was employed which was conducted at the first week of pilot testing of instruments and collect back for scoring. Again, after an interval of two weeks, the same instruments were pilot tested again on the same students, which is in line with Sambo's (2008) recommendation. The scores obtained were correlated using Pearson Product Moment Correlation Statistic for SCPT while Cronbach's Coefficient Alpha Statistic was used to ascertain the internal consistency of SIIQ with the aid of excel and SPSS package.

The result obtained indicated that, the reliability coefficient of SCPT was found to be r =0.80, this indicated that, there is strong positive relationship between the first and second administration of SCPT. Therefore, the instrument is consistent and reliable for the study. (See Appendix I). Also, from the result obtained on SIIQ, 14 items were retained, 5 were reconstructed and 1 item was replaced. The reliability coefficient of SIIQ was obtained to be r = 0.70. This showed a strong internal consistency of the items of the instrument. Hence, the instrument was declared reliable to measure the interest of students in the study area (See Appendix G).

3.6.4 Items Analysis

For the purpose of standardization of the instruments, facility index and discrimination index were determined as follows:

Facility Index (F.I) of the Items in the SCPT and SIIQ

Item analysis was carried out from the pilot testing scores to determine the items' difficulty index, and discrimination index, Sambo, (2008) defined item difficulty index as a measure of percentage of candidates who got the item right over the total number of candidates that attempted the item. The facility index of an item indicates the percentage of candidates that got an item right. The following are the rightful steps in computing the facility index for each item in the test, via:

i. Rank the scores on the test from highest to lowest
ii. Identify the high scoring group and the low scoring group.
iii. Identify one third of the top scoring group and the one third of the bottom scoring group,
iv. Determine the percentage of high scores and low scores of each item.

v. Compute the item facility index by adding the percentage of those correct in low scoring and high scoring and then divide by the number of students involved in the analysis.

The quality of the two tests items was achieved by examining the Facility Index (F.I) and Discrimination Index (D.I) of the two tests items; this is because the quality of a test item depends on how far each item meets these two criteria.

It is used to separate good and bad items in the SCPT and SIIQ. However, each item must be relevant to the course content and neither too easy nor too difficult. The items are analysed to determine the Facility Index (F.I) of a test items. According to Sambo (2008) the items of facility index is the percentage of the students that got an item right over the total number of students that attempted the item and it is determined by the formula:

$F.I = \frac{R}{T} \times 100$

Where

F.I = Facility Index,

R =Number of items correctly answered.

T = Total number of items answered by the students tested.

The items are computed in line with Sambo (2008) whom reported that in the normal research literature, items with Facility Index between (40-60%) are accepted. In this study, items with facility index between (40-60%) was used. Item with facility index below or higher than (40-60%) must be changed or modified for being too difficult or simple respectively.

Discrimination Index of the Items in SCPT and SIIQ

It is the capacity of the test to discriminate or distinguish between high and low or good and weak achievers among students in the sample. It gives room for the ranking of students in the test. If an item shows positive discrimination index, it implies that large proportion of some

competent students than poor ones got the item right. In a situation whereby the item discrimination value is zero, it implies that the items are unable to distinguish between high and low achievers in a given sample of students (equal number of high and low achievers). While the negative discrimination index is indicating that more poor students got the item right compared to more competent students. The calculation is done using scores of the upper and lower groups of the total respondents. This is calculated using the formulae:

D.I = $\frac{RU-RL}{1/2(T)}$

Where:

D.I = Discrimination Index,

RU = Number of items among upper group who responded correctly to the item,

RL = Number of items among lower group who responded correctly to the items, and

T = Number of items respondents in each of the group.

In line with Sambo (2008), item with discrimination index ranges between 0.40 - 0.70 were regarded as moderately positive and were accepted for the study. And items with discrimination index which did not fall within the accepted ranges of 0.40 to 0.70 were not accepted. This is considered in selecting the final items in SCPT and SIIQ.

3.7 Administration of Treatment

The researcher visited the selected schools to seek official permission from the authorities to use the schools and facilities. Also, researcher solicited the corporation of both the staffers as well as the students in all the selected schools. The Geography teachers in all the schools were trained as research assistance. The first week of experiment was used for the administration of the pre-test to both groups to check for the students' entry behaviour. The two groups were taught the same settlement concepts for period of six weeks. Lesson plans

for the two groups contained the same topic and sub-topics. The experimental group exposed to meta-heuristic strategy while the control group was taught using lecture method. Each class has double periods of 80 minutes per week for six weeks also. At the end of the six weeks, all the members of the two groups were given 3-days for revision and post-test was administered for the two groups after treatment to measure students' interest and performance with SCPT and SIIQ respectively. Two weeks later, post-posttest was administered to the two groups to measure retention level students which is in accordance with Sambo's (2008); Musa's (2012) principles which stated that, minimum interval of two weeks between post-test and post-posttest is viable for this research nature.

The lesson plan of meta-heuristic strategy model that was used in this study is illustrated in the following flowchart adapted from Tobia's and Everson's hierarchical model.

See Appendix H.

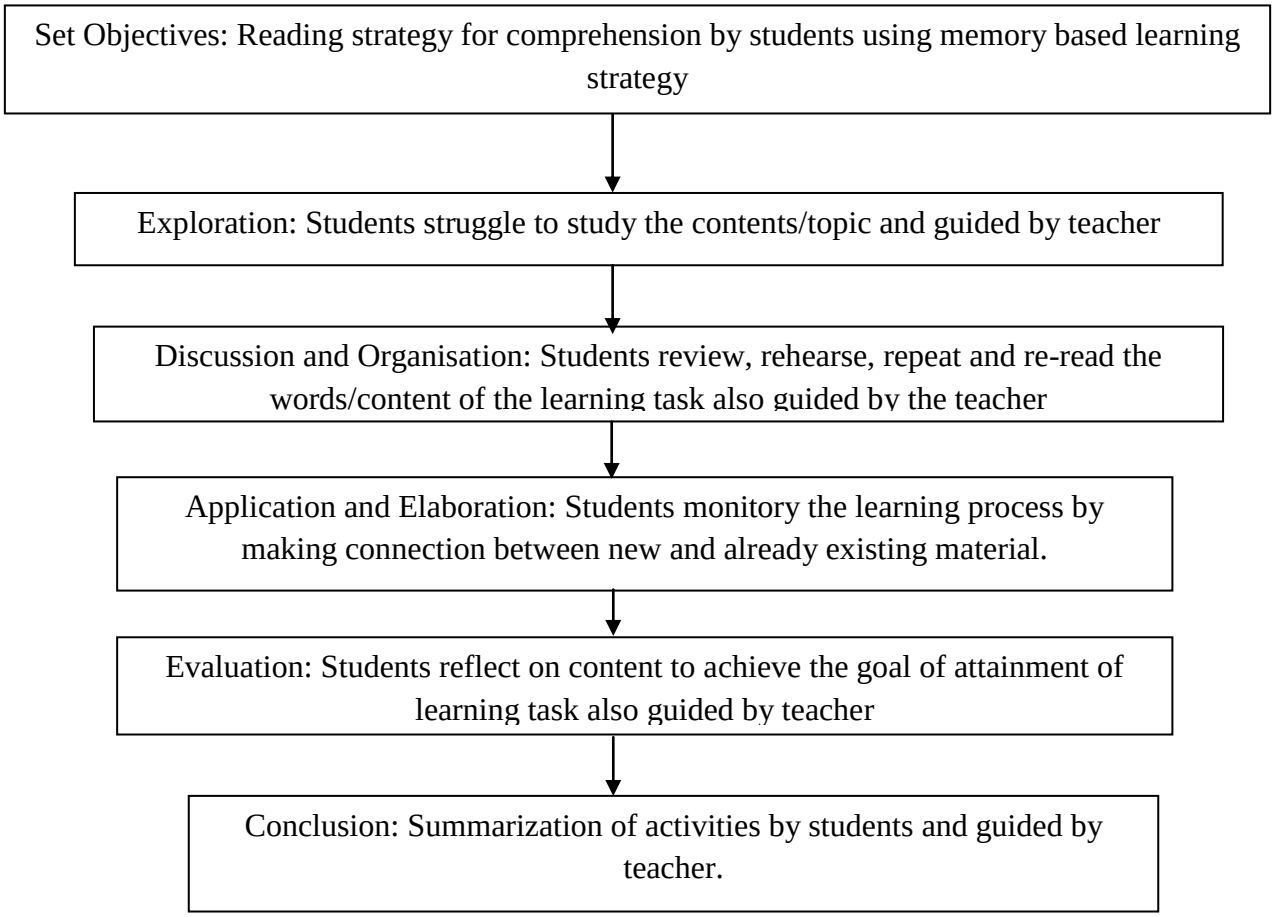


Figure 3.2: Flowchart of Meta-Heuristic Strategy.

Source: (Adapted from Tobia and Everson, 2009).

Step 1: Set objectives: The teacher informs the students to use the checklist or stated objectives before they rehearse content of the topic. Also agree on the content and knowledge learners want to acquire. Students tick off the checklist/objective to make sure not to forget anything important.

Step 2: Exploration: The teacher asks the students to read and study the content of the topic based on the stated objectives. The learners engage in reading whereby struggling to comprehend a topic using adaptive memory based learning approach of meta-heuristic strategy.

Step 3: Discussion: The teacher observes the students, while learners make discussion and organise information on relevant points to enhance mastering of the topic. At this stage, students review, rehearse, repeat and re-read the words/content of learning task in order to learn and store them in memory so as to be able to remember and apply them.

Step 4: Application and Elaboration: The teacher allows the students to participate more actively in rehearsal to involve completely in monitory the learning process by checking if they are still on the right track and adjusting their learning approach, if so required. Also, making connections between new and already existing material in order to restructure and encode the information of the learning task to facilitate the storage of this knowledge in the long-term memory.

Step 5: Evaluation: After completing the task and reconsider either the process or reflect on the product, if there are problems or mistakes. The students also reflect again on the stated objectives thereby perceiving themselves want to master skills, obtaining high grades, achieving a good performance or evaluation by others. Students can also reflect on their performance individually. This thinking skills enable learners to think again in order to get information stores in memory which results to ability to make application, analysis, conclusion and realisation of goal.

Control Group: The students were exposed to teaching using lecture method. At the beginning the teacher introduced the lesson by presenting the objectives of the lesson to the students. This is followed by verbal presentation of contents where students are encouraged to listen and write down notes. After the lesson, the teacher opened a discussion for the lesson. Comments, questions and discussion are entertained again and points are clarified. See Appendix I.

3.8 Data Collection Procedure

For the purpose of data collection, the following sequential steps were used. The Settlement Concepts Performance Test (SCPT) and Settlement Inventory Interest Questionnaire (SIIQ) following the use of pre-test, post-test and post-posttest administered by the researcher through the use of marking scheme so as to obtain information from the students. The data collected after marking the students' answer scriptswere computed into experimental and control groups. Thereafter, the scores collected from tests were recorded, calculated, and subjected to data analyses respectively.

3.9 Procedure for Data Analyses

The data collected were subjected to analyses at two different levels, via descriptive and inferential levels. At the descriptive level, the descriptive statistics of mean and standard deviation were used to respond to research questions. While at the inferential level, t-test analysis and Mann Whitney (U-test) were used to test the null hypotheses at the significance level of $p \leq 0.05$. The inferential statistical level forms the basis to permit decision making on whether to reject or retain the null hypotheses after being tested.

The following null hypotheses were formulated and tested at $p \leq 0.05$ level of significance.

HO1: There is no significant difference between the meaninterestscoresof co-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method.Mann Whitney (U-test) Statistical tool was used to test the null hypothesis.

HO2: There is no significant difference between the meanacademic performance scores of co-education studentstaught settlement concepts using Meta-Heuristic Strategy and

those taught using Lecture Method.Independent t-testanalysis was used to test the nullhypothesis.

HO3: There is no significant difference between the mean retention scores of co-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method.Independent t-testanalysis was used to test the null hypothesis.

HO4: There is no significant difference between the meaninterestscores of male and female co-education students taught settlement concepts using Meta-Heuristic Strategy. Mann Whitney (U-test) Statistical tool was used to test the null hypothesis.

HO5: There is no significant difference between the meaninterest scores in two different single schools of male and femalestudents taught settlement concepts using Meta-Heuristic Strategy.Mann Whitney (U-test) Statistical tool was used to test the null hypothesis.

HO6: There is no significant difference between the mean academic performance scores of male and femaleco-education students taught settlement concepts using Meta-Heuristic Strategy.Independent t-testanalysis was used to test the nullhypothesis.

HO7: There is no significant difference between the mean academic performance scores in two different single schools of male and female students taught settlement concepts using Meta-Heuristic Strategy.Independent t-testanalysis was used to test the null hypothesis.

HO8: There is no significant difference between the mean retention scoresof male and femaleco-education students taught settlement concepts using Meta-Heuristic Strategy.Independent t-testanalysis was used to test the nullhypothesis.

HO9: There is no significant difference between the mean retention scores in two different single schools of male and female students taught settlement concepts using Meta-Heuristic Strategy.Independent t-testanalysis was used to test the nullhypothesis.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSIONOF RESULTS

4.1Introduction

The study examined the effect of meta-heuristic strategy on interest, retention and performance in settlement concepts among secondary geography students in Minna Education Zone. This chapter explaineddata analysis, presentation and discussion of results. Data collected through the instruments were analysed using mean, standard deviation, t-test, independent t-test and u-test at alpha= 0.05 using Software Package for Social Science (SPSS). The following sub-headings were discussed in this chapter.

4.2 Answering Research Questions

4.3 Testing of Null Hypotheses

4.4 Discussion of Results

4.2 Answering the Research Questions

Data obtained for the purpose of this study were analysed based on the research questions as follows:

Research Question One: What is the difference between the interest scores of co-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method?

Table 4.1: Summary of Mean Rank and Sum of Ranks of Settlement Concepts on Interest on Co-education Students for Experimental and Control Groups

Groups	N	Mean Rank	Sum of Rank	Mean Rank Diff.
Experimental	77	100.39	7730.00	66.42
Control	63	33.97	2140.00	

Table 4.1 showed that the mean rank and sum of rank of interest ofco-education students in experimental and control groups were found to be 100.39and 33.97 and also 7730.00 and 2140.00 as the sum of rank. The mean rank difference was found to be 66.42 indicating difference in the interest in learning settlement concepts by Secondary School Students using Meta-Heuristic Strategy and lecture method. The students taught settlement concepts using Meta-Heuristic Strategy have the greatersum of rank than control group

ResearchQuestionTwo: What is the difference between the mean academic performance scores of co-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method?

Table 4.2: Mean, Standard Deviation and Mean Difference of Settlement Concepts on Academic Performance Scores on Co-education StudentsforExperimental and Control Groups

Group	**N**	**Mean**	**SD**	**Mean Difference**
Experimental Group	77	27.75	7.87	10.02
Control Group	63	17.73	5.18	

Table 4.2 indicated that, the mean scores of co-education students taught settlement concepts for experimental and control groups were found to be 27.75 and 17.73. Also the standard

deviation of performance in settlement concepts of experimental and control groups were found to be 7.87 and 5.18.The mean scores difference was also found to be 10.02 which indicated that, there is difference between the performance of students taught using Meta-Heuristic Strategy and those taught using lecture method. This proves that, the experimental group had mean scores greater than that of the control group. This establishes the evidence that, the treatment had improved student's performance in settlement concepts positively.

ResearchQuestionThree: What is the difference between the mean retention scores of co-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method?

Table 4.3: Mean,Standard Deviation and Mean Difference of Settlement Conceptson Retention on Co-education Students forthe Experimental and Control Groups

Group	N	Mean	SD	Mean Difference
Experimental Group	77	32.18	6.67	15.42
Control Group	63	16.76	5.99	

Table 4.3 portrayed that, the mean scores of co-education studentsfor experimental and control groups were found to be 32.18and 16.76. Also the standard deviation of retention level of experimental and control groups were found to be 6.67 and 5.99. The mean scores difference was found to be 15.42of students taught settlement concepts using Meta-Heuristic Strategy and those taught using lecture method. This proves that, the experimental group had mean scores greater than that of the control group. This shows the evidence that the treatment had enhanced the retention ability of students in learning settlement concepts effectively.

ResearchQuestionFour: What is the difference between the mean interestscores of male and female co-education students taught settlement concepts using Meta-Heuristic Strategy?

Table 4.4: Comparison of Mean Rank and Sum of Ranksof Male and Female Students on Interest for Co-education Studentsin Experimental Group

Variable/Group		N	Mean Rank	Sum of Ranks	Mean Rank Difference
Experimental Group	Male	40	37.71	1508.50	2.680
	Female	37	40.39	1494.50	

Table 4.4 indicated that, the mean rank of male and femaleco-education students in experimental group were found to be 37.710 and 40.390 while the sum of ranks were found to be 1508.50 and 1494.50. The mean rank difference was found to be 2.680. From their sum of ranks, both male and female students have almost equal ranks. The established the signed that the treatment had promoted the interest of both male and female students in learning settlement concepts significantly.

Research Question Five: What is the difference between the mean interest scores in two different single schools of male and female students taught settlement concepts using Meta-Heuristic Strategy?

Table 4.5: Comparison of Mean Rank and Sum of Ranks in two Different Single Schools of Male and Female Students on Interest in Experimental Group

Variable/Group		N	Mean Rank	Sum of Ranks	Mean Rank Difference
Experimental Group	Male	31	28.55	799.50	0.07
	Female	30	28.48	796.50	

Table 4.5 indicated that, the mean rank in two different single schools of male and female students for experimental group were found to be 28.55 and 28.48 while the sum of ranks were found to be 799.50 and 796.50. The mean rank difference was found to be 0.07. From their sum of ranks, both male and female students have almost equal ranks. The established the signed that the treatment had promoted the interest of both male and female students in learning settlement concepts significantly

Research Question Six: What is the difference between the mean academic performance scores of male and female co-education students taught settlement concepts using Meta-Heuristic Strategy?

Table 4.6: Comparison ofMean, Standard Deviation and Mean Difference of Male and Female Students on Academic on Co-education StudentsPerformance Scores in Experimental Group

Variable/Group		N	Mean	SD	Mean Difference
Experimental Group	Male	40	27.05	7.37	1.19
	Female	37	28.24	8.26	

Table 4.6 showed that, the mean scores of male and femaleco-education students were found to be 27.05 and 28.24 while the standard deviations are 7.37 and 8.26 respectively. The mean scores difference was found to be 1.19. From their standard deviations, both male and female students have almost equal standard deviations. The established the signed that the treatment had improved the performance of both male and female students in learning settlement concepts significantly.

Research Question Seven: What is the difference between the mean academic performance scores in two different single schools of male and female students taught settlement concepts using Meta-Heuristic Strategy?

Table 4.7: Comparison ofMean, Standard Deviation and Mean Difference in two Different Single Schools of Male and Female Students on Academic Performance Scores in Experimental Group

Variable/Group		N	Mean	SD	Mean Difference
Experimental Group	Male	31	27.19	7.58	1.01
	Female	30	28.20	7.57	

Table 4.7 revealed that, the mean scores in two different single schools of male and female students were found to be 27.19 and 28.20 while the standard deviations are 7.58 and 7.57 respectively. The mean scores difference was found to be 1.01. From their standard

deviations, both male and female students have almost equal standard deviations. The established the signed that the treatment had improved the performance of both male and female students in learning settlement concepts significantly.

Research Question Eight: What is the difference between the mean retention scores of male and femaleco-education students taught settlement concepts using Meta-Heuristic Strategy?

Table 4.8: Comparison ofMean, Standard Deviation and Mean Difference of Male and Female Co-education Studentson Retention in Experimental Group

Variable/Group		N	Mean	SD	Mean Difference
Experimental Group	Male	40	30.75	6.12	2.93
	Female	37	33.68	6.904	

Table 4.8 presented that, the mean scores of male and femaleco-education students were found to be 30.75 and 33.68 and the standard deviation were found to be 6.12 and 6.904 respectively. The mean scores difference between the male and female retention level was found to be 2.93. Thus, from their standard deviations, both male and female students have almost equivalentstandard deviations. The established the signed that the treatment had enhanced the retention ability of both male and female students in learning settlement concepts effectively.

Research Question Nine: What is the difference between the mean retention scores in two different single schools of male and female students taught settlement concepts using Meta-Heuristic Strategy?

Table 4.9: Comparison ofMean, Standard Deviation and Mean Differencein two Different Single Schools of Male and Female Students on Retention in Experimental Group

Variable/Group		N	Mean	SD	Mean Difference
Experimental Group	Male	31	30.25	6.30	1.05
	Female	30	31.57	7.09	

Table 4.9 presented that, the mean scores in two different single schools of male and female students were found to be 30.25 and 31.57 and the standard deviation were found to be 6.30and 7.09 respectively. The mean scores difference between the male and female retention level was found to be 1.05. Thus, from their standard deviations, both male and female students have almost equivalent standard deviations. The established the signed that the treatment had enhanced the retention ability of both male and female students in learning settlement concepts effectively

4.3 Testing of Null Hypotheses

The following null hypotheses were formulated and tested at 0.05 level of significance.

NullHypothesisOne(HO1): There is no significant difference between the meaninterest scores ofco-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method.Mann Whitney (U-test) Statistical tool was used to test the null hypothesis at α=0.05, as shown in Table 4.10

Table 4.10: Mann Whitney (U-test) Analysis among the Interest ofCo-education Studentsfor Experimental and Control Groups

Group	N	Mean Rank	Sum ofRanks	Df	$\chi 2$	P	Remark
Experimental Group	77	100.39	7730.00	139	9.65	0.001	Significant
Control Group	63	33.97	2140.00				

Significant at $p < 0.05$

The result in Table 4.10 compares the change in interest ofco-education students in experimental and control groups. The result portrayed that, the experimental group and control group have sum of ranks values of 7730.00 and 2140.00respectively. The MannWhitney (U-test), $\chi 2(140) = 9.65$, P = 0.001at df.of 139.Since, the p-value of 0.001 is less than $p < 0.05$level. This indicates that, there was a significant difference in the interest of students taught settlement concepts due to exposure to treatment against those taught without exposure to treatment.Thus, (HO1) was rejected.

Null Hypothesis Two (HO2): There is no significant difference between the meanacademic performance scores ofco-education studentstaught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method.t-test analysis was used to test the null hypothesis at $\boldsymbol{\alpha}$ =0.05, as shown in Table 4.11.

Table 4.11: t-test Analysis on Academic Performance ofCo-education Students for Experimental and ControlGroups

Group	N	Mean	SD	Df	T	P	Remark
Experimental Group	77	27.75	7.87	138	8.68	0.001	Significant
Control Group	63	17.73	5.18				

Significant at $p < 0.05$

The results in Table 4.11 presents t-test analysis that showed a significant difference between the mean academic performance scores ofco-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method; t (140) = 8.68, P = 0.001 at df.of 138. With $P < 0.05$ the results indicated that, there was a significant difference

in students' academic performance taught settlement concepts due to exposure to treatment against those taught without exposure to treatment. Thus, (HO2) was rejected.

Null Hypothesis Three (HO3): There is no significant difference between the mean retention scores ofco-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method.t-test analysis was used to test the null hypothesis at α=0.05, as shown in Table 4.12.

Table 4.12: t-test Analysis on Retention ofCo-education Students for Experimental and Control Groups

Group	N	Mean	SD	Df	T	P	Remark
Experimental Group	77	32.18	6.68				
				138	14.24	0.001	Significant
Control Group	63	16.76	5.99				

Significant at $p < 0.05$

Results in Table 4.12 showed a significant difference between the retention scores ofco-education students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method; t (140) = 14.24, P = 0.001 at df.of 138. With $P < 0.05$. The results showed that, there was a significant difference in retention ability of students taught settlement concepts due to exposure to treatment against those taught using lecture method. Hence, HO3 was rejected.

Null Hypothesis Four (HO4): There is no significant difference between the meaninterest scores of male and femaleco-educationstudents taught settlement concepts using Meta-Heuristic Strategy.Mann Whitney (U-test) Statistical tool was used to test the null hypothesis at **α**=0.05 as shown in Table 4.13.

Table 4.13: Mann Whitney (U-test) Comparison on Male and FemaleCo-education Students on Interest in Experimental Group

Variable/Group		N	Mean Rank	Sum of Ranks	Df	χ^2	P	Remark
	Male	40	37.71	1508.50				
Experimental Group					76	0.53	0.59	Not Significant
	Female	37	40.39	1494.50				

Not Significant at p > 0.05

The results in Table 4.13 compares the change of interest of male and femaleco-education students. The results showed that, the male and female students have sum of ranks of 100.26 and 40.76 respectively. The MannWhitney (U-test), $\chi 2(77) = 0.53$, p = 0.59 at df. of 76. With P < 0.05. The results indicated that,there was no significant difference between the mean interest scores of male and female students taught settlement concepts using Meta-Heuristic Strategy. Hence, HO4 was retained.

Null Hypothesis Five (HO5): There is no significant difference between the meaninterest scores in two different single schools of male and femalestudents taught settlement conceptsusing Meta-Heuristic Strategy.Mann Whitney (U-test) Statistical tool was used to test the null hypothesis at **α**=0.05 as shown in Table 4.14.

Table 4.14: Mann Whitney (U-test) Comparison in two Different Single Schools of Male and Female Students on Interest for Experimental Group

Variable/Group		N	Mean Rank	Sum of Ranks	Df	χ^2	P	Remark
	Male	31	28.55	799.50				
Experimental Group					60	0.54	0.98	Not Significant
	Female	30	28.48	796.50				

Not Significant at p > 0.05

The results in Table 4.14 showed the change of interestin two different single schools of male and female students. The results portrayed that, the male and female students have sum of ranks of 799.50 and 796.50respectively. The MannWhitney (U-test), $\chi 2(61) = 0.54$, p = 0.98

at df. of 60. With P < 0.05. The results indicated that, there was no significant difference between the mean interest scores of male and female students taught settlement concepts using Meta-Heuristic Strategy. Hence, HO5 was retained.

Null Hypothesis Six (HO6): There is no significant difference between the mean academic performance scores of male and femaleco-education students taught settlement concepts using Meta-Heuristic Strategy.Independent t-testanalysis was used to test the nullhypothesis at **α**=0.05 as shown in Table 4.15.

Table 4.15: t-test Comparison on Academic Performance of Male and Female Co-education Students in Experimental Group

Group	N	Mean	SD	Df	T	P	Remark
Male	40	27.05	7.37				
				75	0.67	0.32	Not Significant
Female	37	28.24	8.26				

Not Significant at p > 0.05

The results presented in Table 4.15 portrayed that, there is no significant difference between the mean academic performance scores of male and female co-education students taught settlement concepts using Metal-Heuristic Strategy; t (77) = 0.67, P = 0.32 at df. of 75. With P < 0.05. Hence, HO6 was retained.

Null Hypothesis Seven (HO7): There is no significant difference between the mean academic performance scores in two different single schools of male and female students taught settlement concepts using Meta-Heuristic Strategy.Independent t-testanalysis was used to test the null hypothesis at **α**=0.05 as shown in Table 4.16.

Table 4.16: t-test Comparison on Academic Performance in two Different Single Schools of Male and Female Students for Experimental Group

Group	N	Mean	SD	Df	T	P	Remark
Male	31	27.19	7.58				
				59	0.52	0.61	Not Significant
Female	30	28.20	7.57				

Not Significant at $p > 0.05$

The results presented in Table 4.16 indicated that, there was no significant difference between the mean academic performance scores in two different single schools of male and female students taught settlement concepts using Metal-Heuristic Strategy; t (61) = 0.52, P = 0.61 at df. of 59. With $P < 0.05$. Hence, HO7 was retained.

Null Hypothesis Eight (HO8): There is no significant difference between the mean retention scoresof male and female co-education students taught settlement concepts using Meta-Heuristic Strategy.Independent t-testanalysis was used to test the nullhypothesis at **α**=0.05 as shown in Table 4.17.

Table 4.17: t-test Comparison onRetention of Male and FemaleCo-education Students inExperimental Group

Group	N	Mean	SD	Df	t	P	Remark
Male	40	30.75	6.12				
				75	-1.97	0.05	Not-Significant
Female	37	33.69	6.90				

Not-Significant at $p > 0.05$

The result presented in Table 4.17 indicated that, there was significant difference between the mean retention scores of male and female co-education students taught settlement concepts using Metal-Heuristic Strategy; t(77) = -1.97, P = 0.05.at df. of 75. With $P < 0.05$. Therefore, HO8 was rejected. There was significant difference in favour of female students.

Null Hypothesis Nine(HO9): There is no significant difference between the mean retention scores in two different single schools of male and female students taught settlement concepts

using Meta-Heuristic Strategy.Independent t-testanalysis was used to test the nullhypothesis at **α**=0.05 as shown in Table 4.18.

Table 4.18: t-test Comparison on Retentionin two Different Single Schools of Male and Female Students forExperimental Group

Group	N	Mean	SD	Df	t	P	Remark
Male	31	30.52	6.30				
				59	0.61	0.54	Not-Significant
Female	30	31.57	7.09				

Not-Significant at $p > 0.05$

The result presented in Table 4.18 showed that, there was no significant difference between the mean retention scoresin two different single schools of male and females students taught settlement concepts using Metal-Heuristic Strategy; t (61) = 0.61, P = 0.54. at df. of 59. With $P < 0.05$. Therefore, HO9 was retained.

4.4 Discussion of Results

In order to achieve the objective of the study, nine (9) null hypotheses were formulated and tested.

The analysis of the results presented in Table 4.10 indicated that there was significant difference between the mean interest of co-education students taught settlement concepts using Meta-Heuristic Strategy (Experimental Group) and those taught using Lecture Method (Control Group). The experimental group therefore, achieved significantly greater than the control group. Therefore, the null hypotheses was rejected based on the finding.

The analysis of the results presented in Table 4.11 showed that, there was significant difference between academic performance of students taught settlement concepts using Meta-Heuristic Strategy (Experimental Group) and those taught using Lecture Method (Control Group). Therefore, the experimental group performed significantly greater than the control group and the null hypothesis was rejected based on the finding which was in line with the

findings of Abubakar (2015) showed that, the experimental group exposed to treatment performed significantly greater than the control group without exposure to treatment in terms of their academic performance. The findings of Owalabi and Oginni (2013) indicated that, those teaching method that are activity-based result in better learning and understanding of science concepts on the part of the learner.

The analysis of results presented in Table 4.12 indicated thatthere was significant difference among the retention of co-educationstudents taught settlement concepts using Meta-Heuristic Strategy (Experimental Group) and those taught using Lecture Method (Control Group). Therefore, the experimental group showed greater retention scores than control group base on the finding which was in accordance with finding of Bello (2015) stated that, there was a significant difference in the retention scores of studentsdue to exposure to treatment while Obeka (2010) opined that, there was no significant difference in the retention scores of male and female students in environmental education concepts of Geography due to exposure to demonstration and inquiry teaching methods.

The analysis of the results in Table 4.13, 4.14, 4.15, 4.16, 4.17 and 4.18 indicated that there was no significant difference between the interest scores, mean academic performance scores and retention scores in two different single schools of male and female students and co-education students taught settlement concepts using Meta-Heuristic Strategy in the study area.In addition, male and female students exposed to Metal-Heuristic Strategy did not differ significantly. The researcher discovered that, use ofMetal-Heuristic Strategy was found to be gender friendly based on the finding whichis in accordance with finding of Obeka, (2012) showed that, the use of innovative strategies in environmental education concepts of Geography proved to be effective in enhancing the performance of male and female students likewise gender friendly.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The study determined the Effect of Meta-Heuristic Strategy on Interest, Performance and Retention in Settlement Concepts among Secondary Geography Students in Minna Education Zone, Nigeria. The study was restricted to senior secondary schools in Minna Metropolis, Niger State. Four schools were used. This is because they are state owned secondary schools and regulated by the state ministry of education. This chapter was discussed under following sub-headings.

5.2 Summary

5.3 Summary of Findings

5.4 Conclusion

5.5 Recommendations

5.6 Contributions to Knowledge

5.7 Limitations of the Study

5.8 Suggestions for Further Studies

5.2 Summary

The study examined the Effect of Meta-Heuristic Strategy on Interest, Performance and Retention in Settlement Concepts among Secondary Geography Students in Minna Education Zone, Nigeria. The study was restricted to senior secondary schools in Minna Metropolis, Niger State. In chapter one, the problem that prompted the researcher to conduct the study was explained, theoretical framework, scope and significance of the study were paraphrased

accordingly. Nine (9) objectives with their corresponding research questions and null hypotheses were formulated and tested for the study.

In chapter two related literatures were reviewed which provided the basis of the existing information about the problem of the study. The following sub-headings were discussed; Geography as a course of study, teaching method in Geography,models of meta-heuristic strategy in Geography, meta-heuristic strategy and academic performance in Geography, gender and academic performance in Geography, retention and interest in Geography. Generally, overview of similar studies and implication of literature reviewed for the present study were also explained.

The chapter three presented the research methodology. Quasi-experimental design was used and the study involved the use of experimental and control groups with emphasis on pre-test, post-test and post-pottest. The population of the study covered all the 273 public senior secondary schools (SSSII) students offering Geography with total enrolment of ninety three thousand, nine hundred (93,900) as at 2018/2019 academic session out of which 201 students were sampled from the two co-education and two single schools selected using stratified random sampling technique. Two validated instruments were developed by the researcher namely; SCPT and SIIQ with coefficients of 0.8 and 0.7 respectively.

The chapter four presented the results, analyses and discussions, the research questions raised were answered using descriptive statistics whereby the null hypotheses formulated were tested using inferential statistics. Finally, the chapter five explained the summary, findings, conclusion, recommendationsas well as suggestions for further studies.

5.3 Summary of Findings

The following comprised the findings from the study.

Based on the outcome of the analysis of data collected in the present study, the following are the major findings of the study:

The following comprised the findings from the study.

1. There was significant difference between the interest scores of students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method.

2. There was significant difference between the mean academic performance scores of students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method.

3. There was significant difference between the mean retention scores of students taught settlement concepts using Meta-Heuristic Strategy and those taught using Lecture Method.

4. There was no significant difference between the mean interest scores in two different single schools of male and female students and co-education students taught settlement concepts using Meta-Heuristic Strategy.

5. There was no significant difference between the academic performance scores in two different single schools of male and female students and co-education students taught settlement concepts using Meta-Heuristic Strategy.

6. There was significant difference between the retention scoresof male and female co-education students taught settlement concepts using Meta-Heuristic Strategy. The

result is in favour of female students, having greater mean retention than male students. Thus, there was no significant difference between the retention scoresin two different single schoolsof male and female students taught settlement concepts using Meta-Heuristic Strategy

5.4 Conclusion

Based on the findings obtained from this study, the researcher made the following conclusions.

1. The use of meta-heuristic strategy is effective in arousing stimulus on interest of students in learning settlement concepts of Geography
2. The use of meta-heuristic strategy has significant effect on enhancing learners' academic performance in learning settlement concepts of Geography.
3. The use of meta-heuristic strategy has effect on retention among students in learning settlement concepts of Geography.
4. The treatment is suitable for bothsingle and co-education male and female students meaning that, is gender friendly and not bias. Hence, meta-heuristic strategy has the capacity for improving the learners' interest, academic performance and retention ability in learning settlement concepts of Geography.

5.5 Recommendations

Based on the findings of this study, the researcher recommended that:

1. Professional association like Science Teachers' Association of Nigeria (STAN), Comparative Educations and Adaptation Centre (CESAC), Mathematics Association of Nigeria (MAN) and research centres like Nigerian Educational and Research

Development Council (NERDC) and National Teachers' Institute (NTI) should incorporate the use of meta-heuristic strategy in science curricula as well as delivery instructions at senior secondary schools.

2. Seminars, workshops and conferences should be organized by secondary education board, STAN, ICASE, NTI, ETF, CESAC, CON, TRCN and NERDC in order to train science teachers on effective implementation for the use of meta-heuristic strategy in teaching science subjects such as Geography.
3. Stakeholders in education, Non-governmental Organizations (NGOs), Parent Teachers' Association (PTA) and State Universal Basic Education Commission (SUBEC) should be encouraged and fascinated to provide sufficient funds so as to facilitate teachers on the use of meta-heuristic strategy for delivery instructions in science subjects at senior secondary schools.

5.6 Contributions to Knowledge

This study has the following contributions to knowledge.

i. The researcher was able to establish that, using meta-heuristic strategy to teachsettlement concepts is highly effective has it improved the performance and added significant impetus to interest of Studentsin learning Settlement Concepts in Minna Education Zone, Niger State.
ii. Participation in meta-heuristic strategy model enhances the interest, performance and retention ability among Secondary Geography Studentsin learning Settlement Concepts in Minna Education Zone, Niger State.
iii. The adapted flowchart used as a guide to deliver instruction with MHS Model based on the study findings of the study was so effective and added positive values in terms of disseminating meaningful knowledge to learners.

iv. Meta-Heuristic Strategy was established to be gender friendly as it improved learning Settlement Conceptsfor both male and female studentsin Minna Education Zone, Niger State.

v. The findings of the study have added new information to the existing literatures basically on effectiveness of meta-heuristic strategy that improved the interest, performance and retention ability among Secondary Geography Studentsin learning Settlement Concepts in Minna Education Zone, Niger State which other researchers can use. Previous researches on meta-heuristic strategy model have mostly been from countries like Germany, Kenya, Turkey, Jordan, Malaysia based on literature reviewed.

5.7 Limitations of the Study

In the course of conducting the study, the researcher accepted the following as limitations to the study.

1 The restriction of the study to only four SSS2 Geography Students public senior secondary schools in Minna Education Zone, Niger State is narrowing the study. This makes the generalization of results fairly narrow and perchance not applicable nationwide.

2 Inadequate punctuality was serious challenges encounter by the researcher during the treatment as some students were absent without any concrete reason.

3 Poor communication abilities in English Language from the part of some students was also a problem, because the researcher as to resort to the native dialect in explaining some Settlement Concepts to students during the treatment.

4 The research assistants and students were not too familiar with meta-heuristic strategy hence, a lot explanations were done on them before the commencement of the treatment.

5.8 Suggestions for Further Studies

From the findings of the study, the researcher made the following suggestions.

i. There is need for other researchers to conduct research on effectiveness of meta-heuristic strategyon interest and performance in other Geography concepts.

ii. There is need for other researchers to conduct research on effect of meta-heuristic strategy on retention and performance among learners of varied abilities.

iii. Similar studies should be carried out in other subjects such as; Biology, Mathematics, Physics, Chemistry and Geology among others.

iv. The current study was only on SSSII students in Minna Education Zone, Niger State. If other levels like SSSI, SSSIII and even junior secondary levels can be used to replicate the study to enable wider generalization.

v. The Settlement Concepts Performance Test (SCPT) and Settlement Inventory Interest Questionnaire (SIIQ) developed by the researcher are useful tools that can assist in further research.

References

Abdellah, R.R. (2015). Meta-heuristic Awareness and its' Relation to Academic Achievement and Teaching Performance of Pre-service Female Teachers in A. J. Man University. *Procedia-Social and Behavioral Sciences,* 17(5), 560-567.

Abdulkarim, B. & Lawal, T.E. (2012). Seasonal Variations and Academic Performance in Basic Science among Junior Secondary School Students in Anchau and Zaria Education Zones, Katsina, Nigeria. *International Journal of Applied Science and Technology, 2*(8), 5-10.

Abdulkarim, B. (2010). An Assessment of Facilities for Teaching Practical Geography in Senior Secondary Schools in Zaria Education Zone. *Journal of Science and Mathematics Education,* 1(1), 89-91.

Abdulkarim, B. (2011). Identification, Analysis and Remediation of Errors in the Presentation and Interpretation of Topography Maps among Senior Secondary School Students of Geography in Kaduna State, Nigeria. Unpublished PhD Thesis Submitted to the Department of Science Education, Faculty of Education, Ahmadu Bello University Zaria.

Abdulkarim, B. (2013). The Perception of Geography as a Subject among Secondary School Students in Zaria Metropolis, *Journal of Educational Research and Development,* 5(1), 99-103.

Abdullahi, D. (2010). Relevance of Instructional Materials to the Teaching and Learning of Islamic Studies. *Journal of Educational. Research and Development,* 5(1), 179-182.

Abubakar, M. (2015). Effect of Media-Enriched Expository on Retention and Performance in Environmental Education among Colleges of Education Students, North-West, Nigeria. Unpublished Dissertation Submitted to the Department of Science Education, Faculty of Education, Ahmadu Bello University Zaria.

Abubakar, S.D. & Mamman M.B. (2016). *Giant in the Tropics and a People United, a Future Assured.* University of Abuja Department of Geography and Environmental Management Centre for Distance learning and Continuing Education Itinerary and Activities for GEO 309 (Field Course) 2(6), 395-397.

Adeniyi, E. (2013). Production of Cheap Instructional Materials for 6-3-3-4 System of Education with Emphasis on the First Six-Years. *Trends in Educational Technology. Nigeria Educational Technology Centre, Kaduna.*

Aderogba, K.A. (2005). Dearth of Maps for Effective Teaching and Learning about Geography in Nigeria Schools and Colleges: A Case Study of Ogun State. *International Journal of Research in Education,* 3(2), 217-224.

Aderogba, K.A. (2012) Improving Teaching and Learning Aids in Classes of Geography Secondary School in Ogun state, Nigeria. *International Journal of Research in Education*, 3(2), 250-255.

Aderogba, K.A. (2012). Laboratories and Sustainable Teaching and Learning about Senior Secondary School Geography in Nigeria. *Journal of Educational and Social Research,* 2(4), 9-11.

Adeyemi, T.O. (2008). Effective Teaching of Geography in Senior Secondary School in Ondo State, Nigeria. *The Social Science,*3(2), 200-206.

Adeyemo, D.A. & Ogundukun, M.O. (2010). Emotional Intelligence and Academic Achievement. The Moderating Influence of Age, Intrinsic and Extrinsic Motivation. *The African Symposium*, 141(10), 12-15.

Agbeyanku, P. (2011). Influence of Advanced Organizers on Students Performance and Retention of Ecology Concept in Senior Secondary Schools in Giwa Educational Zone. An Unpublished Thesis Submitted to the Department of Science Education, Faculty of Education, Ahmadu Bello University Zaria.

Aggarwal, J.C. (2007). *Principles of Practice Teaching*. New Dehhi: Vikas Publishers.

Aggarwal, J.C. (2008). *Essentials of Educational psychology.* Delhi*:* Publishing House Ltd, 287-292.

Ajibade, L.T. & Raheem, U.A. (2010).*Reappraisal of Field Work as Teaching Method in Geography. Retrieved from http:scholar.google.com/teaching method/geography.pdf.*

Alpha, Y.M. (2007). Gender Disparity in Achievement in Mathematics of Secondary School in Bosso Local Government Area, in A.A Hassan, Effect of School Type on Visual Perception of Geometric Shape and Performance of Junior Secondary School Students in Minna Metropolis. *Journal of Studies and Science, Mathematics Education,* 1(1), 12-18.

Amosun, A.P. (2008). What Does Geography Teach and what do Students Learn? In Abdulkarim, B. & Yakubu, S. (2010). The Perception of Geography as a Subject among Senior Secondary School Students in Zaria Metropolis. *Journal of Educational Research and Development,* 5(1), 7-9.

Areola, O. Ahmed, K. & Adeleke, B. (2016). *Certificate Physical and Human Geography for Senior Secondary School.* Ibadan: University Press, 16(36), 381-312.

Asante, K. (2012). Secondary Students' Attitude towards Mathematics, IFE Psychology, 20(1), 121-133.

Asiruwa, O.D. (2005). *Education in Science Creativity*. Ibadan: Ibadan University Press.

Atere, P. (2006). *Geography Methods.* Lagos: National Open University of Nigeria. www.NOU.EDU.NG.Retrived on 3rd December, 2013.

Ati, O.F. & Sawa, B.A. (2011). *The Geography of Change and Development in the Middle Niger River Basin.* A Field Course Handbook. Occasional Paper, 2(2), 82

Ausubel, D.P. (1968). *Educational Psychology.* A Cognitive View. New York: Holt Reinhart and Winson.

Aydin, F. (2011). Geography Teaching and Metacognition. *Educational Research and Review,* 6 *(3), 274-278.*

Aydin, G. (2011). Effect of the mind Mapping Technique on Comprehension and Retention of what is listened to. *Journal of Ataturk University Social Sciences Institute,* 14(2), 1-16.

Aydm, F. & Coskum, M. (2011). Secondary School Students, Academic and Motivation towards Geography Lesions Scholars Research Library Retrieved on 12-08-2014.

Asogwa, C.I. (2018). Impact of Advance-Organizer on Interest, Retention and Performance in Recycling Solid waste Concepts among Senior Secondary Chemistry Students in Zaria, Kaduna State. Unpublished Dissertation Submitted to the Department of Science Education, Faculty of Education, Ahmadu Bello University Zaria.

Bacchus, R. (2004). *Caring for Relationships in Karma and Reincarnation for Teachers.* New Zealand.

Battitie, M. & Brunato, C. (2014). *The Lion Way. Machine Learning Plus Intelligent Optimization.* University of Trento Italy.

Beer, J. (2010). *New Research Findings Executive Function of Adolescence*: Asha Leading Publishers.

Beeth, M.E. (2003). *Teaching the Conceptual Change:* Using Status as Meta-Cognitive Tool, Science Education, 82(3), 50-5

Bell, M.J. (2015). *Define Academic Performance.* Binchart and Winston. 183-184.

Bichi, S.S. (2002). Effect of Problem Solving Strategy and Enriched Curriculum on Students' Achievement in Evolution Concepts among Secondary School Students. Unpublished Doctoral Dissertation, Department of Science Education, Faculty of Education, Ahmadu Bello University Zaria.

Bichi, S.S. (2004). The Effect of Gender on Academic Performance in Concepts among Secondary School Students in Zaria. *Journal of Education, 3(1), 123-133.*

Bichi, S.S. (2006). Constructivism and the Teaching of Science in the 21st Century. *Journal of Educational Research and Development, 1 (3), 5-6.*

Blank, L.M. (2000). A Meta-Cognitive Learning Cycle: A Better Warranty for Students' Understanding. *Journal of Science Education,* 84(3), 486-506.

Bredderman, T. (2014). Effect of Activity Based Elementary Science on Student Outcome. *Journal of Education Research,* 53(4), 499-518

Bruner, J.S. (1960). *The Process of Education*. Cambridge. M. A. Haverd University Press.

Busari, A.T. (2009). Field Study in Geography, an Inevitable Tool for Acquiring Observation and Analytical Skills. *International Journal of Research in Education*, 6(1&2), 3-7.

Canas, A. J., Novak. J. & Vanhear. E. (2012). The Effect of Heuristic Instructional Strategy on the Biology Achievement of Senior Secondary School Slow Learners. *Journal of Research in Science Teaching, 36(5), 123-133.*

Chin, C. & Brown, D.E. (2000). Learning in Science: A Comparison of Deep and Surface Approaches. *Journal of Research in Science Teaching,* 37(2), 109-138.

Chukwuka, C.N. (2005). The Effects of Moral Dilemma and Problem-Solving Strategies on Secondary School Students' Environmental Knowledge, Problem-Solving Performance and Attitudes in Selected Ecology Concepts in Biology. Unpublished PhD Thesis. University of Ibadan.

Clearly, T.J. & Chen, P.P. (2009). Self-regulation, Motivation *and* Mathematics Achievement in Middle School. *Journal of School Psychology*, 47(5), 291-314.

Coa, E. (2015). A Tabu Search Algorithm for Cohesive Clustering Problem. *Journal of Heuristic,* 21(4), 457-477.

Cole, R.W. (2008). Educating Everybodys' Children: *Diverse Teaching Strategies for Diverse Learners,* 2(1), 2-20.

Conskun, Y. (2018). A Study on Meta-cognitive Thinking Skills of University Students in Educational Sciences Department, Turkey. *Journal of Education and Training Studies,* 6(3), 38-43.

Cooper, S.S. & Moulding, P.W. (2007). *Meta-Heuristic Development in Professional Education*. Retrieved fromhttp://www.lifecircle-inc.com/on 7/4/2012

Costa, A.L. & Gamston, R. (2002). *Cognitive Coaching: A Foundation for Renaissance School.* Norwood, Mass: Christopher-Gordon Publisher, 3(8), 166-175.

Cou, M.T. (2008). *Meta Reasoning: A Manifesto for Technical Report*.

Coutinho, S. (2007). The Relationship between Goals, Meta-Heuristic and Academic Success. *Journal of Education,* 7(1), 39-47.

Dana, S.D. (2000). *Statistical and Data Analysis for the Behavioural Science.* MC Grae-HillHigher Education, New York 10(2), 65-69.

David, A.O. & George, M.S. (2015). *New Approaches for Meta-Heuristic Framework: A Position Paper,* 3(10), 52-54.

Davis, S.L. & Buckendahi, C.W. (2011). *Incorporating Cognitive Demand in Credentialing Examination.* North Carrolina: Information Age Publishing, 5(9), 303-325.

Dengiz, C.A. (2008). Tabu Search Algorithm for the Training of Neural Networks. *Journal of the Operational Research Society,* 60(2), 282-291.

Desoete, A. (2007). Evaluation and Improving the Mathematics Teaching-Learning Process through Meta-Heuristic. *Electronic Journal of Research in Psychology*, 5(3), 705-730.

Dignath, C., Biittner, G. & Langfeldt, H. (2008). How can Primary School Students, Learn Self-Regulated Learning-Strategies most Effectively? A Meta-Analysis on Self-Regulation Training Programmes. *Educational Research Review,* 3(5), 101-129.

Duyilemi, B.O. (2004). Language in Science Education. Unpublished Lecture Handout Ondo State University, Ado-Ekiti.

Emaikwu, S.O. (2012). Assessing the Effect of Prompt Feedback as a Motivational Strategy on Students Achievement in Secondary School Mathematics. *Journal of Educational Research*, 3(4), 371-379.

Eze, J.E. (2011). A Practical Teaching and Learning of Mathematics in Nomadic Schools. *Journal of the Mathematical Association of Nigeria*, 36 (1), 129-138.

Federal Republic of Nigeria, (2013). *National Policy on Education and Major Reforms and Innovations Introduced into the Nigeria Educational System between* 2005 and 2012. NERDC Abuja, Nigeria.

Fraenkel, J.R. & Wallen, N.E. (2000). *How to Design and Evaluate Research in Education*. New York: McGraw-Hill Companies Inc.

Gama, C.A. (2004). Integrating Meta Cognition Instruction in Interactive Learning Environment. Unpublished PhD These Submitted to the University of Sussex.

Getis, A. (2011). *Introduction to Geography*. New York: The McGraw-Hill Companies, 13 (1), 2.

Gezer-Templeton, P.G. (2017). Use of Exam Wrapper to Enhance Students Meta-Heuristic Skills. *Research in Food Science Education,* 16(1), 28-36.

Glover, F. (1986). Future Paths for Integer Programming and Links to Artificial Intelligence. *Computer and Operations Research,* 13(8), 533-549.

Goh, C. (2008). Meta-Heuristic Instruction for Second Language Listening Development. Theory, Practice and Research Implications. *Regional Language Centre Journal*, 39(2), 188-213.

Goldstain, B. (2010). *Cognitive Psychology:* Connecting Mind, Research and Every Day experience. Handworth Publishers.

Gopinath, S. (2014). Metacongnitive awareness in Teaching Competency: A survey on Student Teachers at Secondary level. *Journal of Research and Method in Education,* 4(4), 33-35.

Guglinelmino, L.M. (2013). The Case for Promoting Self-directed Learning in Formal Educational Institutions. *SA-eDUC Journal,* 10(2), 1-18.

Gurickis, T.M. & Markant, D.B. (2012). Self-directed Learning. A Cognitive and Computational Prospective. *Perspectives on Psychological Science,* 7(5), 464-481.

Haliru, U. (2015). Effect of Cooperative Learning Strategy on Geography Students' Academic Performance in Senior Secondary Schools in Sokoto State, Nigeria. Unpublished M.Ed. Thesis in Curriculum and Instruction, Ahmadu Bello University, Zaria.

Havenga, M. (2015). The Role of Metacognitive Skills in Solving Object-Oriented Programming Problems. *Journal for Trans disciplinary Research in Southern African,* 1(1), 133-147.

Hedges, C. & Woodworth, A. (2010). Intrinsic Motivation in the Classroom. *International Review of Education,* 42(2), 73-105.

Henson, K.T. & Eller, B.F. (2004). *Educational Psychology for Effective Teaching.* Bsoton, New York: Wadsworth Publishing Company, 2(2), 35-37.

Hossam, E.D.L. (2012). Effectiveness of the Use of Meta-Cognition Strategies on the Development of Comprehension and Achievement in Science among Second Prep Students. *Journal of Education,* 5(4), 1-125.

Huber, R.A. & Moore, C.J. (2011). A Model for Extending Hands-on Science to be Inquiry-Based. *School Science and Mathematics,* 101(10), 32-42.

Huigin, S; Kejun. S. & Lui. Q. (2013). Heuristic Teaching Method on Innovative Talents Cultivation of Electrical Engineering. International Conference on Education Technology and Management Sciences. Atlantis Press. Pp862-864.

Irfan, M. & Shabana, N.K. (2012). Factors Affecting Students' Academic Performance. *Global Journal of Management and Business Research,* 12(9), 16-22.

Ivowi, U.M.O. (2003). Students Misconception about Motion. *Journal of Research in Curriculum, 3(2), 57-64.*

Iwena, O.A. (2018). *Essential Geography for Senior Secondary Schools.* Lagos: Tonad Publisher Limited, 5(1), 1.

James, T. (2000). Effect of Combing Entry with Concept Mapping and Lecture Method on Primary Performance Teachers Attitude and Achievement in Biology. Unpublished Phd Thesis Submitted to the Department of Science Education, Faculty of Education, Ahmadu Belle University Zaria.

Jarwan, F. (2009). *Teaching Thinking, Concepts and Applications.* Jordan: University Book House.

John, W.B. & James, V.K. (2011). *Research in Education.* Tenth Edition: PHI Learning Private Limited, New Delhi-110001.

Joshi, S.R. (2008). *Teaching of Science.* New Delhi: A.P.H Publishers Corporation.

Kalgo, F.A. (2008). *Teacher and General Methods of Teaching.* A Paper Presented at Induction Programme for the Newly Recruited Staff of Usman Danfodio University, Sokoto.

Kan'an, A. & Osman, K. (2015). The Relationship between Self-Directed Learning Skills and Science Achievement among Qatari Students. *Journal of Creative Education*, 6(8), 790-797.

Kerlinger, F.N. (2000). *Foundation of Behavioural Research:Research Design in Occupational Education.* Oklahoma State University, 9(6), 72.

Kevogo, N., William, V.T. & Stanley, N.M. (2013). Influence of Class Size on Techniques of Teaching Science in Primary Schools of Vihiga County, Kenya. *International Journal of Educational Research and Reviews,1(1), 23-32.*

Kocak, R. & Bayaci, M. (2012). The Predictive Role of Basic Ability Levels and Meta-Cognitive Strategies of Students on their Academic Success. *Procedia Social and Behavioral Sciences*, 2(2), 767-772.

Kofo, A.A. (2011). Climate Change and Implications for Sustainable Senior Secondary School (SSS) Geography Curriculum in Nigeria. *Journal of Geography and Regional Planning*, 4(1,6), 776-784.

Lawan, A.S. (2017). Impact of Heuristic Strategy on Self-Efficacy, Anxiety and Performance in Ecology among Secondary School Students of Varied Class-Sizes in Kano State, Nigeria. Unpublished Thesis Submitted to the Department of Science Education, Ahmadu Bello University Zaria.

Leon, M.R. (2015). Science Teachers Understanding of Process-Based Science Teaching. Case of Rwandan Lower Secondary School Science Teachers. *Ruwanda Journal of Education*, 3(1), 77-80.

Leopold, C. & Leutner, D. (2015). Improving Students Science Text Comprehension through Metacognitive Self-Regulation when Applying Learning Strategies. *Metacognition and Learning*, 10(4), 313-346.

Likert, R. (1973). *The Human Organization. Its Management and Values.* New York: McGraw Hill.

Lipton, L.E. & Wellman, B. (2004). *The Adaptive School: A Source Book for Developing Collaborative Groups.* Norwood Mass: Christopher-Gordon Publisher, 2(8), 160-170.

Londom, K. (2011). Investigating Differences in Structural Knowledge and Meta-Heuristic Processes among Lay Helpers Advanced Students and Senior Professional. Theraplists. Unpublished PhD Thesis Submitted to the Faculty of the Graduate School of the University of Many Land.

Maikano, S. (2010). Effects of Outdoor and Indoor Laboratory. Experience on Secondary School Students' Academic Achievement and Retention in Ecology in Kaduna State. Unpublished M.Ed. Thesis, Department of Science Education, Faculty of Education, Ahmadu Bello University, Zaria.

Maikano, S. (2016). Impact of Computer Assisted and Process-Base Instructions on Retention and Performance in Biology among Varied Abilities Secondary School Students in Kaduna, Nigeria. Unpublished Thesis Submitted to the Department of Science Education, Ahmadu Bello University Zaria.

Mandrill, P. & Precke L.D. (2009). Effect of Similarity-Based Guided Discovery Learning on Conceptual Performance. *School Science and Mathematics Journal, 109(3), 133-145.*

Mangal, S.K. (2009). *Advanced Educational Psychology*. New Delhi: PHI Learning Private Limited.

Mangal, S.K. *(2010). Essentials of Educational Psychology.* New Delhi: PHI Learning Private Limited, 5(8), 351-359.

Manoufi, S. (2012). Effectiveness of the Use of Systematic Approach in Teaching Trigonometry and Its Effect on the Systematic Thinking among Secondary School Students. *The Egyptian Society of Curricula and Teaching Methods, 14th Congress, the Education Curriculum in the Light of the Concept of Performance.*

Martinez, J.I. (2000). *Education as a Cultivation of Intelligence*: New Jessy Association.

Marzaon, R., Pickering, D.J. & Pollock, J.E. (2001). *Classroom Instruction That Works: Research-Based Strategies for Increasing Students Achievement* Alexandria: Association For Supervision and Curriculum Development, 2(8), 168-171.

Mayer, R. E. (2004). "Should there be a Three-Strikes Rule against Pure Discovery Learning"": The Case for Guided Method of Instruction. *American Psychology Journal. 59 (1), 14-19.*

Mayer, R.E. (2008). *Learning and Instruction.* Upper Saddle River: Pearson Merrill Prentice Hall, 2(2), 30-37.

Mayhew, S. (2009). *Oxford Dictionary of Geography.* U.K: Oxford University Press Inc, 4, 206.

Mburu, N.P.D. (2013). Effects of School Attended on Students' Academic Performance in Jericho and Kipkelion District, Kenya.

Meng. C.C. & Idris, N. (2012). Enhancing Students Geometric Thinking and Achievement in Solid Geometry. *Journal of Mathematics Education,* 4(1), 15-33.

Mentz, E. & Van Zyl, S. (2016). Introducing Cooperative Learning: Students' Attitudes towards Learning and the Implications for Self-Directed Learning. *Journal of Education,* 64(25), 79-109.

Mevarech, Z.R. & Kramarski, B. (2003). Enhancing Mathematical Reasoning in the Classroom: Effects of Cooperation Learning and Meta-Cognitive Training. *America Educational Research Journal,* 40(1), 281-300.

Mgeni, E.M. (2013). Teacher Perception on Effective Teaching Methods for Large Classes. *American International Journal of Contemporary Research, 3(2), 114-118.*

Michigan, S. (2013). *Students Performance in Rural Schools*. University of Michgan. Retrieved from http//www.sitemaker.umich.edu/butler on 18/06/2003.

Minna Educational Zone, (2019). Test and Statistics Section, Zonal Education Office, Minna.

Moga, A. (2012). Meta-Heuristic Trasining Effects on Student's mathematical Performance from Inclusive Classroom. Unpublished PhD Thesis Submitted to Faculty of Psychology and Educational Science, Babes-Bolyai University.

Moghtaderi, L. &Khanjani, Z. (2012). The Effectiveness of Training Cognitive/Mata-Cognitive Strategy on Self-Efficacy and Ability of Mathematical Problem-Solving for Students with Dyscalculia. *Jokull Journal*, 2(2), 173-195.

Mohammed, I.B. (2017). Effects of Project-Based Approach on Acquisition of Skills, Retention and Performance in Biology among Secondary School Students in Niger State, Nigeria. Unpublished Thesis Submitted to the Department of Science Education, Ahmadu Bello University Zaria.

Mohammed, D. A. (2017).Impact of Lecture Enriched with Excursion on Interest, Retention and Performance in Landform Processes among Secondary Geography Students**,** Minna, Nigeria**.** Unpublished Thesis Submitted to the Department of Science Education, Ahmadu Bello University Zaria.

Morribend, B. (2004). Gender and Academic Ability as Determinant of Students' Affective and Cognitive Performance in Environmental Education. *Journal of Environmental Value Education, 98 (2), 10-25.*

Mouna. Q.A. & Mousa. S.J. (2012). The Impact of Using Heuristic Teaching Method on Jordanian Mathematics Students. *Journal of International Education Research, 8(4). 453-459.*

Musa, M. (2012). *Research Design for Studies in Education.* Postgraduate Seminar Series Published by the Department of Science Education, Zaria: Ahmadu Bello University Press Limited Kaduna State, Nigeria, 1(1), 1-7.

Myers, B.E. (2016). Effects of Investigative Laboratory on Student Content Knowledge and Science Process Skill Achievement across Learning Style. Unpublished Doctoral Dissertation, University of Florida, Gainesville.

Najazadah, S. (2018). Investigating the Relationship between Meta-cognitive Strategy and Academic Enthusiasm with Academic Resiliency in Second Elementary School and First Period High School Students. *Revista Publicando*, 5(1), 515-537.

NECO, (2019). *National Examination Council*. Chief Examiner's Report

Neumann, D. & Hood, M. (2011).Evaluating Computer Based Simulations, Multimedia and Animations that help Integrated Blended Learning with Lectures in First Years Statistic. *Australian Journal of Educational Technology, 27(2), 38-42.*

Nurudden, A.I. (2013). Use of Photoshop Video Tutorial Instructional Modes for Effective Teaching of Graphic Arts in SS II.*NAEMT. Proceedings of the 34th International Conference, 1(1), 47-55.*

Obeid, W. & Afaneh, I. (2013). *Thinking and School Curriculum.* Kuwait: Al-Dalah Publishing and Distribution House.

Obeka, S.S. (2009). *EPODEWALAD and Power Simulation Games of Geographical and Environmental Education*. Zaria: Ahmadu Bello University Press Limited.

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

Obeka, S.S. (2010). Effect of Inquiry and Demonstration Methods on Students' Achievement and Retention in Some Environmental Educational Concepts of Geography. *A Journal of Studies in Science and Mathematics*, 1 (1), 52-58.

Obeka, S.S. (2012). *Introduction to Science and Environmental Education Concepts – With Empirical Studies (EPODEWALAD and Power Simulation).* Zaria: Ahmadu Bello University Press Limited, 1(24), 283.

Ochu, A.N.O. & Atagher, K.F. (2011). Gender Inbalance in Secondary School Physics in Vandeikya Local Government Area of Benue State: *Implication for Sustainable Development*, 5(1), 387-396.

Ogundukun, M.O. & Adeyomo, D.A. (2010).Emotional Intelligence and Academic Achievement. The Moderating Influence of Age, Intrinsic and Extrinsic Motivation. *The African Symposium,* 10(2), 127-141.

Ogunleye, B.O. (2002). Evaluation of the Environmental Aspect of the Senior Secondary School Chemistry Curriculum in Ibadan. Nigeria. Unpublished PhD Thesis. University of Ibadan, Ibadan.

Ogunojemite, G.B. & Omodara, O.D. (2013). Mass Media: Pre-requisite for Adult Education. *NAEMT Proceedings of the 34th International Conference, 1(1), 9-14.*

Okechukwu S. A. & Umeh, O. V. (2014). Effect of Heuristic Method of Teaching on Students Performance in Algebra. *International Journal of Scientific and Engineering Research, 5/2)23-31.*

Olagunji, M.A. (2001). Increasing Girls Interest, Participation and Achievement in Science.42th *Conference Proceedings of Science Teachers' Association of Nigeria, 3(4), 50-55.*

Olajide, J.O. (2009). Role of Inquiry Teaching in Promoting Entrepreneurship. *International Journal of Education and Science, 3*(2), 74-78.

Oloyede, O.I. (2011). A Meta-analysis of Effects of the Advance Organizers on Acknowledgment and Retention of Senior Secondary School (SSS) Chemistry. *International Journal of Education and Science, 3(2), 129-135.*

Oludipe, D.I. (2012). Gender Difference in Nigerian Junior Secondary Students Academic Achievement in Basic Science. *Journal of Educational and Social Research, 2(1), 93-99.*

Ormrod, J.E. (2004). *Human Learning, Upper Saddle River.* N.J: Pearson Prentice Hall.

Owalabi, O.T. & Oginni, O.I. (2013). Assessing the Relative Effectiveness of Three Teaching Methods in the Measurement of Students Performance in Physics. *International Journal of Materials, Methods and Technologies. 1(8), 116-125.*

Patil, G.S. (2013). Development of Strategies for Teaching Sciences by Using Heuristic Method. *International Conference, New Perspectives in Science Education.New* Delhi, India.

Pennequin, V., Olivier, S., Isabelle, G.& Roger,F. (2010). The Effect of Training in the Use of Meta-Heuristic Skills to Solve Mathematics Word Problems. Thinking and Reasoning, 16(2),198-22.

Penich, P.R. (2009). A Conceptual Framework for Assessing Motivation a Self-Regulated Learning in College Students. *Educational Psychology Review*, 5(16), 385-407.

Polya, G. (2014). The Implementation of the Polya Method in Solving Euclidean Geometry Problems. *Journal of International Education Studies,* 7(7), 149-152.

Poopola, A. (2010). Teachers Mathematics Anxiety as a Correlate of Pupils Attitude to Mathematics. *Research in Curriculum Studies, 3(2), 42-49.*

Rahimi, M. (2012). The Role of Meta-Cognitive Listening Strategies Awareness and Podcast-Use Readiness in Using Podcasting for Learning English as a Foreign Language. *Journal of Computer in Human Behaviour,* 5(28), 1158-1161.

Raidl, G.R. & Puchinger, J. (2008). *Combining Linear Programming Techniques and Meta-Heuristics for Combinational Optimization.*

Raimi, S.M. (2003). Gender Differences in Acquisition of Practical Skills. *Paper Presented at the 1st National Conference on Science, Technology and Mathematics Education. School of Science, St.* Andrew's College of Education, 17th - 20th, July.

Relwani, M.L, Akahomen, D. & Gbakeji, J. (2014). Secondary School Students Attrition in Geography in Esan West Local Government Area, Edo State. *Journal of Educational Research,* 2(4), 28-36

Riordan, C. (2008). *Early Implementation of Public Single-Sex Schools. Perceptions and Characteristics*. Jessup: United State Department of Education.

Saks, K. & Leijen, A. (2014). Distinguishing Self-Directed and Self-Regulated Learning and Measuring them in the E-Learning Context. *Procedia-Social and Behavioural Science,* 5(112), 190-198.

Sambo, A.A. (2008). *Research Method in Education.* Ibadan: Stirling-Horedon Publishers Nigeria Limited. Oyo State.

Saulawa, S.A. (2005). *Methodology of Teaching Geography Based on the Reviewed NCCE Syllabus and Standard.* Dutsinma: Eddey Press.

Shabbir. M.L., Mohsin. N.M. & Awan. A.S. (2013). Gender Differences in Terms of Test Anxiety and Attitude toward Sciences. *International Journal of Environment, Ecology Family and Urban Studies,* 3(1), 133-134.

Shakir, H. (2014). The Role of Study Skills in Academic Performance of Students. A closer focus on gender Pakistan. *Journal of Psychological Research,* 27(1), 37-51.

Shannon, S.V. (2008). Using Meta-heuristic Strategies and Learning Styles to Create Self-Directed Learners. *Institute for Learning Styles Journal,* 1(1),14-28.

Shihab, M. (2010). Effectiveness of the Use of Meta-Cognitive Strategies on Science Achievement and the Development of Complementary Science Operations Skills and Innovative Thinking among Third Preparation Grade Students. *Journal of Education,* 3(4), 1-40.

Shuaibu, A.M. (2017). Effects of Collateral Learning on Attitude and Performance in Genetics among Convergent and Divergent Senior Secondary School Students of Suleja Education Zone, Nigeria. Unpublished M.Ed. Thesis Submitted to the Department of Science Education, Ahmadu Bello University Zaria.

Singh, S. (2014). *Geography for State Civil Service and Other Competitive Examinations,* New Delhi: McGraw Hill Education Private Limited, 7(9), 239-240.

Sofowora, O.A. & Egbedokun, A. (2010). An Empirical Survey of Technology Application in Teaching Geography in Nigerian Secondary Schools. *Ethiopian Journal of Environmental Studies and Management, 3(1), 46-54.*

Solomon, R.O. (2004). Gender Difference and Students Performance in Secondary School Biology in Okene Local Government Area of Kogi State. Unpublished M.Ed Project, University of Ibadan, Nigeria.

Song, D.& Bank, C.J. (2016). Motivational Factors in Self-Directed Information Learning from Online Learning Resources. *Cogent Education,* 3(5), 1-11.

Stacy, A. (2010). The Role of Meta-Cognitive in Learning Chemistry. *Journal of Chemical Education,* 77(7), 12-18.

STAN, (2009). Raising the Standard of Performance in Public Examination in Science Technology and Mathematics. *Position Paper Number 4.* Ibadan: STAN.

Steinmayr R., Weidinger, A.F. & Wirthwein, L. (2015). *Academic Achievement*. DOI: 10.1093/Obo/0108.

Strahler, A. & Strahler, A. (2006). *Introducing Physical Geography*. USA: John Wiley and Sons, Inc, 4(9), 36-40.

Sulaiman, Z. (2015). Effectiveness of Problem Solving and Process-Based Strategy on Academic Performance and Retention in Basic Science Concepts among Upper Basic Science Students in Zaria. Unpublished Dissertation Submitted to the Department of Science Education, Ahmadu Bello University Zaria.

Sunshine, B.A., Lawrence, C.C. & Juan, J.T.D. (2015). Factors Effecting the Academic Performance of the Students Nurses of Manquet State University. *International Journal of Nursing Science,* 5(2), 60-65.

Surah, C. (2018). The Effectiveness of Meta-cognitive Prompts on a Genetics Test among High School Students in Kenya. *The Eurasia Proceedings of Educational and Social Sciences,* 9(1), 134-142.

Teoh, S.H., Parmjit, S., Cheong, T.H. & Kor, L.K. (2013). Heuristic Approach Experience in Solving Mathematical Problems. *Educational Research Journal*, 4(8), 607-611.

Thomas, O.O. & Israel, O.O. (2014). Effectiveness of Animation and Multimedia Teachingon Students Performance in Science Subjects. *British Journal of Education, and Behavioural Science,* 4(2), 10-15.

Tobia, S. & Everson, H. (2009). The Importance of knowing what you know: A Knowledge Monitoring Framework for Studying Meta-Heuristic in Education Handbook of Meta-Heuristic in Education. New York Routledge.

Tshibola, A.E. (2003). Cooperative Learning as Strategy to Improve the Teaching of Map work to Grade 11 and 12 Geography Learners in Region 3 (Limpolo Province). A case study conducted at Romaano Mbulaheni Inservice Training Centre. *Proceeding of the 21st International Cartographic Conference (ICC). Durban, South Africa*.

Ulrike, E.N., Thomas, G., Nathen, C.H. & Anne, C.F. (2012). Meta-cognitive Strategies and Test Performance: An Experience Sampling Analysis of Students' Learning Behaviour. *Educational Research International*, 36(1), 49-59.

Usman, I.A. (2010). Effect of Indoor and Outdoor Laboratory Instructional Methods on Academic Achievement of Junior Secondary School, Integrated Science Students in Zaria. *Journal of Studies in Science and Mathematics Education,* 1(1), 66-73.

Usman, I.A. (2012). *Introduction to Science Education for NCE and Undergraduates*. Zaria: E-Watc Print Media.

Usman, S. (2016). Impact of Inquiry Instructional Method on Academic Performance among Secondary Chemistry Students of Different Reasoning Abilities,Unpublished PhD Thesis Submitted to Department of Education A.B.U. Zaria, Kaduna State, Nigeria.

Usman. F.U. (2012). Effectiveness of Heuristic Teaching on Performance and Anxiety among Chemistry Students" of Different Class-sizes. Unpublished PGDE Thesis, Federal College of Education, Kano.

Uwazurike, N.R. (2010). Meta-Heuristic and Achievement Goals as Correlates of Academic Success. *Continental Journal Educational Research,* 1(3), 1-6.

Van Gog, T., Paas, F. & Kostons, D. (2010). Self-Assessment and Task Selection in Learner-Controlled Instruction. Differences between Effective and Effective Learners. *Journal ofComputer and Education,* 9(54), 932-940.

Veenman, M.V.J. (2010). *Development of Meta-Cognitive Skilfulness: Longitudinal Study, Learning and Individual Differences,* 2(12) 79-80.

Wang, N: Man. L; Gang. *X*.L. & Zhang. T. C. (2012). Discussion on the Teaching Methods on Pharmaceutical Engineering Education. *Creative Education Journal, 3(1), 80-82.*

Wole, B. (2011). Studied the Effect of Heuristic and Expository Instructional Methods on Attitude and Self-efficacy among Biology Students in Oyo south, Oyo state, Nigeria.

Young, J.R., Tiz, N.A. & Young, J.L. (2017). A Meta-Analysis of the Effects of Out-of-School Time on Students Interest. *International Journal of Education in Mathematics, Science and Technology*, 5(1), 62-74.

Yunus, F. (2010). *Reading In Thinking Skills and Teaching Critical and Creative Thinking*. Cairo: Arab Renaissance House.

Yusuf, K. (2014). *A Meta-Cognitive Strategy.* Freie University Berlin, 1(1), 3-5.

Zakariya, A. (2017). Investigated the Impact of Metacognitive Strategy on Attitude, Retention and Performance in Calculus among Colleges of Education Students in North-central Zone, Nigeria. Unpublished PhD. Thesis Submitted to the Department of Science Education, Faculty of Education, Ahmadu Bello University Zaria.

Zakaria, E., Solfitri, T., Doud. Y. & Zainal Abidin, Z. (2013). Efficacy of Heuristic Learning on Secondary School Students" Mathematics Achievement. *Creative Education, 4 (2), 98-115.*

Zimmerman, B.J. (2002). *Becoming a Self-Regulated Learner: An Overview Theory Into Practice,* 5(41), 64-70.

Zion, M., Michalsky, T. & Mevarech, Z.R. (2005). The Effects of Meta-Cognitive Instruction Embedded Within an Asynchronous Learning Network on Scientific Inquiry Skills. *International Journal of Science Education,* 27(8), 957-983.

APPENDIX A

SETTLEMENTCONCEPTS PERFORMANCE TEST (SCPT)

SECTION A: Bio-data

Name of School: …….

Add. No: …….

Gender: Male [ ] Female [ ]

SECTION B: Instruction

1. Write your name, identification number and tick the gender in the space provided.
2. Read each question carefully.
3. Go to your answer sheet and shade correct option/letter/alphabet.
4. Shade only one alphabet on each question.
5. Please shade or mark the correct question appropriately.

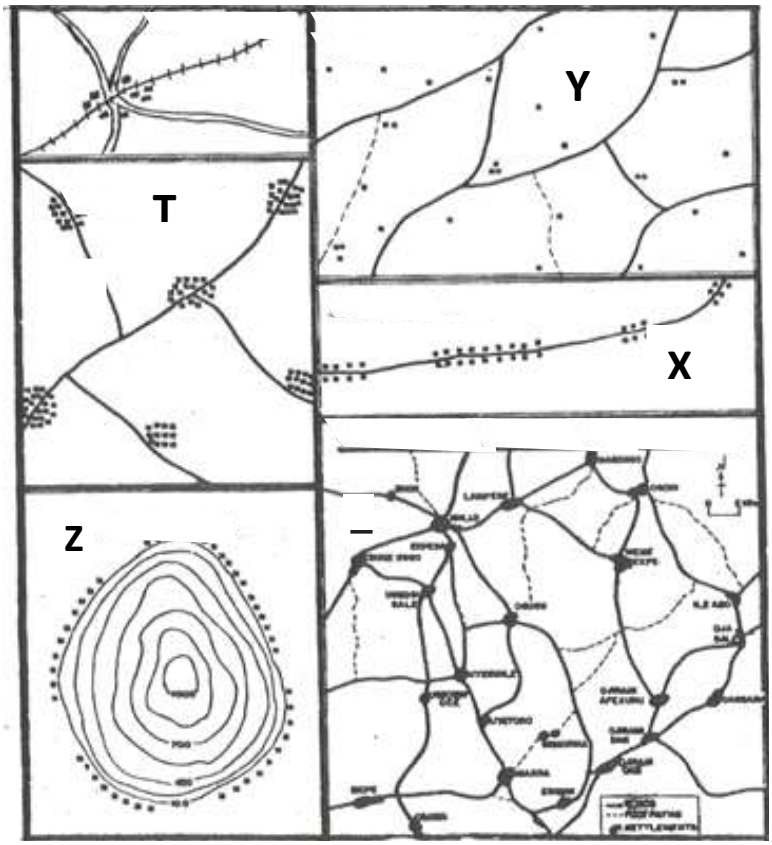
ATTEMPT ALL THE FOLLOWING QUESTIONS

1. _____ is settlement with few thousand people? (a) Locality (b) Urban settlement (c) Rural settlement (d) Environment
2. The following are categories of settlement **Except** _____? (a) Town (b) City (c) Farm (d) Farmstead
3. Which of the following patterns is system of several family residences (a) Dispersed patterns (b) Ring patterns (c) Linear patterns (d) Nucleated patterns
4. The following are functions perform by rural areas **Except?** (a) Lumbering (b) Industrial (c) Hunting (d) Fishing
5. Which of the following contains more than 100,000 people living in it? (a) House (b) Country side (c) Cities (d) Village
6. _____ provide places where people go for a holiday and rest? (a) Royal towns (b) Resort towns (c) Military towns (d) Administrative towns

7. Which of the following areas socio-economic activities are found? (a) Urban areas (b) Rural areas (c) Population (d) Decreasing areas
8. The following are factors which determine the patterns of settlement **Except**? (a) Social influences (b) Influence of central authority (c) Topography and soil (d) Influence vulcanicity
9. A place where a group of people such as soldiers, miners or sportsmen are temporarily lodged is called _____ (a) Village (b) Town (c) House (d) Camp
10. Which of the following area produce food most? (a) Urban centres (b) Camp (c) Rural areas (d) Populated areas
11. The major capital city of a state is also referred to _____? (a) Camp (b) Villages (c) Metropolis (d) Locality
12. Settlements that are developed along a road and a river sides are called _____ (a) Nucleated settlements (b) Linear settlements (c) Dispersed settlements (d) Ring settlements
13. The highest category of settlement or urbanised region is known as ____? (a) Town (b) Vicinity (c) Country side (d) Megalopolis
14. _____ are common among the Ibos in south-east Nigeria? (a) Dispersed rural settlements (b) Nucleated rural settlement (c) Linear rural settlements (d) Farmstead.
15. The banking insurance and other stock exchange take place in which of the following? (a) Cultural towns (b) Commercial towns (c) Market towns (d) Port towns
16. Urban centres produce good that are of _____? (a) High demand (b) Low demand (c) Zero demand (d) Null demand
17. The process by which towns and cities are growing and developing is called _____? (a) Urban development (b) Consolidation (c) Growth (d) Urbanisation

18. A combination of two or more large urban centres is known as _____? (a) Hamlet (b) Locality (c) City (d) Conurbation
19. _____ are satellite places which are constructed to attract some population of people? (a) Military towns (b) Residential towns (c) Administrative town (d) Entertainment centres.
20. _____ is an isolated one-family settlement locates on a farm? (a) City (b) Pattern (c) Metropolis (d) Farmstead
21. The most quiet and more peaceful areas are located at _____? (a) Rural places (b) Towns (c) Urban areas (d) Sport areas
22. Factories and government institutions are often located at _____? (a) Urban centres (b) Rural centres (c) Local centres (d) All of the above.
23. _____ are settlements with millions of people? (a) Urban settlements (b) Markets (c) Village (d) Rural settlements
24. _____ state performs changing functions and multi-functions in Nigeria? (a) Kano (b) Abuja (c) Enugu (d) Lagos
25. Most of the rural settlements are below_____? (a) 1000 (b) 2000 (c) 10,000 (d) 100,000
26. One of the main function rural areas engaged is _____? (a) Primary production (b) Secondary production (c) Tertiary production (d) Industrial production
27. Which of the following areas are employers of labour force? (a) Urban centres (b) Rural areas (c) Villages (d) Hotels
28. _____ are examples of conurbation in Nigeria Except? (a) Kaduna city (b) Kano city (c) Kampala city (d) Lagos city
29. All the following are functions of settlements **Except**? (a) Satellite towns (b) Cultural function (c) Resort function (d) Null functions

30. _____ has heterogeneous population? (a) Urban centres (b) Villages (c) Rural areas (d) Country side
31. Most of the raw materials are found in _____? (a) Town (b) Cities (c) Rural settlement (d) Urban centres
32. _____ is a place which is a centre for trading and shipping? (a) Environmental port (b) Wire house (c) Military port (d) Enterpot
33. _____ is defined as a group of houses with people living in them? (a) Population (b) Growth (c) Market (d) Settlement
34. _____ are common among the Yorubas in south-west Nigeria and in many parts of the world? (a) Nucleated rural settlements (b) Linear rural settlements (c) Ring rural settlements (d) Dispersed rural settlements
35. Most of the natural tourist attractions are found in ___? (a) Metropolis (b) Weather (c) Rural areas (d) Cities.



Use the sketch in figure 1 above to answer question 36-39.

36. The area marked T is called _____? (a) Nucleated patterns of settlement (b) Linear patterns of settlement (c) Ring patterns of settlement (d) Dispersed patterns of settlement
37. The portion labelled X is referred to as _____? (a) Dispersed settlements (b) Nucleated settlements (c) Linear settlements (d) Ring patterns.
38. Which of the following portion of the marked letter is called dispersed settlements (a) T (b) X (c) Y (d) Z
39. The areas marked Z is referred to _____? (a) Ring settlements (b) linear settlements (c) Dispersed settlements (d) Nucleated settlements
40. The process through which government groups dispersed settlements together to from nucleated settlement is called _____? (a) Disjoint settlements (b) Globalisation of settlements (c) Null consolidation (d) Settlement consolidation

APPENDIX B

MARKING SCHEME OF SETTLEMENT CONCEPTS PERFORMANCE TEST (SCPT)

1	C	11	C	21	A	31	C
2	C	12	B	22	A	32	D
3	D	13	D	23	A	33	D
4	B	14	A	24	D	34	A
5	C	15	B	25	C	35	A
6	B	16	A	26	A	36	A
7	A	17	D	27	A	37	C
8	D	18	D	28	C	38	C
9	D	19	B	29	D	39	A
10	C	20	D	30	A	40	D

Total = 1 mark X 40 = 40 marks

APPENDIX C

ANSWER SHEET FOR SETTLEMENT CONCEPTS PERFORMANCE TEST (SCPT)

SECTION A: Bio-data

Add. No: …….

Gender **Male [ ]** **Female [ ]**

SECTION B: Instruction

Please shade the correct option appropriately.

1	=A=	=B=	=C=	=D=	21	=A=	=B=	=C=	=D=
2	=A=	=B=	=C=	=D=	22	=A=	=B=	=C=	=D=
3	=A=	=B=	=C=	=D=	23	=A=	=B=	=C=	=D=
4	=A=	=B=	=C=	=D=	24	=A=	=B=	=C=	=D=
5	=A=	=B=	=C=	=D=	25	=A=	=B=	=C=	=D=
6	=A=	=B=	=C=	=D=	26	=A=	=B=	=C=	=D=
7	=A=	=B=	=C=	=D=	27	=A=	=B=	=C=	=D=
8	=A=	=B=	=C=	=D=	28	=A=	=B=	=C=	=D=
9	=A=	=B=	=C=	=D=	29	=A=	=B=	=C=	=D=
10	=A=	=B=	=C=	=D=	30	=A=	=B=	=C=	=D=
11	=A=	=B=	=C=	=D=	31	=A=	=B=	=C=	=D=
12	=A=	=B=	=C=	=D=	32	=A=	=B=	=C=	=D=
13	=A=	=B=	=C=	=D=	33	=A=	=B=	=C=	=D=
14	=A=	=B=	=C=	=D=	34	=A=	=B=	=C=	=D=
15	=A=	=B=	=C=	=D=	35	=A=	=B=	=C=	=D=
16	=A=	=B=	=C=	=D=	36	=A=	=B=	=C=	=D=
17	=A=	=B=	=C=	=D=	37	=A=	=B=	=C=	=D=
18	=A=	=B=	=C=	=D=	38	=A=	=B=	=C=	=D=
19	=A=	=B=	=C=	=D=	39	=A=	=B=	=C=	=D=
20	=A=	=B=	=C=	=D=	40	=A=	=B=	=C=	=D=

APPENDIX D

Result of Pilot Testing of Settlement Concepts Performance Test (SCPT)

Reliability Statistic

PPMC	PPMC based on standardized items	No. of items
.829	**.850**	**40**

Item analysis for the Settlement Concepts Performance Test (SCPT)

Items No	Facility Index FI $=\frac{R}{T}X\frac{100}{1}$	Item Discriminations DI $=\frac{RU-RI}{1/2N}$
1	0.4	0.3
2	0.*	0.2*
3	0.3	0.3
4	0.5	0.3
5	0.4	0.4
6	0.6	0.4
7	0.6	0.4
8	0.5	0.4
9	0.6	0.3
10	0.5	0.5
11	0.6	0.4
12	0.6	0.5
13	0.5	0.4
14	0.5	0.4
15	- 0.5*	0.8*
16	0.4	0.3
17	0.6	0.4
18	0.6	0.3
19	0.4	0.4
20	0.2*	0.1*
21	0.4	0.3
22	0.5	0.5
23	0.6	0.6
24	0.5	0.4
25	0.5	0.4
26	0.5	0.3
27	0.6	0.4
28	0.5	0.5
29	0.5	0.4
30	0.5	0.5
31	0.5	0.5
32	0.4	0.4
33	0.5	0.5
34	0.6	0.4
35	0.5	0.4
36	0.5	0.5
37	0.5	0.4
38	0.6	0.4
39	0.5	0.5
40	0.4	0.6

F.I = Facility Index (also known as discriminative index)

D.I = Difficulty Index

*** =** Items which were reconstructed/improved or discarded.

Percentage Range	Difficulty Index	Interpretation
75% - 100%	0.75 – 1.00	Easy
26% - 100%		
74% - 100%	0.25 – 0.75	Average
0.25 – 100%	0.25 or below	Hard

Discrimination Index	Interpretation
0.30 and above	Good
0.10 – 0.30	Fair
Equal to 0	No discrimination. All students got the item right
Negative	Poor. The item was flawed or miskeyed

APPENDIX E

SETTLEMENT INVENTORY INTEREST QUESTIONNAIRE (SIIQ)

Dear Respondent,

The bearer of this research instrument is student of PhD in the Department of Science Education, Faculty of Education, Ahmadu Bello University, Zaria. The items presented are designed to determine the degree of your interest in Settlement Concepts of Senior Secondary School Geography. You are therefore requested to rate yourself on the questionnaire items. You are guaranteed an outmost confidentiality as the information provided will be used strictly for this research only.

Thanks!

ABDULLAHI DOKOCHI MOHAMMED

SECTION A: Bio-data

Name of School: ……..

Add. No: …….

Gender: Male [ ] Female [ ]

Please take note of the following instructions:

SA	-	-	-	-	-	Strongly Agreed
A	-	-	-	-	-	Agreed
U	-	-	-	-	-	Undecided
D	-	-	-	-	-	Disagreed
SD	-	-	-	-	-	Strongly Disagreed

SECTION B: Instruction

Please tick (√) the appropriate column that suits your interest.

S/NO	ITEMS	SA	A	U	D	SD
1	To me settlement concepts of Geography need to be taught right from primary school for the students to be familiar with our immediate environment.					
2	I am interested in listening to my teacher teaching Settlement concepts using Meta-Heuristic Strategy.					
3	I will be interested, if people in my area shall be enlightened on categories and functions of settlements.					
4	The settlement concepts imparted to us in classroom, I really appreciate them very well.					
5	I will like my school to adapt the use of Meta-Heuristic Strategy in order to facilitate learning tasks of students in classroom.					
6	I like to study Geography in future because of its concern about environment.					
7	I think Meta-Heuristic Strategy has the capacity to bring first-hand experience to me.					
8	I don't like Geography class when it involve settlements lesson.					
9	I am very interested in the lesson attended on settlement.					
10	I always appreciate reading about settlement in textbooks.					
11	I am interested that, Meta-Heuristic Strategy can improve meaningful learning of Geography to me.					
12	Study of settlement is no longer interested to me and in my environment.					
13	Teaching settlement using Meta-Heuristic Strategy arouses my interest.					
14	I appreciate the way my teacher explained the concept of settlement in Geography lesson.					
15	I believe that Meta-Heuristic Strategy will be so interactive and learner-centred.					
16	Because of my key interest in learning settlement, I always want to answer questions on settlement.					
17	I like watching and listening to television when it involves report on spatial arrangement of settlement.					
18	I am not interested in observing the effect of settlement in my locality.					
19	I do not want to develop any interest on environmental issues broadcast on media.					
20	I am not interested in discussing the functions of settlement with my colleagues.					

Sources: Adapted from Mohammed (2017) and Asogwa (2018).

APPENDIX F

Result of Pilot Testing Analysis for Settlement Inventory Interest Questionnaire (SIIQ)

Case processing summary

		N	%
	Valid	22	100
Cases	Excluded	0	0
	Total	22	100

A. Deletion based on all variables in the procedure

Reliability Statistic

Cronbach's Alpha	Cronbach's Alpha based on standardized item	No. of items
0.708	0.750	28

Scale: Settlement Inventory Interest Questionnaire

Case processing summary

		N	%
	Valid	22	100
Cases	Excluded	0	0
	Total	22	100

B. Deletion based on all variables in the procedure

Reliability Statistic

Cronbach's Alpha	Cronbach's Alpha based on standardized item	No. of items
0.708	0.750	20

Item Statistic

	Mean	Standard Deviation	N
Settlement concepts of Geography need to be taught right from primary school for the students to be familiar with their immediate environment.	4.3438	.82733	37
I am interested in listening to my teacher teaching Settlement concepts using Meta-Heuristic Strategy.	4.1875	.78030	37
Meta-Heuristic Strategy can be used to enlighten people on categories and functions of settlements.	3.9375	1.31830	37
The settlement impact taught to us in classroom, I really appreciate them very well.	3.6875	1.11984	37
I will like my school to adapt the use of Meta-Heuristic Strategy in order to facilitate learning tasks of students in classroom.	3.8750	1.15703	37
I like to study Geography in future because of its consciousness about environment.	4.2188	.94132	37
Meta-Heuristic Strategy has the capacity to bring first-hand experience.	4.1250	.83280	37
I don't like Geography class when it involve settlement lesson in it.	3.4063	1.26642	37
I am very interested in the lesson attended on settlement.	3.5313	1.24394	37
I always appreciate reading about settlement in textbooks.	3.9375	1.16224	37
Meta-Heuristic Strategy improves meaningful learning of Geography.	4.0938	.89296	37
Study of settlement is no longer important to me and my environment.	4.1875	.64446	37
The best way of teaching is through the use of Meta-Heuristic Strategy.	2.9375	1.31830	37
I appreciate the way my teacher explained the concept of settlement to us.	3.4375	1.26841	37
I believe that Meta-Heuristic Strategy will be so interactive and learner-centred.	3.4375	1.38977	37
Because of my key interest in settlement, I always want to answer questions on map reading of Geography.	4.3125	.82060	37
I like watching and listening to television when it involves report on spatial arrangement of settlement.	4.5000	.84242	37
I am not interested in observing the effect of settlement in my locality.	3.5525	1.24272	37
It is waste of time to listen to environmental broadcast on media.	4.0938	1.26642	37
I am not interested in discussing the functions of settlement with my colleagues.	4.1875	1.24394	37

Summary item statistic

	Mean	Minimum	Maximum	Range	Max/min	Variance
Inter-items correlation	0.69	-.709	.729	1.138	-1.235	0.46

Summary item statistic

	No of items
Inter-items correlation	20

Item-Total Statistic

	Scale mean if item deleted	Scale variance if item deleted	Corrected item total correlation	Squared multiple correlation
Settlement concepts of Geography need to be taught right from primary school for the students to be familiar with their immediate environment.	88.8438	74.652	.121	.728
I am interested in listening to my teacher teaching Settlements concept using Meta-Heuristic Strategy.	89.0000	71.871	.346	.838
Meta-Heuristic Strategy can be used to enlighten people on categories and functions of settlement.	89.2500	71.097	.190	.886
The settlement concepts impacted to us in classroom, I really appreciate them very well.	89.5000	86.839	.375	.704
I will like my school to adapt the use of Meta-Heuristic Strategy in order to facilitate learning tasks of students in classroom.	89.3125	74.673	.052	.764
I like to study Geography in future because of its consciousness about environment.	88.9688	71.773	.276	.860
Meta-Heuristic Strategy has the capacity to bring first-hand experience.	89.0625	69.673	.481	.780
I don't like Geography class when it involve settlement lesson in it.	89.7813	86.822	-.482	.837
I am very interested in the lesson attended on settlement.	89.6563	70.555	.237	.742
I always appreciate reading about settlement in textbooks.	89.2500	68.839	.356	.862
Meta-Heuristic Strategy improves meaningful learning of Geography.	89.0938	73.507	.180	.838
Study of settlement is no longer important to me and my environment.	89.0000	73.871	.250	.786
The best way of teaching is through the use of Meta-Heuristic Strategy.	90.2500	75.484	-.007	.688
I appreciate the way my teacher explained the concepts of settlement to us.	89.7500	78.516	-.136	.761
I believe that Meta-Heuristic Strategy will be so interactive and learner-centred.	89.7500	70.903	.181	.838
Because of my key interest in settlement, I always want to answer questions on map reading of Geography.	88.8700	73.081	.236	.840
I like watching and listening to television when it involves report on spatial arrangement of settlement.	88.6875	69.770	.468	.855
I am not interested in observing the effect of settlement in my locality.	89.6250	66.661	.384	.855
It is waste of time to listen to environmental broadcast on media.	89.5313	66.386	.513	.828
I am not interested in discussing the functions of settlement with my colleagues.	89.7188	64.273	.535	.919

Item-Total Statistic

	Cronbach's Alpha if item deleted
I am interested in listening to my teacher teaching Settlement concepts using Meta-Heuristic Strategy.	.625
Meta-Heuristic Strategy can be used to enlighten people on categories and functions of settlement.	.640
The settlement concepts imparted to us in classroom, I really appreciate them very well.	.601
I will like my school to adapt the use of Meta-Heuristic Strategy in order to facilitate learning tasks of students in classroom.	.596
I like to study Geography in future because of its consciousness about environment.	.576
Meta-Heuristic Strategy has the capacity to bring first-hand experience.	.574
I am not interested in discussing the functions of settlements with my colleagues.	.560

Scale Statistics

Mean	Variance	Std. Deviation	No of items
93.1875	77.060	8.77841	20

APPENDIX G

LETTER OF VALIDATION OF RESEARCH INSTRUMENT

Department of Science Education,
Faculty of Education,
Ahmadu Bello University, Zaria.
5th October, 2018.

Dr. Abdullahi Jibrin,
Department of Geography,
Ahmadu Bello University, Zaria
Kaduna State.

20/10/2018. Endorsed subject to corrections

Sir,

VALIDATION OF RESEARCH INSTRUMENTS

I have developed research instruments designed to generate data for my PhD. Thesis on Effect of Meta – Heuristic Strategy on Interest, Retention and Performance in Settlements Concepts among secondary Geography Students of Different School-Setting, Niger East Education Zone, Niger State. The instruments titled Settlement Concepts Performance Test (SCPT) and Settlement Inventory Interest Questionnaire (SIIQ). The drafts of the instruments are enlisted here with.

Kindly, go through the instruments and validate them so as to enable me collect reliable date. Research Objectives, Questions and Null Hypotheses of the study from chapter one are attached here with for your reference.

I very much appreciate your kind assistance.

Thanks!

Dr. B. Abdulkarim,

Student's Supervisor.

Yours faithfully,

Abdullahi Dokochi Mohammed,
P17EDSC9039
08036874043

Department of Science Education,
Faculty of Education,
Ahmadu Bello University, Zaria.
5th October, 2018.

Prof. I.A. Usman
Department of Science Education,
Faculty of Education,
Ahmadu Bello University, Zaria.

Validated
11/10/18

Sir,

VALIDATION OF RESEARCH INSTRUMENTS

I have developed research instruments designed to generate data for my PhD. Thesis on Effect of Meta – HeuristicStrategy on Interest, Retention and Performance in Settlements Concepts among secondary Geography Students of Different School-Setting, Niger East Education Zone, Niger State. The instruments titled Settlement Concepts Performance Test (SCPT) and Settlement Inventory Interest Questionnaire (SIIQ). The drafts of the instruments are enlisted here with.

Kindly, go through the instruments and validate them so as to enable me collect reliable date. Research Objectives, Questions and Null Hypotheses of the study from chapter one arc attached here with for your reference.

I very much appreciate your kind assistance.

Thanks!

Dr. B. Abdulkarim,

Student's Supervisor.

Yours faithfully,

Abdullahi Dokochi Mohammed,
P17EDSC9039

APPENDICES

Appendix A: Letter of Introduction

DEPARTMENT OF SCIENCE EDUCATION

AHMADU BELLO UNIVERSITY, ZARIA

Vice Chancellor: **Professor Ibrahim Garba** B.Sc, M.Sc(ABU) Ph.D DIC (London), FNMGS
Head of Department: **Professor Sani Sale Bichi** NCE, B.Ed, M.Ed, Ph.D(ABU), AKC. Lond

Your Ref:

Our Ref: DSE/VRI/I/Vol.1

Date: 12th Nov. 2019

Dr. Ibrahim Muktar,
Department of Geography,
Ahmadu Bello University,
Zaria.

Gone through the research questions and hypotheses and items and they are ok.
13/11/19

Dear Sir/Madam.

VALIDATING RESEARCH INSTRUMENT

This is to introduce the bearer, Abdullahi Bokochi Mohammed, as one of our Geography Education PhD students with registration number PGFBSC/9039 in this department.

The above postgraduate student is about to go for pilot testing and pre-data seminar. He/She has an instrument for validation on a study topic: Effect of Meta-Heuristic Strategy on Interest, Retention and Performance in Settlements Concepts among Secondary Geography Students in Minna Education Zone, Niger State, Nigeria.

The instrument is for you to study and validate accordingly.

The objective of the study, the research question and hypotheses are attached herewith for your reference.

Thank you.

Yours faithfully,

H.O.D
SCIENCE EDUCATION
A.B.U. Zaria

Prof. S.S. Bichi
Head, Department of Science Education

APPENDICES

Appendix A: Letter of Introduction

DEPARTMENT OF SCIENCE EDUCATION

AHMADU BELLO UNIVERSITY, ZARIA

Vice Chancellor: ***Professor Ibrahim Garba*** *B.Sc, M.Sc(ABU) Ph.D DIC (London), FNMGS*
Head of Department: ***Professor Sani Sale Bichi*** *NCE, B.Ed, M.Ed, Ph.D(ABU), AKC. Lond*

Your Ref:

Our Ref: *DSE/VRI/I/Vol.1* ***Date:***

Dr. Abdullahi Jibrin,
Department of Geograph,
Ahmadu Bello University,
Zaria.

Validated
10/11/2019

Dear Sir/Madam.

VALIDATING RESEARCH INSTRUMENT

This is to introduce the bearer, Abdullahi Sokochi Mohammed, as one of our Geography Education PhD students with registration number P17EDSC9039 in this department.

The above postgraduate student is about to go for pilot testing and pre-data seminar. He/She has an instrument for validation on a study topic: Effect of Meta-Heuristic Strategy on Interest, Retention and Performance in Settlement Concepts among Secondary Geography Students in Minna Education Zone, Niger State, Nigeria.

The instrument is for you to study and validate accordingly.

The objective of the study, the research question and hypotheses are attached herewith for your reference.

Thank you.

Yours faithfully,

DEPARTMENT OF SCIENCE EDUCATION
A.B.U. Zaria

Prof. S.S. Bichi
Head, Department of Science Education

APPENDIX H

LESSON PLAN FOR EXPERIMENTAL GROUP (META-HEURISTIC STRATEGY) WEEK ONE

Subject: Geography

Topic: Settlement

Group: Experimental (Meta-Heuristic Strategy)

Class: SSII

Age: 15-17 years

Sex: Co-education (mixed)

Teaching Method: Meta-Heuristic Strategy Model

Dur**ation:** 80 Minutes

Instructional Material: Chart, Map and Picture

Specific Objectives: By the end of this lesson the students should be able to:

a. define settlement
b. mention nine (9) categories of settlement
c. explain any five categories of the settlement mention above.

Prior Knowledge: The students have learnt about population which leads to present lesson.

Introduction: The teacher introduces the lesson by telling the students about the way students move around in their various localities and villages, that is, as you could notice when you are on holidays you travel to villages or cities to enjoy your holidays with your relations that are far away from your immediate environment. Therefore, the topic for today lesson is settlement.

Presentation:

Step I: Set an Objectives

Teacher's Activities:

Teacher asks learners the following questions based on settlement.

i. What is settlement?
ii. Mention nine (9) categories of settlement?
iii. Explain any five (5) categories of the settlement mention above?

Students' Activities;

i. Students respond to the questions above.
ii. Students ask questions on more clarifications.

Step II: Exploration.

Teacher's Activities:

i. Teacher guides the students on how to read and study the content of the topic based on the stated objectives using adaptive memory-based learning approach of Meta-Heuristic Strategy.

Students' Activities:

i. Students engage in reading whereby struggling to comprehend and mastering the topic using their sensory organs and internalising them to derive at universal statement by reasoning.

Step III: Discussion.

Teacher's Activities:

The teacher assists students to discuss ideas from the various activities they observe and carried out using the following questions.

i. What is settlement?
ii. Mention nine (9) categories of settlement?
iii. Explain any five (5) categories of the settlement mentioned above?

Students' Activities:

i. The students partake and engage in the discussion by contributing their experiences in answering the questions.
ii. The students interact and explain to one another the meaning of settlement and its categories to share ideas and generate their own meaningful knowledge by reasoning.
iii. Students also rehearse, repeat and re-read the wording of learning tasks in order to learn and study them in memory so as to ease remembering and apply them.

Step IV: Application.

Teacher's Activities:

The teacher helps students to mention how to apply the ideas of the activities they undergo on Meta-Heuristic Strategy through the following question.

i. How can a person identify different categories of settlement in a given environment?

Students' Activities:

The students respond to the question above, so as to make connection between new and already existing material in order to reinstruction and encode the information of the learning task to facilitate the storage of this knowledge in the long term event

Step V: Evaluation.

Teacher's Activities:

The teacher asks the students the following questions based on the stated objectives

i. Who can define settlement?
ii. Who can mention and explain any five (5) categories of settlement?

Students' Activities:

i. The students respond to the above questions by reflecting and perceiving themselves one to master a skill. This thinking skill enable learners to think again in order to get new information stores in memory which results to ability to make application analysis and realisation of goal.

Conclusion:

Teacher's Activities:

The teacher ends the activities on meta-heuristic learning approach thereby giving students assignment and assists the learners in necessary places.

Students' Activities:

The students make summary based on their observations on the process of learning task to end the activities on Meta-Heuristic Strategy.

LESSON PLAN FOR EXPERIMENTAL GROUP (META-HEURISTIC STRATEGY) WEEK TWO

Subject: Geography

Topic: Settlement

Sub-Topic: Classification of Settlement (Rural and Urban Settlements)

Group: Experimental (Meta-Heuristic Strategy)

Class: SSII

Age: 15-17 years

Sex: Co-education (mixed) and single school

Teaching Method: Meta-Heuristic Strategy Model

Dur**ation:** 80 Minutes

Instructional Material: Chart, Map and Picture

Specific Objectives: By the end of this lesson the students should be able to:

a. define settlement
b. explain the rural and urban type of settlement
c. state five differences between rural and urban settlement.

Prior Knowledge: The students have learnt about settlements and its categories which bring about the present lesson.

Introduction: The teacher begins the lesson by telling the students about the way students move around in their various localities and villages, that is, as you could notice when you are on holidays you travel to villages or cities to enjoy your holidays with your relations that are far away from your immediate environment. Therefore, the topic for today lesson is classification of settlement.

Presentation:

Step I: Set an Objectives

Teacher's Activities:

Teacher asks learners the following questions based on settlement.

i. What is settlement?
ii. Explain the rural and urban settlement?
iii. State five (5) differences between urban and rural settlement?

Students' Activities;

i. Students respond to the questions above.
ii. Students ask questions on more clarifications.

Step II: Exploration.

Teacher's Activities:

i. Teacher guides the students on how to read and study the content of the topic based on the stated objectives using adaptive memory-based learning approach of Meta-Heuristic Strategy.

Students' Activities:

a. Students engage in reading whereby struggling to comprehend and mastering the topic using their sensory organs and internalising them to derive at universal statement by reasoning.

Step III: Discussion.

Teacher's Activities:

The teacher assists students to discuss ideas from the various activities they observe and carried out using the following questions.

i. What is settlement?
ii. Explain the rural and urban settlement?
iii. State five (5) differences between urban and rural settlement?

Students' Activities:

i. The students partake and engage in the discussion by contributing their experiences in answering the questions.
ii. The students interact and explain to one another the meaning of rural and urban type of settlements with their differences to share ideas and generate their own meaningful knowledge by reasoning.
iii. Students also rehearse, repeat and re-read the wording of learning tasks in order to learn and study them in memory so as to ease remembering and apply them.

Step IV: Application.

Teacher's Activities:

The teacher helps students to mention how to apply the ideas of the activities they undergo on Meta-Heuristic Strategy through the following question.

i. In what ways one can differentiate that a given environments belong to either rural or urban settlement?

Students' Activities:

The students respond to the question above, so as to make connection between new and already existing material in order to reinstruction and encode the information of the learning task to facilitate the storage of this knowledge in the long term event

Step V: Evaluation.

Teacher's Activities:

The teacher asks the students the following questions based on the stated objectives

i. Who can define rural and urban settlement?

ii. Who can state five (5) differences between rural and urban settlement?

Students' Activities:

i. The students respond to the above questions by reflecting and perceiving themselves want to master a skill. This thinking skill enable learners to think again in order to get new information stores in memory which results to ability to make application analysis and realisation of goal.

Conclusion:

Teacher's Activities:

The teacher terminates the activities on meta-heuristic learning approach thereby giving students assignment and helps the learners in necessary places.

Students' Activities:

The students make summary based on their observations on the process of learning task to end the activities on Meta-Heuristic Strategy.

LESSON PLAN FOR EXPERIMENTAL GROUP (META-HEURISTIC STRATEGY) WEEK THREE

Subject:	Geography
Topic:	Settlements
Sub-Topic	Functions of Settlement
Group:	Experimental (Meta-Heuristic Strategy)
Class:	SSII
Age:	15-17 years
Sex:	Co-education (mixed)
Teaching Method:	Meta-Heuristic Strategy Model
Dur**ation:**	80 Minutes
Instructional Material:	Chart, Map and Picture
Specific Objectives:	By the end of this lesson the students should be able to: a. define settlement b. list five functions of each of the rural and urban settlement c. state and explain eight (8) functions of urban settlement.

Prior Knowledge: The students have learnt about categories and type of settlement which leads to present lesson.

Introduction: The teacher starts the lesson by telling the students on the activities of man, influence and comfort he derives from the environment in terms of his shelter, accommodation and conducive environment of learning. Therefore, the topic for today's lesson is functions of settlement.

Presentation:

Step I: Set an Objectives

Teacher's Activities:

Teacher asks learners the following questions based on functions of settlement.

i. List five functions of urban settlement?
ii. In a tabular form, mention five functions of each of the rural and urban settlement?
iii. State and explain eight (8) functions of urban settlement?

Students' Activities;

i. Students respond to the questions above.
ii. Students ask questions on more clarifications.

Step II: Exploration.

Teacher's Activities:

i. Teacher guides the students on how to read and study the content of the topic based on the stated objectives using adaptive memory-based learning approach of Meta-Heuristic Strategy.

Students' Activities:

i. Students engage in reading whereby struggling to comprehend and mastering the topic using their sensory organs and internalising them to derive at universal statement by reasoning.

Step III: Discussion.

Teacher's Activities:

The teacher assists students to discuss ideas from the various activities they observe and carried out using the following questions.

i. List five functions of each of the rural and urban settlement?
ii. State and explain eight (8) functions of urban settlement?

Students' Activities:

i. The students partake and engage in the discussion by contributing their experiences in answering the questions.
ii. The students interact and explain to one another about the functions of rural and urban settlements and its categories to share ideas and generate their own meaningful knowledge by reasoning.
iii. Students also rehearse, repeat and re-read the wording of learning tasks in order to learn and study them in memory so as to ease remembering and apply them.

Step IV: Application.

Teacher's Activities:

The teacher helps students to mention how to apply the ideas of the activities they undergo on Meta-Heuristic Strategy through the following question.

i. How will a person notice that, some certain functions in a given environments are either that of rural or urban settlement?

Students' Activities:

The students respond to the question above, so as to make connection between new and already existing material in order to reinstruction and encode the information of the learning task to facilitate the storage of this knowledge in the long term event

Step V: Evaluation.

Teacher's Activities:

The teacher asks the students the following questions based on the stated objectives

i. Who can list five (5) functions of each of the rural and urban settlement?

ii. Who can state and explain eight (8) functions of urban settlement?

Students' Activities:

i. The students respond to the above questions by reflecting and perceiving themselves one to master a skill. This thinking skill enable learners to think again in order to get new information stores in memory which results to ability to make application analysis and realisation of goal.

Conclusion:

Teacher's Activities:

The teacher finishes the activities on meta-heuristic learning approach thereby giving students assignment and assists the learners in necessary places.

Students' Activities:

The students make summary based on their observations on the process of learning task to end the activities on Meta-Heuristic Strategy.

LESSON PLAN FOR EXPERIMENTAL GROUP (META-HEURISTIC STRATEGY) WEEK FOUR

Subject: Geography

Topic: Settlement

Sub-Topic: Patterns of Settlement (Dispersed and Nucleated Patterns)

Group: Experimental (Meta-Heuristic Strategy)

Class: SSII

Age: 15-17 years

Sex: Co-education (mixed)

Teaching Method: Meta-Heuristic Strategy Model

Dur**ation:** 80 Minutes

Instructional Material: Chart, Map and Picture

Specific Objectives: By the end of this lesson the students should be able to:

a. define patterns settlement
b. define the disperse and nucleated patterns of settlement
c. differentiate between disperse and nucleated patterns of settlement.

Prior Knowledge: The students have learnt about functions of settlements which lead to present lesson.

Introduction: The teacher commences the lesson by telling the students on the activities of man, influence and comfort he derives from the environment in terms of his shelter, accommodation as well as conducive environment of learning. Therefore, the topic for today's lesson is dispersed and nucleated patterns of settlement.

Presentation:

Step I: Set an Objectives

Teacher's Activities:

Teacher asks learners the following questions based on patterns settlement.

i. What is pattern of settlement?
ii. Define dispersed and nucleated patterns of settlement?
iii. Differentiate between dispersed and nucleated patterns of settlement?

Students' Activities;

i. Students respond to the questions above.
ii. Students ask questions on more clarifications.

Step II: Exploration.

Teacher's Activities:

i. Teacher guides the students on how to read and study the content of the topic based on the stated objectives using adaptive memory-based learning approach of Meta-Heuristic Strategy.

Students' Activities:

i. Students engage in reading whereby struggling to comprehend and mastering the topic using their sensory organs and internalising them to derive at universal statement by reasoning.

Step III: Discussion.

Teacher's Activities:

The teacher assists students to discuss ideas from the various activities they observe and carried out using the following questions.

i. What are patterns of settlement?
ii. Define dispersed and nucleated patterns of settlement?
iii. Differentiate between dispersed and nucleated patterns of settlement?

Students' Activities:

i. The students partake and engage in the discussion by contributing their experiences in answering the questions.
ii. The students interact and explain to one another the dispersed and nucleated patterns of settlement and its categories to share ideas and generate their own meaningful knowledge by reasoning.
iii. Students also rehearse, repeat and re-read the wording of learning tasks in order to learn and study them in memory so as to ease remembering and apply them.

Step IV: Application.

Teacher's Activities:

The teacher helps students to mention how to apply the ideas of the activities they undergo on Meta-Heuristic Strategy through the following question.

i. In what way a person shall indicate that, a given pattern of settlement is either dispersed or nucleated pattern of settlement?

Students' Activities:

The students respond to the question above, so as to make connection between new and already existing material in order to reinstruction and encode the information of the learning task to facilitate the storage of this knowledge in the long term event

Step V: Evaluation.

Teacher's Activities:

The teacher asks the students the following questions based on the stated objectives

i. Who can define pattern of settlement?
ii. Define dispersed and nucleated patterns of settlement?
iii. Differentiate between dispersed and nucleated patterns of settlement?

Students' Activities:

i. The students respond to the above questions by reflecting and perceiving themselves one to master a skill. This thinking skill enable learners to think again in order to get new information stores in memory which results to ability to make application analysis and realisation of goal.

Conclusion:

Teacher's Activities:

The teacher concludes the activities on meta-heuristic learning approach thereby giving students assignment and assists the learners in necessary places.

Students' Activities:

The students make summary based on their observations on the process of learning task to end the activities on Meta-Heuristic Strategy.

LESSON PLAN FOR EXPERIMENTAL GROUP (META-HEURISTIC STRATEGY)
WEEK FIVE

Subject: Geography

Topic: Settlement

Sub-Topic: Patterns of Settlement (Linear and Ring Patterns)

Group: Experimental (Meta-Heuristic Strategy)

Class: SSII

Age: 15-17 years

Sex: Co-education (mixed)

Teaching Method: Meta-Heuristic Strategy Model

Dur**ation:** 80 Minutes

Instructional Material: Chart, Map and Picture

Specific Objectives: By the end of this lesson the students should be able to:

i. define patterns of settlement
ii. explain linear and ring patterns of settlement
iii. differentiate between linear and ring patterns of settlement.

Prior Knowledge: The students have learnt about functions of settlements which result to present lesson.

Introduction: The instructor begins the lesson by teaching by informing the learners on how spatial arrangement of houses are structured in their environments, that is, as you can notice houses are built inform of linear or scattered settlements . Therefore, the topic for today's lesson is linear and ring patterns of settlement.

Presentation:

Step I: Set an Objectives

Teacher's Activities:

Teacher asks learners the following questions based on settlement.

i. What is pattern settlement?
ii. Explain linear and ring patterns of settlement?
iii. Differentiate between linear and ring patterns of settlement?

Students' Activities;

i. Students respond to the questions above.
ii. Students ask questions on more clarifications.

Step II: Exploration.

Teacher's Activities:

i. Teacher guides the students on how to read and study the content of the topic based on the stated objectives using adaptive memory-based learning approach of Meta-Heuristic Strategy.

Students' Activities:

i. Students engage in reading whereby struggling to comprehend and mastering the topic using their sensory organs and internalising them to derive at universal statement by reasoning.

Step III: Discussion.

Teacher's Activities:

The teacher assists students to discuss ideas from the various activities they observe and carried out using the following questions.

Define patterns of settlement?

Explain linear and ring patterns of settlement?

Differentiate between linear and ring patterns of settlement?

Students' Activities:

i. The students partake and engage in the discussion by contributing their experiences in answering the questions.
ii. The students interact and explain to one another the linear and ring patterns of settlement and its categories to share ideas and generate their own meaningful knowledge by reasoning.
iii. Students also rehearse, repeat and re-read the wording of learning tasks in order to learn and study them in memory so as to ease remembering and apply them.

Step IV: Application.

Teacher's Activities:

The teacher helps students to mention how to apply the ideas of the activities they undergo on Meta-Heuristic Strategy through the following question.

i. In what sign can I show that, I certain pattern of settlement is either linear or ring pattern?

Students' Activities:

The students respond to the question above, so as to make connection between new and already existing material in order to reinstruction and encode the information of the learning task to facilitate the storage of this knowledge in the long term event

Step V: Evaluation.

Teacher's Activities:

The teacher asks the students the following questions based on the stated objectives

i. Who can define patterns of settlement?
ii. Who can explain linear and ring patterns of settlement?
iii. Differentiate between linear and ring patterns of settlement?

Students' Activities:

i. The students respond to the above questions by reflecting and perceiving themselves one to master a skill. This thinking skill enable learners to think again in order to get new information stores in memory which results to ability to make application analysis and realisation of goal.

Conclusion:

Teacher's Activities:

The teacher terminates the activities on meta-heuristic learning approach thereby giving students assignment and aids the learners in necessary places.

Students' Activities:

The students make summary based on their observations on the process of learning task to end the activities on Meta-Heuristic Strategy.

LESSON PLAN FOR EXPERIMENTAL GROUP (META-HEURISTIC STRATEGY)
WEEK SIX

Subject: Geography

Topic: Settlement

Sub-Topic: Factors that determine the patterns of settlement

Group: Experimental (Meta-Heuristic Strategy)

Class: SSII

Age: 15-17 years

Sex: Co-education (mixed)

Teaching Method: Meta-Heuristic Strategy Model

Dur**ation:** 80 Minutes

Instructional Material: Chart, Map and Picture

Specific Objectives: By the end of this lesson the students should be able to:

i. define patterns of settlements
ii. mention eight (8) factors that determine the patterns of settlement
iii. explain six (6) factors that determine the patterns of settlement.

Prior Knowledge: The students have learnt about population which leads to present lesson.

Introduction: The teacher starts the lesson by telling the students on how spatial arrangements of houses are structured in the environment that brings about shelter, accommodation as well as comfort. Therefore, the topic for today's lesson is factors that determine the patterns of settlement.

Presentation:

Step I: Set an Objectives

Teacher's Activities:

Teacher asks learners the following questions based on factors that determine patterns of settlement.

i. Define patterns of settlement?
ii. Mention eight (8) factors that determine the patterns of settlement?
iii. Explain six (6) factors that determine the patterns of settlement?

Students' Activities;

i. Students respond to the questions above.

ii. Students ask questions on more clarifications.

Step II: Exploration.

Teacher's Activities:

i. Teacher guides the students on how to read and study the content of the topic based on the stated objectives using adaptive memory-based learning approach of Meta-Heuristic Strategy.

Students' Activities:

i. Students engage in reading whereby struggling to comprehend and mastering the topic using their sensory organs and internalising them to derive at universal statement by reasoning.

Step III: Discussion.

Teacher's Activities:

The teacher assists students to discuss ideas from the various activities they observe and carried out using the following questions.

i. Define patterns of settlement?
ii. Mention eight (8) factors that determine the patterns of settlement?
iii. Explain six (6) factors that determine the patterns of settlement?

Students' Activities:

i. The students partake and engage in the discussion by contributing their experiences in answering the questions.
ii. The students interact and explain to one another the factors that determine the patterns of settlement and its categories to share ideas and generate their own meaningful knowledge by reasoning.
iii. Students also rehearse, repeat and re-read the wordings of learning tasks in order to learn and study them in memory so as to ease remembering and apply them.

Step IV: Application.

Teacher's Activities:

The teacher helps students to mention how to apply the ideas of the activities they undergo on Meta-Heuristic Strategy through the following question.

i. How can a person identify different categories of settlements in a given pattern of environment?

Students' Activities:

The students respond to the question above, so as to make connection between new and already existing material in order to reinstruction and encode the information of the learning task to facilitate the storage of this knowledge in the long term event

Step V: Evaluation.

Teacher's Activities:

The teacher asks the students the following questions based on the stated objectives

i. Who can define pattern of settlement?
ii. Who can mention eight (8) factors that determine the pattern of settlement?
iii. Explain six (6) factors that determine the pattern of settlement?

Students' Activities:

i. The students respond to the above questions by reflecting and perceiving themselves one to master a skill. This thinking skill enable learners to think again in order to get new information stores in memory which results to ability to make application analysis and realisation of goal.

Conclusion:

Teacher's Activities:

The teacher finishes the activities on meta-heuristic learning approach thereby giving students assignment and helps the learners in necessary places.

Students' Activities:

The students make summary based on their observations on the process of learning task to end the activities on Meta-Heuristic Strategy.

APPENDIX I
LESSON PLAN FOR CONTROL GROUP (LECTURE METHOD)

WEEK ONE

Subject: Geography

Topic: Settlement

Group: Control Group (Lecture Method)

Class: SSII

Age: 15-17 years

Sex: Co-education (mixed)

Teaching Method: Lecture Method

Dur**ation:** 45 Minutes

Instructional Material: Chart, Map and Picture

Specific Objectives: By the end of this lesson the students should be able to:

a. define settlement
b. mention nine (9) categories of settlement
c. explain any five categories of the settlements mention above.

Prior Knowledge: The students have learnt about population which leads to present lesson.

Introduction: The teacher starts the lesson by telling the students about the way students move around in their various localities and villages, that is, as you could notice when you are on holidays you travel to villages or cities to enjoy your holidays with your relations that are far away from your immediate environment. Therefore, the topic for today lesson is settlement.

Presentation: The teacher begins the lesson through the following steps:

Step I: The teacher defines settlements to students.

Step II: The teacher lists nine (9) categories of settlement.

Step III: The teacher explains nine (9) categories of settlement.

Evaluation: The teacher evaluates the lesson by asking the students the following questions.

a. Who can define settlement?
b. Who can list and explain four categories of settlement?

Conclusion: The teacher terminates the lesson by giving class work to students and going round to assist in necessary places.

LESSON PLAN FOR CONTROL GROUP (LECTURE METHOD)

WEEK TWO

Subject: Geography

Topic: Settlement

Sub-Topic: Classifications of Settlement (Rural and Urban)

Group: Control Group (Lecture Method)

Class: SSII

Age: 15-17 years

Sex: Co-education (mixed)

Teaching Method: Lecture Method

Dur**ation:** 45 Minutes

Instructional Material: Chart, Map and Picture

Specific Objectives: By the end of this lesson the students should be able to:

a. define settlements
b. explain the rural and urban types of settlement
c. states five differences between rural and urban settlement.

Prior Knowledge: The students have learnt about settlement and its categories which lead to present lesson.

Introduction: The teacher begins the lesson by telling the students about the way students move around in their various localities and villages, that is, as you could notice when you are on holidays you travel to villages or cities to enjoy your holidays with your relations that are far away from your immediate environment. Therefore, the topic for today lesson is classification of settlement.

Presentation: The teacher commences the lesson through the following steps:

Step I: The teacher defines settlements to students.

Step II: The teacher explains the rural and urban settlement.

Step III: The teacher States five differences between rural and urban settlement.

Evaluation: The teacher evaluates the lesson by asking the students the following questions

i. Who can define rural and urban settlement?
ii. Who can state five differences between rural and urban settlement?

Conclusion: The teacher concludes the lesson by giving class work to students and going round to assist in necessary places.

LESSON PLAN FOR CONTROL GROUP (LECTURE METHOD)

WEEK THREE

Subject: Geography

Topic: Settlement

Sub-Topic: Functions of Settlement

Group: Control Group (Lecture Method)

Class: SSII

Age: 15-17 years

Sex: Co-education (mixed)

Teaching Method: Lecture Method

Dur**ation:** 45 Minutes

Instructional Material: Chart, Map and Picture

Specific Objectives: By the end of this lesson the students should be able to:

a. define settlement
b. mention five (5) functions of rural and urban settlement
c. explain eight function of urban and urban settlement.

Prior Knowledge: The students have learnt about types of settlements which leads to present lesson.

Introduction: The teacher introduces the lesson by telling the students about the way students move around in their various localities and villages, that is, as you could notice when you are on holidays you travel to villages or cities to enjoy your holidays with your relations that are far away from your immediate environment. Therefore, the topic for today lesson is functions settlement.

Presentation: The teacher begins the lesson through the following steps:

Step I: The teacher mentions the functions of rural and urban settlement.

Step II: The teacher explains the functions of rural and urban settlement to students.

Evaluation: The teacher evaluates the lesson by asking the students the following questions.

i. Who can list functions of rural and urban settlement?
ii. Who can explain four functions of rural and urban settlement?

Conclusion: The teacher ends the lesson by giving class work or assignment to students and going round to assist in necessary places.

LESSON PLAN FOR CONTROL GROUP (LECTURE METHOD)

WEEK FOUR

Subject: Geography

Topic: Settlement

Sub-Topic: Patterns of Settlement (Dispersed and Nucleated Patterns)

Group: Control Group (Lecture Method)

Class: SSII

Age: 15-17 years

Sex: Co-education (mixed)

Teaching Method: Lecture Method

Dur**ation:** 45 Minutes

Instructional Material: Chart, Map and Picture

Specific Objectives: By the end of this lesson the students should be able to:

a. explain patterns of settlement
b. define dispersed and nucleated patterns of settlement
c. differentiate between disperse and nucleated patterns of settlement.

Prior Knowledge: The students have learnt about functions of settlements which lead to present lesson.

Introduction: The teacher commences the lesson by telling the students about the way students move around in their various localities and villages, that is, as you could notice when you are on holidays you travel to villages or cities to enjoy your holidays with your relations that are far away from your immediate environment. Therefore, the topic for today lesson is disperse and nucleated patterns of settlement.

Presentation: The teacher commences the lesson through the following steps:

Step I: The teacher explains patterns of settlements to students.

Step II: The teacher differentiates between disperse and nucleated patterns of settlement.

Evaluation: The teacher evaluates the lesson by asking the students the following questions.

i. Who can define patterns of settlement?
ii. Who can explain disperse and nucleated patterns of settlement?
iii. Who can state two differences between disperse and nucleated patterns of settlement?

Conclusion: The teacher terminates the lesson by giving class work to students and going round to assist in necessary places.

LESSON PLAN FOR CONTROL GROUP (LECTURE METHOD)

WEEK FIVE

Subject: Geography

Topic: Settlement

Sub-Topic: Patterns of Settlement (Linear and Ring Patterns)

Group: Control Group (Lecture Method)

Class: SSII

Age: 15-17 years

Sex: Co-education (mixed)

Teaching Method: Lecture Method

Dur**ation:** 45 Minutes

Instructional Material: Chart, Map and Picture

Specific Objectives: By the end of this lesson the students should be able to:

a. explain patterns of settlement
b. define linear and ring patterns of settlement
c. differentiate between linear and ring patterns of settlement.

Prior Knowledge: The students have learnt about functions of settlements which lead to present lesson.

Introduction: The teacher begins the lesson by telling the students about the way students move around in their various localities and villages, that is, as you could notice when you are on holidays you travel to villages or cities to enjoy your holidays with your relations that are far away from your immediate environment. Therefore, the topic for today lesson is patterns of settlement.

Presentation: The teacher commences the lesson through the following steps:

Step I: The teacher defines patterns of settlements to students.

Step II: The teacher explains linear and ring patterns of settlement.

Step III: The teacher states the differences between linear and ring patterns of settlement to students.

Evaluation: The teacher evaluates the lesson by asking the students the following questions.

i. Who can explain linear and ring patterns of settlement?
ii. Who can state three differences between linear and ring patterns of settlement?

Conclusion: The teacher terminates the lesson by giving class work to students and going round to assist in necessary places.

LESSON PLAN FOR CONTROL GROUP (LECTURE METHOD)

WEEK SIX

Subject: Geography

Topic: Settlement

Sub-Topic: Factor that Determine the Patterns of Settlement

Group: Control Group (Lecture Method)

Class: SSII

Age: 15-17 years

Sex: Co-education (mixed)

Teaching Method: Lecture Method

Dur**ation:** 45 Minutes

Instructional Material: Chart, Map and Picture

Specific Objectives: By the end of this lesson the students should be able to:

a. define the patterns of settlement
b. mention eight (8) factors that determine patterns of settlement
c. explain any six factors that determine the patterns of settlement.

Prior Knowledge: The students have learnt about patterns of settlement which leads to present lesson.

Introduction: The teacher starts the lesson by telling the students about the way students move around in their various localities and villages, that is, as you could notice when you are on holidays you travel to villages or cities to enjoy your holidays with your relations that are far away from your immediate environment. Therefore, the topic for today lesson is factors that determine the patterns of settlement.

Presentation: The teacher starts the lesson through the following steps:

Step I: The teacher explains the patterns of settlement to students.

Step II: The teacher lists eight (8) factors that determine the patterns of settlement.

Step III: The teacher explains the factors that determine patterns of settlements to students.

Evaluation: The teacher evaluates the lesson by asking the students the following questions.

i. Who can list five factors that determine the patterns of settlement?
ii. Who can explain any three (3) factors that determine the patterns of settlement?

Conclusion: The teacher ends the lesson by giving class work to students and going round to assist in necessary places.

APPENDIX J

Computer Generated Results

```
>Warning # 849 in column 23.  Text: en_NG
>The LOCALE subcommand of the SET command has an invalid parameter.  It could
>not be mapped to a valid backend locale.

SAVE OUTFILE='C:\Users\KIL ABU\Documents\dokaci data.sav'
  /COMPRESSED.
DATASET ACTIVATE DataSet0.
SAVE OUTFILE='C:\Users\KIL ABU\Documents\dokaci data.sav'
 /COMPRESSED.
NPAR TESTS
  /M-W= test1 BY post1(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

```
[DataSet0] C:\Users\KIL ABU\Documents\dokaci data.sav
```

Mann-Whitney Test

Ranks

	post1	N	Mean Rank	Sum of Ranks
test1	1.00	77	100.39	7730.00
	2.00	63	33.97	2140.00
	Total	140		

Test Statistics[a]

	test1
Mann-Whitney U	124.000
Wilcoxon W	2140.000
Z	-9.646
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: post1

```
T-TEST GROUPS=post2(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=test2
  /CRITERIA=CI(.95).
```

T-Test

```
[DataSet0] C:\Users\KIL ABU\Documents\dokaci data.sav
```

Group Statistics

	post2	N	Mean	Std. Deviation	Std. Error Mean
test2	1.00	77	27.7532	7.87427	.89736
	2.00	63	17.7302	5.18436	.65317

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
test2	Equal variances assumed	22.978	.000	8.678	138
	Equal variances not assumed			9.031	132.331

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence ... Lower
test2	Equal variances assumed	.000	10.02309	1.15498	7.73934
	Equal variances not assumed	.000	10.02309	1.10990	7.82765

Independent Samples Test

		t-test for Equality of ... 95% Confidence ... Upper
test2	Equal variances assumed	12.30684
	Equal variances not assumed	12.21853

```
T-TEST GROUPS=post3(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=test3
  /CRITERIA=CI(.95).
```

T-Test

[DataSet0] C:\Users\KIL ABU\Documents\dokaci data.sav

Group Statistics

	post3	N	Mean	Std. Deviation	Std. Error Mean
test3	1.00	77	32.1818	6.66635	.75970
	2.00	63	16.7619	5.99385	.75515

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
test3	Equal variances assumed	2.422	.122	14.243	138
	Equal variances not assumed			14.395	136.741

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence ... Lower
test3	Equal variances assumed	.000	15.41991	1.08266	13.27917
	Equal variances not assumed	.000	15.41991	1.07117	13.30171

Independent Samples Test

		t-test for Equality of ... 95% Confidence ... Upper
test3	Equal variances assumed	17.56066
	Equal variances not assumed	17.53811

```
NPAR TESTS
  /M-W= test4 BY post4(1 2)
  /MISSING ANALYSIS.
```

NPar Tests

[DataSet0] C:\Users\KIL ABU\Documents\dokaci data.sav

Mann-Whitney Test

Ranks

	post4	N	Mean Rank	Sum of Ranks
test4	1.00	40	37.71	1508.50
	2.00	37	40.39	1494.50
	Total	77		

Test Statistics[a]

	test4
Mann-Whitney U	688.500
Wilcoxon W	1508.500
Z	-.527
Asymp. Sig. (2-tailed)	.599

a. Grouping Variable: post4

```
T-TEST GROUPS=post5(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=test5
  /CRITERIA=CI(.95).
```

T-Test

[DataSet0] C:\Users\KIL ABU\Documents\dokaci data.sav

Group Statistics

	post5	N	Mean	Std. Deviation	Std. Error Mean
test5	1.00	40	27.0500	7.37268	1.16572
	2.00	37	28.2432	8.26440	1.35866

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
test5	Equal variances assumed	1.017	.316	-.670	75
	Equal variances not assumed			-.667	72.330

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence ... Lower
test5	Equal variances assumed	.505	-1.19324	1.78220	-4.74356
	Equal variances not assumed	.507	-1.19324	1.79021	-4.76169

Independent Samples Test

		t-test for Equality of ... 95% Confidence ... Upper
test5	Equal variances assumed	2.35707
	Equal variances not assumed	2.37520

```
T-TEST GROUPS=post6(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=test6
  /CRITERIA=CI(.95).
```

T-Test

```
[DataSet0] C:\Users\KIL ABU\Documents\dokaci data.sav
```

Group Statistics

	post6	N	Mean	Std. Deviation	Std. Error Mean
test6	1.00	40	30.7500	6.12163	.96791
	2.00	37	33.6757	6.90432	1.13506

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
test6	Equal variances assumed	.001	.972	-1.971	75
	Equal variances not assumed			-1.961	72.167

Independent Samples Test

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence ... Lower
test6	Equal variances assumed	.052	-2.92568	1.48468	-5.88332
	Equal variances not assumed	.054	-2.92568	1.49172	-5.89925

Independent Samples Test

		t-test for Equality of ... 95% Confidence ... Upper
test6	Equal variances assumed	.03197
	Equal variances not assumed	.04790