USMANU DANFODIYO UNIVERSITY, SOKOTO
(POSTGRADUATE SCHOOL)

EFFECTS OF INQUIRY METHOD ON MATHEMATICS PERFORMANCEAMONG SENIOR SECONDARY STUDENTS IN NIGER STATE, NIGERIA

A Dissertation

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By

ONAKPA, Aye Blessing
Adm. No.: 12210409004
Department of Science and Vocational Education

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DEDICATION

This dissertation is dedicated to my beloved husband Mr. Ojima N. Okeme and my Parents Mr. and Mrs. Michael Onakpa for their prayers, provisions and support.

CERTIFICATION

This dissertation by Onakpa Aye Blessing (12210409004) has met the requirements for the award of the degree of Master of Education (Mathematics Education) of the Usmanu Danfodiyo University, Sokoto, and is approved for its contributions to knowledge.

_____	_____
Prof/Dr External Examiner	Date
_____	_____
Prof. I. Galadima Major Supervisor	Date
_____	_____
Dr. M.A. Yasha'u Co-Supervisor I	Date
_____	_____
Prof. A.A Uba Co- Supervisor II	Date
_____	_____
Prof/Dr Head/Ag. Head of Department	Date

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ABSTRACT

This study investigated the effect of inquiry method on mathematics performance of senior secondary school students in Niger state, Nigeria. The population for the study was made up of one thousand, one hundred and thirty-three (1,133) students from six schools in the three educational zones of Niger state. A sample of two hundred and ninety one (291) students was selected using Krejcie and Morgan Table for determining sample size. The instrument used was Mathematics Performance Test (MPT) with a reliability coefficient of 0.74. Mean and standard deviation were used to describe the performance of the two groups while Hypothesis $H0_1$, $H0_2$ and $H0_3$ were tested using two tailed t-test statistic. Results of the study revealed that there was significant difference in the performance of students taught by Inquiry Method and those taught by Expository Method. Similarly, there was significant difference in the performance of students from urban and rural schools in mathematics.Hence, $H0_1$and $H0_3$ were rejected ($P< 0.05$). However, there was no significant difference in the performance of male and female students. Hence, $H0_2$ was retained ($P > 0.05$). Based on the findings of the study, it was recommendedthat teachers should be trained and motivated to use the inquiry method so as to bring about better academic performance among senior secondary school students in mathematics.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Mathematics is the science of shape, quantity and arrangement. According to Obodo(2000), mathematicians viewed mathematics as a universal language that uses carefully defined terms and concise symbolic representations to add precision to communication. Usman(2002) stated that mathematics arose from the peoples' need in organized society. It is also one of the most powerful and acceptable tool, which the intelligence of man has made for its own use over centuries. Mathematics is the science of numbers, quantity and space (Odili, 2006). He stated that it is a systemized, organized and exact branch of science. He also viewed mathematics as the creation of the mind, concerned primarily with ideas, processes and reasoning. It is not just a language of science, but contributes to business, finance, health and defense.Nurudeen(2007) stated that all sciences have their roots in mathematics and described mathematics as the gateway to human endeavor. Many mathematicians viewed mathematics in various ways based on its activities and importance.

Mathematics is an essential tool for the advancement of science and technology in this century. It plays very crucial and important roles in the Development of any country. The values of Mathematics to man was noticed as far back as the pre-historic dark age, when counting and computations were rigorously done with the use of stick, stones, strokes on walls, days of the weeks, markets days or any other

eventful or memorial phenomena.The Science Teachers Association of Nigeria (STAN, 1992) referred to Mathematics as the central intellectual discipline of the technology societies. The knowledge of science and technology remains superficial without Mathematics. It therefore means that the position of Mathematics in secondary school curriculum in Nigeria is important for scientific development.The significance of Mathematics in producing versatile and resourceful graduates that are needed for economic development cannot be over-emphasized. This is why Setidisho (1996) affirmed that Mathematics is a fundamental science that is necessary for understanding of most other fields in education. He stressed further that, it is glaring that no other subject forms such a strong force among the various branches of science.In his submission, Odusoro (2002) affirmed that the knowledge of science remains superficial without Mathematics. It therefore means that, the position of Mathematics in secondary school curriculum in Nigeria is important for scientific development.Mathematics is used for calculations, computation and manipulations of numbers in a more reliable, efficient and accurate manner born out of the creed of technological advancement (Ibrahim, 2012).

Fafunwa (1990) and Fatunla (1992) agreed to the fact that a nation can never become prosperous and economically independent without mathematics.Abakporo (2005), defined mathematics as the queen and substances of science and technology. Therefore, the importance of competence in Mathematics to learners at all levels of education particularly senior secondary school cannot be over emphasized. However, reports from different researches have portrayed a poor state of Nigerian students in terms of mathematics performance. Odili (2006), Maduabum and Odili (2006) and

Ashikhia (2010) in separate studies revealed low academic performance in mathematics. This pattern of students performing poorly in mathematics has brought much growing concern among parents, teachers, society, and within government circles. The fear is, if nothing positive is done, the scientific and technological development will be dwindled thereby affecting the hope and vision of Nigeria as one of the twenty countries in scientific and technological advancement in 20:2020

Secondary school mathematics has many areas of study such as algebra, mensuration, statistics, number and numeration, geometry and trigonometry. The problem that results in poor performance of students in mathematics at external examinations like National Examination Council (NECO), and senior examination for SSS 3 as well as WASSC does not just start at that level but from the primary schools. Adebayo (2001) is of the opinion that this could be due to poor teaching of the subject. Some teachers teach not minding whether the students are learning with ease or not, thus correct use of an approach or teaching method is critical to successful teaching and learning. Crowlay (2003) observed that what students learn is greatly influenced by how they are taught. It is therefore very important for mathematics teachers to be familiar with different teaching methods especially the ones that will help students achieve the required learning objectives. Azuka (2012) observed that one of the challenges in the school system is how to teach and ensure that students comprehend the mathematics concepts to facilitate effective retrieval when required. Thus, there are different teaching methods that mathematics teachers can use to ensure effective learning and sustain the attention of the learners to have positive attitude and interest towards the subject.

The way mathematics is taught in schools in the last ten years has gained the attention of policy makers, parents and stakeholders. Teaching students mathematics with understanding, actively builds new knowledgefrom experience and prior knowledge. This position implies that students should receive mathematics instruction that build on their prior knowledge and should apply in real life situations. Other studieson methodology of science and mathematics teaching and learning methods of teaching mathematics such as inquiry, expository, discovery and problem solving techniques have shown that students learn science and mathematics more by dong rather than by mere observation. Nigerians are demanding that the nation's schools provide effective education to keep pace with a rapidly changing world. Research however supports that most teachers teach the way they learnt (Stilt-Gohdes, 2001). Eze (2002) found out that poor quality of instruction techniques employed by teachers is the major cause of poor performance among secondary school students in mathematics.These teachers dominate the class activities and the students are not involved in active learning. Iji (2005) pointed at teaching approaches and strategies used in the classrooms by teachers as one of the root causes of the undesirable poor performance in the subject.

However, in order to make a head way, causes of how educational system has led to this path of failure must be reviewed. Available records have shown that researchers have discovered series of teaching approaches likediscovery method (Ajewole, 1997),ethno mathematics (Kurume, 2006) and team teaching (Achor, Imoko and Jimin, 2011) which are capable of alleviating poor achievement of students in mathematics.

Awodi (1984) defines inquiry method of teaching as a process which encourages students to solve problems in a logical and systematic manner using the process of science. These processes of science are characterized by various skills such as observing, comparing, informing, hypothesizing, experimenting, data collections and interpretation of data.Denise (1997) defines inquiry as the set of behaviors involved in the struggle of human beings for reasonable explanations of phenomena about which they are curious.

Inquiry method is a true problem solving method and could be traced back to the work of Dewey (1933) who maintained that the learner should develop the intellectual fact and sensitivity to solve problems by inquiring constantly. According to Lane (2007), students are required to develop both the principle and the solution of a problem when using inquiry method. The inquiry method is a development of the discovery approach which is done with a view of finding some answers to reasons when certain problems exist. Inquiry investigations therefore go further and deeper than discovery and so the learner needs to use all his discovery abilities in order to succeed in true inquiry (Kurumeh, 2010). As a result, true mathematics inquiry involves the unraveling of the hidden relationships about mathematical concepts (Ashikhia, 2010).

Furthermore, inquiry method is a structured method of teaching mathematics which resultsin students gaining knowledge of the subject principles and concept (Kurume, 2006). It also results in students having the ability to formulate and resolve problems as well as communicate and acquire other skills necessary for working

with people. The method reduces the role of the teacher from dissimulator, to a guide in the process of teaching (Joe, 2007).

The researcher wants to investigate the effects of inquiry method on mathematics performance of senior secondary school students in Niger state, Nigeria.

1.2 Statement of the Problem

Students' poor performance in mathematics examinations has created concerns for mathematics educators to look into possible reasons why the performance is poor. The trends of students' performance in West African senior School Certificate Examinations (WASSCE) for May/June between 2006 and 2014 depicted that the overall performance of students who passed at credit was less than 60% of the total entry of the candidates in 8 out of 9 years result under consideration(WAEC, 2010). Majority of senior secondary school students often dread and show negative attitude towards mathematics and the trends of their performance in the senior secondary school certificate examination is also a source of worry to the stakeholders.

Thus, in Niger State, students' performance in mathematics is below expectation almost every year. A major factor which has been identified for such performance is lack of understanding of mathematical concepts. These misunderstandings were found to be as a result of previous incorrect ideas held by students. Likewise, the misunderstandings could result from the misconception and the alternative conceptions which students were exposed to prior to their classroom experience.However, several efforts by mathematics educators and stakeholders to improve student's performance in mathematics have not resulted into required achievement. Students in senior secondary schools are still struggling with topics

such as algebraic concepts and skills, geometry, trigonometry and statistics and many are discontinuing their study of higher- level mathematics because of their lack of success at the secondary level.

Based on the background, the central problem of this study was that secondary school students in Niger State are performing poorly in mathematics examinations and this performance generates concern among the stakeholders in education. Consequently, this study sought to investigate the extent to which inquiry method will improve the mathematics performance of senior secondary school students in Niger state, Nigeria.

1.3 Objectives of the Study

The main objectives of this study in specific terms are:

1. To determine the mean performance scores of students taughtMathematics using Inquiry Method and those taught using Expository Method.
2. To find out the difference in the mean performance score of male and female students taught Mathematics using Inquiry Method.
3. To determine the mean performance score of students taught Mathematics using Inquiry Teaching Method in the urban and those in the rural schools in Niger State, Nigeria.

1.4 Research Questions

The following research questions guided the conduct of the study:

1. What are the mean performance scores of students taughtMathematics using Inquiry Method and those taught using Expository Method?

2. To what extent will the mean performance score of male and female students taught Mathematicsusing Inquiry Method differ?
3. What are the mean performance scores of students taught Mathematicsusing Inquiry Teaching Method in the urban and those in the rural schools in Niger State, Nigeria?

1.5 Research Hypotheses

The following hypotheses were formulated to guide the conduct of the study:

1. There is no significant difference in the mean performance scores of students taught Mathematicsusing Inquiry Method and those taught using Expository Method.
2. There is no significant difference in the mean performance scores of male and female students taught Mathematicsusing Inquiry Method.
3. There is no significant difference in the mean performance scores of students taught Mathematicsusing Inquiry Teaching Method in the urban and those in the rural schools in Niger State.

1.6 Significance of the Study

The study aimed at determining the effect of inquiry method on mathematics performance of senior secondary school studentsin Niger state, Nigeria. Therefore, this study willbe significant in the sense that: -

- The findings of the study will provide useful information to the teachers on an appropriate teaching method (inquiry method) that will univocally address

the persistent teaching and learning difficulty faced in secondary school Mathematics.

- The study will avail the students to develop interest in Mathematics since inquiry method results in students having the ability to formulate and resolve problems
- It is the hope of the researcher that the study will also be of help to text book publishers to create workbook for senior secondary students in such a way that students, without the help of the teacher make an attempt to think of solutions to any given problems by themselves.
- It is also the hope of the researcher that the study will encourage further interest for more researches on the topic in other levels and in other subjects. Therefore, fellow researchers can make use of this study for further researches.
- In essence, it is the hope of the researcher that the study will expose teachers to inquiry method of teaching and incorporate skill of learning in the students. This study will also help improve students' communication skills necessary for working with people.

1.7 Scope and Delimitation of the Study

This study is about effect of inquiry method on mathematics performance of senior secondary school students in Niger state, Nigeria.The area that was covered by this study was the three educational zones in Niger state with the following number of students:Seventy- seven (77) students from Bida zone, ninety-seven (97) from Minna zone and One hundred and seventeen (117) from Kontagora zone. This

wassummed up to be two hundred and ninety-one students (291) out of the total of one thousand, one hundred and thirty-three (1,133) SS 2 students in Niger State. Though, the study should have best covered all the secondary schools in Niger state, but because of time and financial constraints, thus, the study was limited to senior secondary schools two (SSS 2) students from selected secondary schools in the three educational zones in Niger state. The research instrument used was Mathematics Performance Test (MPT)with thirty (30) objective questions.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

The study was aimed at determining the effect of Inquiry Method on mathematics performance of senior secondary school students in Niger State, Nigeria. In this chapter, relevant materials and related literatures were extensively reviewed. Hence, the chapter was presented in the following sub headings:

2.2 Conceptual Framework

2.2.1 Meaning of Mathematics

2.2.2 Scope of Mathematics

2.2.3 Instructional Methods of Teaching Mathematics

2.3 Theoretical Framework

2.3.1 Constructivist Approach and Cognitive Approach

2.3.2 Dewey and Vygotsky Cognitive Development Theories

2.4 Academic Performance of Students in Mathematics

2.5 Gender Difference and Performance of Students in Mathematics

2.6 Effect of Inquiry Method on Students' Performance in Mathematics

2.7 Effect of Inquiry Method on School Location (urban / rural) on Students' Performance in Mathematics

2.8 Review of Related Empirical Studies

2.9 Critique on the Reviewed Literature

2.2Conceptual Framework

A conceptual framework is a critical element of scholarly inquiry and serves multiple purposes for both individual researchers and the entire field (Mewborn, 2005). The conceptual framework is based on inquiry method of teaching Mathematics and its applications to real world.

2.2.1 Meaning of Mathematics

Mathematics can be described as a subject from which Science, Social Science and even Arts draw aspiration and substance. Eraikhuemen (2003) maintained that background knowledge of Mathematics is a necessary condition for the study of science. This is an oblivious statement because the need for Mathematics in these present days has gone beyond the need for study of science only; rather Mathematics is required in all field of life.

Pilant (2004), described Mathematics as the relationship between numbers and other measurable quantities. He iterated that "Without Mathematics to describe physical phenomena, we might be living in a world with beautiful art, literature and philosophy, but no technology".

Ibrahim (2012) further highlighted some concept of Mathematics as follows;

- **Mathematics is a fact: -**Mathematics is a fact because at any point in time, in all cases, the axioms, postulates, theorems, proofs and other properties of Mathematics are all facts, the whole facts and nothing but the facts. The sum

of two or more mathematical numbers now, today, tomorrow and forever more will always be the same.

E.g. 3 + 4 = 7, 5 + 2 = 7, 8 + 9 = 17, 5 – 8 = -3 and so on in Nigeria as well as anywhere in the whole world, probably the same thing is applicable in heaven or the world beyond.

- **Mathematics is a universal language: -** A person in a strange land can conveniently demonstrate numbers by the use of fingers. Mathematics (Numbers) is the easiest and surest lingual Franca for business transactions and also the language for technological development.
- **Mathematics is beauty: -** Scientist through the ages have noted with some astonishment, not only the remarkable success of mathematics in describing the natural world, but also the fact that the best mathematical formulations are usually those that are the most beautiful. It is also interesting to know that the beauty of mathematics makes it impossible to lie. For instance 1+1 = 2 everywhere in the world. Below is an interesting way to look at the beauty of mathematics:

1 x 9 + 2 = 11 9 x 9 + 7 = 88

12 x 9 + 3 = 11198 x 9 + 6 = 888

123 x 9 + 4 = 1111 987 x 9 + 5 = 8888

1234 x 9 + 5 = 11111 9876 x 9 + 4 = 88888

12345 x 9 + 6 = 111111 98765 x 9 + 3 = 888888

123456 x 9 + 7 = 1111111 987654 x 9 + 2 = 8888888

1234567 x 9 + 8 = 11111111 9876543 x 9 + 1 = 88888888

12345678 x 9 + 9 = 111111111 98765432 x 9 + 0 = 888888888

123456789 x 9 +10= 1111111111

2.2.2 Scope of Mathematics

There are five branches of Mathematics as contained in Nigerian Mathematics Curriculum. They are Arithmetic, Algebra, Geometry, Trigonometry and Statistics

Arithmetic, literally mean the art of counting. The word comes from the Greek arithmētikē, which combines the ideas of two words: arithmos, meaning "number", and technē, referring to an art or skill. Arithmetic is fundamental of mathematical operations: counting, operations—addition, subtraction, multiplication, division, and place holding—form the basis of the Mathematics that we use regularly. In Nigeria, prior to independence till early 80's and some other countries, arithmetic was and is still the primary area of Mathematical study during the first six years of school.

Algebra, branch of Mathematics in which symbols represent relationships. Classical algebra grew out of methods of solving equations; it represents numbers with symbols that combine according to the basic arithmetical operations of addition, subtraction, multiplication, division, and the extraction of roots.

However, arithmetic cannot generalize mathematical relations such as Pythagoras' theorem, which states that in any right-angled triangle, the area of the square drawn on the hypotenuse is equal to the sum of the areas of the squares drawn on the other

two sides. Arithmetic can produce only specific instances of these relations (for example, 3, 4, and 5, where $3^2 + 4^2 = 5^2$). Algebra, by contrast, can make a purely general statement that fulfils the conditions of the theorem: $a^2 + b^2 = c^2$. Any number multiplied by itself is termed squared, and is indicated by a superscript number 2. For example, 3×3 is notated 3^2; similarly, $a \times a$ is equivalent to a^2. Modern algebra has evolved from classical algebra by increasing its attention to the structures within Mathematics. Mathematicians consider modern algebra to be a set of objects with rules for connecting or relating them. As such, in its most general form, algebra may fairly be described as the language of Mathematics.

Geometry, (Greek geō, "Earth"; metrein, "to measure"), branch of Mathematics that deals with the properties of space. In its most elementary form geometry is concerned with such metrical problems as determining the areas and diameters of two-dimensional figures and the surface areas and volumes of solids. Other fields of geometry include analytic geometry, descriptive geometry, topology, the geometry of spaces having four or more dimensions, fractal geometry, and non-Euclidean geometry.

Trigonometry, this is another branch of Mathematics that deals with the relationships between the sides and angles of triangles and with the properties and applications of the trigonometric functions of angles. The two branches of trigonometry are plane trigonometry, which deals with figures lying wholly in a single plane, and spherical or solid trigonometry, which deals with triangles that are sections of the surface of a sphere.

2.2.3 Instructional Methods of Teaching Mathematics

Teaching is a systematic presentation of facts, ideas, skills, and techniques to students. Instruction refers to those curriculum-related, professionally-informed decisions that teachers purposefully enact to enhance learning opportunities for students. Effective instruction is interactive and designed to accommodate student learning needs and styles through a variety of teaching practices.

Throughout history, there have been many instructional methods documented (Egal, 2009). This however can be classified into two that is, the traditional and the Modern methods of teaching Mathematics.

A. Traditional Method of Teaching Mathematics

The traditional method of teaching lay more emphasis on teacher centeredness. This method of teachingincludes the indigenous, non-formal and informal techniques of education such as rote memory, imitation,dictation, repetitive recitation, observation and to some extent the formal lecture teaching style.Although, these methods are obsolete, they give room for diversity in training and permit the students todevelop long and retentive memories. Eve (1998) as contain inZakariyya (2002) sees some loop holes in this teaching technique when he narrated his observation using the techniques thus:

"Traditionally we ask do the students understand the materials that are presented? We also traditionallyask are there any questions about the materials?the response is usually chorus answers YES! and NO!respectively. Somehow I know that many students do not understand or are confused about what I amtrying to teach them".

In another remark on traditional method of teaching mathematics, Jonathan and Henri (2003) iteratedthat Teachers in most schools shape their curricula (divert from given curriculum), design their lessons,and establish their expectations of students for their own convenience to the detriment of these students.

Effective use of Instructional Materials in Traditional Method of Teaching Mathematics

Instructional materials are materials that help the teachers to pass the knowledge (message) totheirstudents more effectively. Shafi and Areelu (2010) opined that instructional materialshelp to reduce the level of abstraction in teaching and learning of a concept. Instructional materials helpto capture the learner interest. They also keep the students busy and active. They give room for effectiveretention of mathematical concepts.

B. Modern Method of Teaching Mathematics

The modern method of teaching is a fullysystemized way of presenting lesson. It exists in different forms some of which include;

I. Inquiry method of teaching Mathematics

II. Expository method of teaching Mathematics

III. Laboratory method of teaching Mathematics

IV. Discussion method of teaching Mathematics

1. Inquiry Method of Teaching Mathematics

Inquiry method of teaching mathematics is a student-centered method of teaching which focuses on asking questions. It encourages students to ask meaningful questionsand to interact directly with one another. It disallows teachers from giving

answers where possible.In inquiry processes, teachers act as facilitator or coach, ratherthan an instructor or dispensers of information. They offer students problems, issues and questions and then provide encouragement for inquiry into the nature of the problems and guidance for seeking solutions. They help students find or pose problems, investigate, and clarify positions and concisions. To function students' term and testhypothesis they develop, ultimately arriving at statements of conclusion, generalizations or solutions. The general goal of inquiry method of teaching is to help students develop the intellectual discipline and skills necessary to raise questions and search out answers steaming from their curiosity.

According to Dang and Jwan (2000), the inquiry method is an approach that seeks to find out more about nature, about how things come by. In this method, the teacher allows the students to raise questions and seek solutions through guided instruction. It gives the opportunity to the students to use their own initiative.

Furthermore, Inquiry is a term used in science teaching that refers to a way of questioning, seeking knowledge or information, or finding out about phenomena. It involves investigation, searching, defining a problem, formulating hypothesis, gathering and interpreting data and arriving at a conclusion. In inquiry situation, students learn not only concepts and principles but self-direction, responsibility and social communication. It also permits students to assimilate and accommodate information (Sola andOjo, 2007). However, Inquiry is the way people learn when they're left alone.

Some advantages of inquiry method are summarized as follows:

- It gives the students opportunity to think carefully about ideas, problems and questions being considered valid by class.
- It creates room for students' full participation which increases their curiosity both inside and outside classroom work.
- It makes the students to develop the spirit of personal initiative.
- It encourages patience, co-operation, unity and decision making amongst the students.
- It arms the students with the right type of attitudes, values, skills and knowledge that enable them explore their social environment.
- It increases students understanding of processes, concept and relationship.

Most people do not have an accurate picture of mathematics. They view mathematics as a set of formulas to be applied to a list of problems at the ends of textbook chapters. The reason for this misjudgment is the way mathematics is often taught. Teaching must not be limited to a teacher demonstrating a method of calculation and students subsequently repeating it without reflection. Learning mathematics is an active, constructive, cumulative and goal-oriented process. This must also be perceptible for the students. Rather than showing facts or a clear, smooth path to a solution, the teacher guides students through well-designed problems through an adventure in mathematical discovery.

Inquiry Method of teaching Mathematics promotes student's active participation in the learning process. It increases student's ability to analyze, synthesize, evaluate

and relate the intended learning to multiple disciplines and everyday life, thereby making the materials more relevant to students (Cherif, 1998).

II. Expository Method of Teaching Mathematics

This method of teaching according to Yusha'u (2016) is one of the oldest teaching strategies in normal classroom setting with some misconceptions of making students 'passive-listeners'. However, Susan, Antoinette, and Gwendolyn (2004) maintained that there are two approaches to teaching:

- Teaching for Procedural Knowledge: which implies teaching definitions, symbols, and isolatedskills in an expository manner without first focusing on building deep, connected meaning tosupport those concepts and
- Teaching for Conceptual Understanding: this entails teaching by beginning with posingproblems that require students to reason flexibly. Through the solution process, students makeconnections to what they already know, thus allowing them to extend their prior knowledgeand transfer it to new situations

III. Laboratory Method of Teaching Mathematics

This is the use of spacious room equipped with instructional materials, where students are taught on howto make practical models for solving theoretical concepts of the traditional teaching techniques. Similarly, Yusha'u (2016) opined that this method engages both the teacher and the students in the learning process. It involves the manipulation of tools and materials, keen observation, accurate recording, analysis of data, stating and testing hypotheses, carrying out experiment and drawing conclusion

2.3 Theoretical Framework

Inquiry based learning is an approach to learning that involves a process of exploring the natural or material world, and that leads to asking questions, making discoveries and rigorously testing those discoveries in the search for new understanding This method of learning engages students in the process of learning, by encouraging them to explore and reflect upon their own questions around a concept. Students are thereby empowered in their own education; they build critical thinking skills and develop analytical reasoning techniques, in addition to learning content knowledge. The learning is interactive and cyclical, as new knowledge brings about more questions and awareness of gaps of knowledge. The philosophy of inquiry based learning finds its antecedents in the work of Piaget, Dewey, Vygotsky, and Freire among others.

2.3.1 Constructivist Approach and Cognitive Science Approach

The traditional behaviorist approach to teaching mathematics is giving way gradually to a constructivist approach. Constructivists advocates for active learning, which allows students to build their own conceptual understanding, it is clear that learning is not about accumulating random information, memorizing it, and then repeating it on some exam; learning is about understanding and applying concepts, constructing meaning, and thinking about ideas. Constructivist theories suggest that in order for students to be successful in solving a problem, they should select and apply correct solving schemas. There is situation where students apply incorrect schemas while having the correct ones in their heads. One possible explanation is

that students probably had the correct methods in their long-term memory but they could not recall the information. According to Christian (1999), the central idea of the constructivist is that, the experience a student gains from learning activities cannot be predetermine by the teacher, since the experience depends both on how the child relates the learning activities too previous experience and also on his effective/emotional attitudes; thus the teacher cannot cause a student to construct specific knowledge. At the heart of the constructivist approach is sensitivity, on the part of the teacher, to be able to feel what the learner feels; to put himself in the learner's shoes, not only in the cognitive sense but also in the emotional sense.

According to the Cognitive Science Society, cognitive scientists aspire to understand the nature of the human mind. Many cognitive scientists operate under the constructivist paradigm, which advocates student strategy selection. Cognitive scientists expect students to develop most efficient strategies and increase understanding through this selection process (Siegler, 2003). Thinking processes advocated by cognitive scientists' further evidence conceptual understanding on the part of the students. Researchers and Educators who subscribe to both the constructivist paradigm and cognitive science theories advocate the use of manipulative in mathematics education. The constructivist paradigm supports the use of manipulatives because learning is active and students functioning at the concrete developmental levels benefit from the concrete aspect of manipulative. Also cognitive science theories support the use of manipulative as they contribute to the creation and application of prior knowledge procedural and conceptual

understandings are both valuable as students learn mathematics. Conceptual understanding is an important component of constructivism and cognitive science; students must make connections and develop understandings, not just memorize a set of facts or procedures. Kilpatrick Swafford and Findell (2001) emphasized that procedural skills must be accompanied by conceptual understanding. As students learn mathematics, they need to do more than just compute; they need to understand the meaning and purpose of computations. For this reason, conceptual understanding may be more important as students solve mathematics. They may be able to use this conceptual understanding to accurately implement correct procedure while solving mathematics.

2.3.2 Vygotsky and Dewey Cognitive Development Theories

Vygotsky, the "founding father" of social constructivism based his theory on the idea that social interaction was essential to the learning process along with critical thinking. Social interaction or cooperative learning had a big impact on how students internalized what they learned. "Vygotsky stated that language enhances learning and that it precedes knowledge or thinking. In order to embrace diversity, students must interact socially [by using language]" (Powell andKalina, 2009, p. 245).

However, the theoretical framework of this study is rooted in John Dewey's work, and aligned with constructivism. Constructivism, which seems to be consistent and appropriate for studying the effect of inquiry method on the performance of students in senior secondary school mathematics. Constructivism according to

Christian (1999) is a philosophical perspective on knowledge and learning, it has indeed gained international recognition as a theory, which has much offer to mathematics education. In the early 1900's, Dewey, a constructivist, contended "that we must teach children how to engage with the world on a practical level and trust them to construct their own knowledge through (successful) engagement in activities of a lifetime" (Glassman and Whaley 2000, p. 2). Dewey's theory of learning is that, optimal learning and human development and growth occur when people are confronted with substantive, real problems to solve. He believed that curriculum and instruction should be based on integrated, community-based tasks and activities that engage learners in forms of pragmatic social action that have real value in the world.Much of the current interest ininquiry can be traced back to the work of John Dewey. He maintained that the learner should develop the intellectual tract and sensitivity to solve problems by inquiry constantly to the classroom. The system is based on the scientific method of investigation on which requires posing a problem, generating hypothesis about the problem, testing the hypothesis and applying the solution.

2.4Academic Performance of Students in Mathematics

Microsoft Encarta (2007) defined Performance to mean manner of functioning, that is, the manner in which somebody functions, operate or behaves in accomplishing task or action. However, one can conclude that the definition simply stands for the level of success attained or accomplished by a learner as a result of the instructions/training he/she received from his teacher. Discussing factors affecting

students' academic performance will require a look at the concept of poor performance.

According to Nwagbo (2001), performance in teaching/learning process has to do with attainment of a set of objectives of instruction. If a learner accomplishes a task successfully and attains the specified goal for a particular learning experience, he is said to have performed.

Aremu (2000), defined poor performance as a performance that adjudged by the examinees as falling below an expected standard. The interpretation of this expected or desired standard is better appreciated from the perpetual cognitive ability of the evaluator of the performance. The evaluator or assessor can therefore give different interpretations depending on some factors.

Also, Abdullahi (2013) described poor academic performance as any performance that falls below a desired standard. The criteria of excellence can be from 40% to 100% depending on some subjective criteria of the evaluator or assessor. Just as in universities in Nigeria, any grade below 40% is considered as poor or failed.

It was also noted that overall performance of students depends on positive attitude towards Mathematics subject. Student's with low positive attitude got lower marks in their test. A study on students' Mathematics achievement and their interest in Mathematics as well as on the relation between these two constructs is also in limelight. The findings suggested that students show hardly any fear of Mathematics

independent of their achievement level (Heinze, Reiss, Rudolph and Augsburg, 2005).

Leng (2006) in his study found that peers have positive relationship with student performance in Mathematics. This gives the impression that student's peer group contributed in the increase in achievement in Mathematics. If students are not guided in choosing appropriate peer group, their performance may be affected.

Aremu and Sokan (2003) submit that the search for the causations of poor academic performance in Mathematics is unending but some of the major factors they put forward are: methods of teaching, self-esteem / self-efficacy, study habits, teacher consultation and poor interpersonal relationships. The foregoing seems to make it increasingly a source of concern considering the fact that Mathematics plays a vital role in scientific, technological and social progress of any nation and indeed all works of life.

Leng (2006) showed that effectiveness of learning depends on environmental factors such as attitudes, interests, teaching teachers, and peers. Tin (2003) found that correlation between attitude, interest, peer influence and perception towards teachers' instruction with upper secondary Mathematicsperformance. Abu Bakar, Kamaruddin and Tan (2009) reported that evaluation of the influence of attitudes, interest, teaching teachers and peers on students' achievement in Mathematics. These factors are rated very important in learning Mathematics in order to ensure good performance.

Essentially, several factors have been discussed as responsible for students' academic performance in Mathematics such as study habit, interest in the subject, and peer group.Many research studies have indicated that students from monogamous (small size) families perform better than the students' from polygamous (large size) families (Ali, 2012). The following reasons are responsible for this:

(1) The students in monogamous homes have more time to read their books and study in most cases, because there are fewer people to send on errand. But in polygamous families, the reverse is the case;
(2) The students from polygamous homes have more tendencies to be social deviants due to lack of care and adequate supervision;
(3) Since there are more people in a polygamous family, they exert a lot of pressure or influences that are negative; this will adversely affect the students.

In a study conducted in Nairobi at the secondary schools (Team of Mathematics Teachers, 2013), the major findings indicated that variation in Mathematics performance was found to be significantly influenced by the type of teaching method. The interactive teaching method was found to be superior to the traditional approach, especially with respect to achieving higher order cognitive skills. The study also found that there was no significant difference in performance when the availability of textbooks was at the student/textbook ratio level 1:1 and 1:2. However, ratio levels beyond 1:3 were found to have a negative effect on performance. Although, students' gender was found not to directly affect the

performance of Mathematics, the performance in Mathematics in this study favored girls, albeit not significantly. Class size was found not to have a significant and direct influence on achievement in assignments. However, the amount of time that students spent on Mathematics tasks was found to be minimum. The study indicated that a student's attitude was a major predictor of his/her performance.

2.5Gender Difference and Performance of Students in Mathematics

Gender refers to the socially culturally constructed characteristics and roles which are ascribed to males and females in any society. It is a major factor that influences career choice and subject interest of students (Okeke, 2008). Gender has been one of the major factors perceived to be influencing performance of students in Mathematics. Perhaps, the reason why males are pursuing Mathematics related disciplines and professions than females. In the paragraphs below the researcher discussed different research findings on gender and Mathematics performance both at home and abroad.

A survey carried out by Maduabum and Odili (2007) on male and female students' Performance in Mathematics, in senior secondary certificate further Mathematics in Nigeria, shows that male out beat female student within the seven (7) years trend of the survey. The result of Maduabum and Odili is not surprising, looking at the performance of male and female students in Mathematics right from the primary school level which is the grass root of learning in Nigeria to senior secondary level. Also, studies have shown that there is great disparity between the Mathematics Performance of male and female at all levels of education (Abubakar,

2010). It is glaring that most of the greatest Mathematicians cited in history of Mathematics are men; this is a pointer to the facts that men are known for challenging and tedious tasks. Researchers generally agreed that men are higher achievers in Mathematics than women. It's obvious that most of the world greatest mathematicians cited in History of Mathematics are men.

According to Umoh (2003), more difficult tasks are usually reserved for males while less difficult ones are considered feminine in a natural setting. Example of this is breaking of firewood, which is often seen as manly task while washing of plates could be seen as a female task at home. Thus at school, males are more likely to take difficult subject areas such as Mathematics while females on the other hand prefer simple subjects and often shy away from difficult task and problem-solving situation.

Mercy (2007) reveals that any conclusion that male performs better than female in science subject may not be acceptable from the fact that male all over the world are usually given preferential treatment when it comes to education. She insisted that cultural stigma happens to be one of the most powerful factors that inhibit the choice of difficult courses among Nigerian girls. In most aspect of human endeavor, males see themselves 'as superior to their female counterpart, when in actual sense there are some aspects that females supersedes males.

Swafford cited in Bashir (2006) attempted to determine whether males and females with comparable mathematical background would have comparable performance, attitude and problem solving skill that occurred during the first year in

mathematics. He observed that there was no significant difference between the two groups with respect to performance in the standardized first year test. In the same vein, the work of Olaganju (2001) shows that the performance of students is not dependent on their sex.

Similarly, Ekeh (2003) discovered that male secondary school students perform better than females in Mathematics. These differences in performance can be attributed to gender stereotyping which encourages male and female students to show interest in subjects relevant and related to the roles expected of them in the society.

Also, Jegede (2007) found that female students show higher anxiety towards the learning of science subjects in secondary schools than male students. In another study, Okereke and Onwukwe (2011) showed that the male students achieved better than the female students.

James (2007), studying the united states of America's National Centre for Education Statistics' reports on the 2004 specific proficiencies in Mathematics and the percentage of gender of students who have reached proficiency in those particular areas, observes that at each level, boys and girls are similarly successful on the most basic levels but for more complex areas, boys show more proficiency. However, He attributes this to existence of cognitive gender differences and accommodation.

Okeke (2008) gave a broad analytical concept which draws out women's role and responsibilities in relation to those of men, describing the males' attributes as bold, aggressive, tactful, economical use of words while the females are fearful, timid, gentle, dull, submissive and talkative. Thus in schools, males are more likely to take too difficult subject areas like science while the females take to career that will not conflict with marriage chances, marriage responsibilities and motherhood. Abiam and Odok (2006) who found no significant relationship between gender and performance in Number and Numeration, Algebraic processes and Statistics, they however found the existence of a weak significant relationship in Geometry and Trigonometry

Clark and Gorski (2002) conducted a study on the decline of females in the technology field. When survey fourth and twelfth grade students, fewer females than males answered yes to the question, "I like Mathematics" and "I am good at Mathematics" at twelfth grade level. Fourth graders of both gender voted similarly, while the number of twelfth grade girls with confidence in Mathematics decreased drastically. This shows that girls have below level of confidence in Mathematics at higher level.

Therefore, one can conclude from all the evidences provided above that there is a very wide gap of gender differences in Mathematics at senior secondary school Mathematics. Thus,the researcher will like to find out if this gap exists between male and female students taught Mathematics using inquiry method.

2.6 Effect of Inquiry Method on Students' Performance in Mathematics

Engaging students in inquiry-based learning is seen nowadays as a means of improving education; especially science and Mathematics on a global level (Khalick, 2004). Students' academic performances have been studied within different frameworks. Many of them have a focus on parents' education, occupation or home background (like; family income, language of the home, activities of the family and work methods), while other studies looked at it from the teachers' variables (such as teacher's age, experience, education, gender, etc), school variables (such as environment, structures, buildings, location, etc), students' variables (such as attitude, self-concept, self-esteem, study habit, interest, etc) or parents' support (such as achievement motivation of wards, parental attitudes towards education, the aspiration of parents, etc).

Bosch (2006) in his findings on inquiry method stated that in Mathematics, inquiry-based teaching and learning often starts with a certain problem or an experiment. He further asserted that inquiry-based learning goes beyond engaging students in activities but places students in the role of researchers. The quality of students' investigations is linked to the quality of their own inquiries. The motivation for pursuing answers to their own questions is very strong.

Similarly, Kurumeh (2010) reveals that the inquiry method is a development of the discovery approach which is done with a view of finding some answers to reasons when certain problems exist. Inquiry investigations therefore go further and deeper than discovery and so the learner needs to use all his discovery abilities in

order to succeed in true inquiry. However, she opines that the advantages of inquiry method are numerous, the method is time consuming. The activities could be expensive in terms of funds since the approach requires a wide variety of materials and equipment. It is therefore not possible sometimes to use inquiry in all situations particularly in large classes. Also, students could be frustrated if they cannot solve the problems by themselves. The method could result to less coverage of scheme of work if not properly handled.

Furthermore, in an attempt to find out the effect of inquiry method on students' performance in teaching Mathematics, the Centre for Science, Mathematics and Engineering Education (2000, p. 25) as cited by (GautreauandBinns, 2012) identifies five essential features of classroom inquiry:

- Learners are engaged by scientifically oriented questions.
- Learners give priority to evidence, which allows them to develop and evaluate explanations that address scientifically oriented questions.
- Learners formulate explanations from evidence to address scientifically oriented questions.
- Learners evaluate their explanations in light of alternative explanations, particularly those reflecting scientific understanding
- Learners communicate and justify their proposed explanations.

Colburn andBianchini (2000) opined that successful inquiry-based instruction is more than curriculum materials. Instead, the teacher is the key element in a classroom. He or she must possess certain attitudes and skills to encourage student success in the inquiry-based classroom. He further explains that first; the teacher must support inquiry-based instruction. He must believe in the value of students

having some element of control over what they will do and how they will behave.Studies have shown that teaching through the inquiry method results in increased understanding of curriculum concepts, improvement of academic achievement and more utilization of critical thinking.

2.7 Effect of Inquiry Method on School Location (urban / rural) on Students' Performance in Mathematics

The concept, school location connotes schools that are located in rural or urban areas. According to Ezeudu (2003) school location means urban and rural schools. Location is a particular place in relation to other areas (Quirk, 2008).Also, Akpan (2008) indicated that schools in urban areas have electricity, water supply, more teachers more learning facilities and infrastructure. To support this, Ezike (2001) stated that urban areas are those with high population density, high variety and beauty while rural areas are those with low population, subsistence mode of life, monotonous and burden.

Onah (2011) and Owoeye (2002) indicated that schools in the urban areas achieved more than schools in the rural areas in science subjects. Specifically, Owoeye and Yara (2011) showed in their studies that schools in urban locations had better academic achievement than their rural counterpart in Mathematics. Yet Ezeudu (2003), Bosede (2010) showed that location has no effect on students' academic performance.

Another study has shown that students in the urban centres have well-equipped schools, with rich infrastructures and facilities as well as extra-moral training outside the school. These according to Oriaifor (1986) as quoted by Joubert (2010), have contributed positively in enhancing their Mathematics performance level.

Arbaugh (2000) and Endreny (2010) respectively observed that schools in urban settings enjoyed better advantages in terms of funding, enhanced social and physical environment, teacher quality and academic support systems, than those in rural schools. Thus, urban schools are significantly advantaged to rural schools in terms of, educational resources, teacher quality and students' performance. Rural education in many less developed countries is often synonymous with disadvantages for learning. Hence, Ahmad (2009) found that students studying in urban schools performed better in academic achievement than students studying in rural schools. Other studies reported significant difference in academic performance between adolescents residing in rural and urban area without any direction (Ayodeji, 2009; Hanson, 2010).

In addition, the study of Opara (2011) has shown that studentswho were taught using inquiry teaching method in theurban schools had high rate of achievement than those in the rural areas. This finding is in accordance with that of Njoku (2004), who stated that this is particularly true in rural areas where there are no science laboratoriesand public libraries and the schools often do not havetheir own libraries/laboratories to serve the teachers andthe learners; and where such libraries exist, they do notstock journals.

From the review of various empirical studies on the effect of inquiry method on location, it is clear that findings on locational performance are not the same. While some maintain that urban students perform better in Mathematics than their rural counterparts, others have found that rural students (in spite of all odds) perform better. Some have submitted in their findings and concluded that no particular set up (urban or rural) can claim superiority over the other because their performances are the same. Precisely, Onuoha (2010) argued that there is no significant difference between students' academic performance in rural and urban areas.

Therefore, it is the objective of this study to determine whether there is or no significant difference in the mean performance scores of students taught Mathematics using inquiry teaching method in the urban and those in the rural schools in Niger state, Nigeria.

2.8 Review of Related Empirical Studies

A brief review of current literature related to Inquiry method of Learning was conducted and quickly showed there is no standard definition for inquiry or agreement about what it should be called. Here is an overview of the various definitions, descriptions and terms that were found in the literature reviewed.

According to Sola and Ojo (2007) Inquiry is a term used in science teaching that refers to a way of questioning, seeking knowledge or information, or finding out about phenomena. It involves investigation, searching, defining a problem, formulating hypothesis, gathering and interpreting data and arriving at a conclusion.

In inquiry situation, students learn not only concepts and principles but self-direction, responsibility and social communication. It also permits students to assimilate and accommodate information. Inquiry is the way people learn when they're left alone. They believed that when teachers occasionally give students topics to go and make inquiry about it, before teaching a new concept, students will be able to explain in their own terms what they know about the new concepts. That is, student's explanation will be regarded as hypothesis to be discussed and tested, if the teacher can create an atmosphere in the classroom of a kind in which the students can express themselves without bordering about making mistakes, their hypotheses can be used to illustrate their concepts.

Kurumeh, Jimin and Mohammed (2012), opine that inquiry method is a structured method of teaching Mathematics which results in students gaining knowledge of the subject principles and concepts. It also results in students having the ability to formulate and resolve problems as well as communicate and acquire other skills necessary for working with people. The method also embeds in the students, positive curiosity which is essential for participating in a Mathematics classroom. Students also develop social skills, problem solving abilities and attitudes necessary for self-directions. The method reduces the role of the teacher from dissimulator of information (Bess, 2000) to a guide in the process of teaching (Joe, 2007).

In Opara's 2011 study entitled "Inquiry Method and Student Academic Achievement in Biology: Lessons and Policy Implications," she pointed out, that

“inquiry allows students to learn and experience biology first-hand, by taking on the roles of scientists. The students use the inquiry process to develop explanations from their observations (evidence) by integrating what they already know with what they have learned. However, she concluded by saying that Inquiry teaching method has generally, greater positive effect on student interest, attitudes and achievement in science.

Opara and Oguzor (2011) stated that Inquiry method develops all the domains of educational behavioral objectives. The essence of the model is the involvement of the students in a genuine problem of inquiry by confronting them with an area of investigation, helping them identify a conceptual or methodological problem within that area of investigation, and inviting them to design ways of overcoming that problem. Thus, they see knowledge in the making and are initiated into the community of scholars. At the same time, they gain a healthy respect for knowledge and will probably learn both the limitations of current knowledge and its dependability. The model promotes strategies of inquiry and the value and attitude that are essential to an inquiring mind including Process skills (observing, collecting and organizing data, identifying and controlling variables formulating and testing hypothesis and explanations, inferring), active, autonomous learning, Verbal expressiveness, Tolerance of ambiguity, Persistence and Logical thinking.

Furthermore, Cater (2004) in his study stated that inquiry-based teaching is understood as an approach of instruction in which learners are put into situations where they engage in learning process more autonomously. These situations are

created through activities in which students are provided opportunities of bringing out their prior knowledge, confrontation to their own way of thinking, organization of those knowledge and experiences, restructuring of their old beliefs and knowledge, and application of new idea to new situations.

2.9Critiques on the Reviewed Literature

On Conceptual Overview of Mathematics, there have been many attempts to reconceptualise the process of teaching Mathematics that sees teachers as mere transmitters of knowledge without minding the ability of the teachers' performance in commensurate to the students' performance. The present study emphasized the concretizations of the teaching of Mathematics at senior secondary level in which the objectives for teaching Mathematics concepts are well spelt out so as to make Mathematics students friendly and enhance better achievement in the subject.

According to Edinyang (2001) students learn more and comprehend better when they are actively involved in the lesson. This is because any teaching procedures which involve students in some positive activity, as did the inquiry, are generally more effectively than any other method which does not give room for learners' active participation as epitomized in the case of the expository method of teaching.

The inception of inquiry-based teaching promoted a discourse not only in the developed world but also in different developing countries which negates the traditional "chalk and talk" method of teaching in schools. For example, commenting on the educational system in developing countries Mohammed and Jones (2008) say

that, “the educational system of many developing countries are frequently criticized for being authoritarian, transitive, syllabus-driven and text-book oriented. To improve the situation, many reformers propose a paradigm of education that recognizes and respects the knowledge and experience that children bring to the classroom that encourages individual construction of knowledge and seeks to create the space and facilities for children’s capabilities to develop fruitful. This paradigm promotes autonomy, imagination, innovation, spontaneity, enquiry and flexibility in general, child ‘child centeredness. (p.39)”.

However, a lot of research reports indicated that the guided inquiry method enhanced students’ achievement in science lessons, Mathematics inclusive (FatokunandYalams, 2007). This situation is worthy of re-investigation especially in the area of this study where none of the studies took place. The problem of this study is therefore to determine which of the two methods (inquiry and Expository method) is more effective in enhancing students’ academic performance in mathematics

The review of literature for this study also indicates that so many teaching techniques have been advocated as remedies to the persistent teaching and learning difficulties in Mathematics. The literature highlighted the gap between performance of male and female students and impact of school location on their performance as well as the effect of gender difference in Mathematics performance.

Although the present study is partially in agreement with the majority of the findings on the relative effect of inquiry method on the performance of students in

Mathematics, it is however, not in support of the cosmetic treatment that provides solutions to the erring problems at its peripheral level as some of the findings prove to be. The present study Effect of inquiry method on the Performance of students among senior secondary school Mathematics in Niger state is thus an attempt to provide an in-depth solution to the nagging problems in teaching and learning Mathematics.

Much has been said favoring student-centered teaching strategies like inquiry-based teaching in Nigeria. However, there are rare examples of introduction of these strategies in real classroom situations (Joe, 2007). This study practically explores the opportunities and challenges of introducing inquiry-based teaching in a senior secondary mathematics in Niger state, Nigeria.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The study was aimed at determining effect of inquiry method on mathematics performance of senior secondary school students in Niger state, Nigeria. This chapter therefore describes the design, method and procedure that would be used in the conduct of this research such as, the population, sample and sampling techniques, instrumentation, validity and reliability of the instrument, pilot testing as well as the method of data analysis.

3.2 Research Design

The research design that was used in this study was quasi-experimental design. The choice of this method was dictated by the nature and scope of the research problem being investigated. Accurate information for large population can be obtained at relatively low costs. That is, this study enabled the researcher to obtain the opinion of the representative sample from the target population in such a way that will permit inference made about the entire population.Sambo(2005) opined that quasi experimental research design explores the opportunity of collecting data in situation where nature has performed or is performing her own experiment. Quasi experimental design allows the researcher to deduce the cause effect and relationship

in situation over which there is very little control. However, pretest and posttestwere the type of quasi experimental design that was used in this study.

The students were randomly assigned into two groups namely the control group and the experimental group. All the groups were given pretest in order to establish the homogeneity in terms of level of understanding among the students. The Students of the experimental group were then exposed to the treatment of the study (Effect of inquiry method), a collaborative and interactive exchange pedagogical idea between the researcher and the students. After the treatment, all the students in both groups were given a posttest to ascertain the effect of the treatments. The research design therefore was be Pre-test Post-test design.

3.3 Population of the Study

There are three educational zones in Niger state (Bida, Minna and Kontagora zones). However, the population for the study consisted of all the senior secondary schools in Niger state which has an estimated population of one hundred and forty-two thousand, eight hundred and ninety-nine (142,899) students. The target population were senior secondary two (SS 2) students with an estimated population of fifty thousand, seven hundred and forty-five (50,745) of which thirty thousand, three hundred and sixty-two (30,362) are boys and twenty thousand, three hundred and eighty-three (20,383) are girls.

There are two hundred and twenty-nine (229) state senior secondary schools. Out of the two hundred and twenty-nine (229) schools, eighty-five (85) are situated within Bida educational zone with a total of twenty thousand and six (20,006) SS 2

students, ninety (90) schools in Minna educational zone with a total of twenty thousand, seven hundred and sixty (20,760) SS 2 students and fifty-four (54) schools in Kontagora educational zone with nine thousand, nine hundred and forty-three (9,943) SS 2 students (Niger State Ministry of Education, 2014/2015). The number of senior secondary school students constituted the target population for this study and is presented in Table 3.1

Table 3.1: Distribution of Population of the Study

S/N	Educational zones	Number of Schools	Number of students	Population of SS 2 students
1	Bida	85	57,571	20,006
2	Minna	90	58,759	20,760
3	Kontagora	54	26,569	9,943
	Total	**229**	**142,899**	**50,745**

Source: Niger State Ministry of Education 2014/2015 Annual School Census.

3.4 Sample and Sampling Techniques

In order to eliminate bias, and to have a reasonable sample size for this study, a random sampling technique was used. Nworgu (1994) noted that random sampling is said to be unbiased. Out of the fifty thousand, seven hundred and forty-five (50,745) SS 2 students in Niger State, the researcher was concern with six (6) selected schools from three (3) educational zones in Niger State which has the population of one thousand, one hundred and thirty-three (1,133) students. The six (6) selected schools represent urban and rural schools. These schools were randomly selected from the three (3) educational zones in Niger State through ballot method of

random sampling. All the senior secondary schools in the zones were written on pieces of paper which were then folded and thoroughly mixed in a basket. Thereafter, the six (6) schools were selected from the three (3) educational zones. Since each school from each zone was only placed on one piece of paper and all the paper were of the same size, each school had the same chance of being picked.

Also, since the numbers were written on separate sheets of paper, the selection of one school was not dependent on the selection of another. This was to make sure that all possible biases were represented.Two hundred and ninety-one (291) students wereselected fromone thousand, one hundred and thirty-three (1,133) students using Krejcie and Morgan Table (1970) from 6 schools in the 3 educational zones in Niger State using stratified proportionate random sampling technique. This was shown in Appendix A. Thatis, from the number 291, a respondent in each educational zone was chosen proportionally in relation to the total number of students in Niger State. The selection of sample size of students from each school is shown in Appendix B. Table 3.2 shows the distribution of sample size of schools and students from each zone.

Table 3.2: Distribution of Sample Size

S/N	**Educational zones**	**Sample of schools**	**Sample size of students**
1	Bida	2	77
2	Minna	2	97
3	Kontagora	2	117
	Total	**6**	**291**

Table 3.2 above shows the sample size of students from each educational zone. Seventy-seven (77) students from Bida zone, Ninety-seven (97) fromMinna zone and One hundred and seventeen (117) from Kontagora zone. This gives a sumofTwo hundred and ninety-one (291) students.

3.5Research Instrument

The instrument that was used for gathering data in this study was Mathematics Performance Test (MPT). Thirty (30) objective test questions were used for eliciting students' response to investigate the effects of inquiry method on the performance of students in senior secondary school mathematics.

The researcher spread the test items into four objective levels based on the topics that were covered (Algebra, Statistics,Geometry and Trigonometry). Algebra constitutes question numbers 1,2,3,4,5,6,7,8Statistics constitutes numbers9,10,11,12,13,14,15,16Geometry constitutes numbers 17,18,19,20,21,22,23,and Trigonometry constitutes question numbers24,25,26,27,28,29,30. For each question, the respondents wereasked to indicate by circling the correct answer from the options a to d

3.5.1Validity of the Instrument

The concept of validity is a check of test efficiency and stability to measure what it is supposed to measure so as to minimize some errors and misinterpretations. Mathematics Performance Test (MPT) was used to determine the performance of

senior secondary two (SS2) students. The instrument designed to collect data and test the hypotheses of the study was self-constructed using some Senior Secondary Schools Mathematics textbooks (New General Mathematics textbook for Senior Secondary Schools 2, Comprehensive Mathematics textbook for Senior Secondary Schools 2 and Teach yourself mathematics text book for Senior Secondary Schools). The instrument developed by the researcher was given tomy supervisors, team of expert mathematics educators from the department of science and vocational education, Usmanu Danfodiyo University, Sokoto and some mathematics teachers of Senior Secondary Schools. The experts were to consider the clarity of the instruction, appropriateness of language used, content coverage and the adequacy of the instrument.

3.5.2Pilot Study

A pilot study is a small scale preliminary study conducted in order to evaluate feasibility, time, and cost in an attempt to predict an appropriate sample size and improve upon the study design prior to full performance of full-scale research project. A pilot study was conducted with a similar sample of secondary school that was not involved in the study. Three (3) secondary schools were selected and thirty-five (35) SS2 students were drawn from three schools.

3.5.3 Reliability of the Instrument

In order to establish the reliability of the instrument that was used to generate the data for this study, a pilot study was conducted using test retest method whereby

the test was re-administered to thirty-five (35) SS 2 students drawn from three (3) schools which were not part of the sampled schools. This was in accordance with Bell (2005), that researchers should pilot test their instrument with a small group of subject similar to those used in the study and the pilot test enables the researcher to observe the administrative procedure of the instrument as well as other aspect such as time. At the end of the pilot study, the data generated was used to calculate the reliability index. Pearson Product Moment Correlation Coefficient (PPMCC) reliability test was carried out and the outcome shows a reliability index of 0.74.

3.6 Administration of theInstrument

After validation of the instrument and obtaining the reliability of the instrument, the researcher collected an introductory letter from the Faculty of education and extension services, Usmanu Danfodiyo University, Sokoto which enabled access into the schools visited. The research instrument was administered to the sampled students of the study with the help ofresearch assistance. The presence of the research assistant was necessary in the distribution and retrieval of the research instrument to ensure the maximum return of the instrument.Each student was given the Mathematics Performance Test to solve and circle the correct answer from the four options ranging from a tod. A total of two hundred and ninety-one (291) Mathematics Performance Test (MPT) was distributed to SS2 students in Niger State.

3.7Approach to Data Analysis

Mean and Standard Deviation were used to answer research questions while 2-tail t-test for independent sample was used to test the null hypotheses at 0.05 level of significance. These were analyzed using Statistical Package for Social Sciences (SPSS) version 20.0. In the same manner, results of the analysis were the basis for discussion of the findings of the research.

However, in order to answer the research questions and test the hypothesis, the data collected was tested as thus:

$H0_1$: There is no significant difference in the mean performance scores of students taught using inquiry method and those taught using expository method.

The hypothesis was tested using t-test of independence at 0.05 level of significance.

$H0_{2:}$ There is no significant difference in the mean performance score of male and female students taught mathematics using inquiry method.

The hypothesis was tested using t-test of independence at 0.05 level of significance.

$H0_3$: There is no significance difference in the mean performance scores of students taught using inquiry method in the urban and those in the rural schools in Niger State.

The null hypothesis was tested using t-test of independence at 0.05 level of significance to find out whether there is significant difference in the two locations.

Statistical treatment and analysis was performed using the Statistical package for social sciences (SPSS) version 20.0.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

This chapter presents an account of the analysis of data obtained from the study. It contains the results of the performance of SS2 students in mathematics in Niger state. It dealt with results from null-hypotheses testing which includes interpretation of findings of the study and discussion of specific areas of difficulties identified from the students. The areas of difficulties were identified from the student's marked scripts as well as the raw scores obtained from the test results which are the interpretation of findings of the study. It contains statistical tests with 0.05 level of significant that were selected from both descriptive and inferential methods and the data obtained were presented in tabular form.

4.2 Analysis of the Research Questions

The analysis of the research questions was made by using descriptive statistics which was presented in tables 4.1, 4.2 and 4.3

Research Question One: What are the mean performance scores of students taught Mathematics using Inquiry Method and those taught using Expository Method?

Table 4.1: Mean and Standard Deviation of Inquiry and Expository Method.

Variables	N	Mean	Std.Deviation	Mean Difference
Inquiry Method	150	65.10	13.36	
				13.68
Expository Method	141	51.42	12.79	

Source: Researcher's Field Work, 2017.

Table 4.1 presents the data of the difference in performance of students in Mathematics taught using Inquiry Method and those taught using Expository Method. Results showed that those taught by Inquiry Method performed better as indicated by a mean of 65.10 (SD=13.36) over those taught by Expository Method by mean of51.42 (SD=12.80). This however answered research question one and it is concluded that there is difference in the mean performance of students in Mathematics taught using Inquiry Method and those taught using Expository Method.

Research Question Two: To what extent will the mean performance score of male and female students taught Mathematics using Inquiry Method differ?

Table 4.2: Mean and Standard Deviation of Male and Female Students Taught Using Inquiry Method.

Variables	N	Mean	Std.Deviation	Mean Difference
Male	173	64.54	11.96	
				1.53
Female	118	63.01	13.24	

Source: Researcher's Field Work, 2017.

Table 4.2 presents the data in the difference of performance between male and female students in Mathematics taught using Inquiry Method. Results showed that the male students performed slightly better as indicated by a mean of 64.54 (SD=11.96) over the females by a mean of 63.01(SD=13.24). This answered research question two and it was concluded that there was no marked difference in

themean performance score of male and female students taught Mathematics using Inquiry Method.

Research Question Three: What are the mean performance scores of students taught Mathematics using Inquiry teaching Method in the urban and those in the rural schools in Niger state, Nigeria?

Table 4.3: Mean and Standard Deviation of Urban and Rural School Students Taught Using Inquiry Method.

Variables	N	Mean	Std.Deviation	Mean Difference
Urban	187	62.78	15.33	13.92
Rural	105	48.86	13.87	

Source: Researcher's Field Work, 2017.

Table 4.3 presents the data in the difference of students' performance in Urban and Rural schools in Mathematics taught using Inquiry Method. Results showed that the students in the urban schools performed better as indicated by a mean of 62.78 (SD=15.33) over those in the rural schools by a mean of 48.86(SD=13.87). It was concluded that there was marked difference in students' mean performance in urban and rural schools in Mathematics taught using Inquiry Method.

4.3 Hypotheses Testing

In this segment, the null hypotheses were tested at 0.05 level of significant.

$H0_1$: There is no significant difference in the mean performance scores of students taught Mathematics using Inquiry Method and those taught using Expository Method.

This hypothesis was tested by subjecting the performance scores of students taught byInquiry Method and those taught by Expository Method to a t-test analysis and presented in table 4.4

Table 4.4: Performance Difference in Mathematicsbetween Inquiry and Expository Method.

Variables	N	Mean	SD	Df	T	P-Value	Decision
Inquiry Method	150	65.10	13.36	289	8.91	.000	H_0 Rejected
Expository Method	141	51.42	12.79				

Source: Researcher's Field Work, 2017

From the result of Table 4.4, difference in the performance of students taught byInquiry Method and those taught by Expository Method was positive and significant, $\alpha = 0.05$, $p = .000$. This indicates a significant difference in performance of students taught byInquiry Method and those taught by Expository Method. Therefore, H_{01} which states that there is no significant difference in the mean performance scores of students taught Mathematics using Inquiry Method and those taught using Expository Method was rejected.

$H0_2$: There is no significant difference in the mean performance score of male and female students taught Mathematics using Inquiry Method.

This hypothesis was tested by subjecting the performance scores of the male and female students taught byInquiry Method to a t-test analysis and presented in Table 4.5

Table 4.5: Performance Difference in Mathematicsbetween Male and Female Students Taught by Inquiry Method.

Variables	N	Mean	SD	Df	T	P-Value	Decision
Male	173	64.54	11.96		0.24	.809	H_0 Accepted

Female	118	63.01	13.24	289

Source: Researcher's Field Work, 2017

From the result of Table 4.5, difference in the performance of male and female students taught byinquiry method though positive was not significant at$\alpha = 0.05$,(p = .809). This indicates that there is no significant difference in the performance of male and female students taught byInquiry Method. Therefore, H_{02} which states that there is no significant difference in the mean performance score of male and female students taught Mathematics using Inquiry Method was retained.

H0$_3$: There is no significant difference in the mean performance scores of students taught Mathematics using inquiry method in the urban and those in the rural schools in Niger state.

This hypothesis was tested by subjecting the performance scores of students in urban and those in the rural schools taught byinquiry method to a t-test analysis and presented in Table 4.6

Table 4.6: Performance Difference in Mathematicsbetween Urban and Rural Schools

Variables	N	Mean	SD	Df	T	P-Value	Decision
Urban	187	62.78	15.33	289	7.65	.000	H_0 Rejected
Rural	105	48.86	13.87				

Source: Researcher's Field Work, 2017

From the result of Table 4.6, difference students' performance in urban and rural schools taught byInquiry Method was positive and significant at $\alpha = 0.05$,(p = .000). This indicated that there was a significant difference in the performance of students in urban and rural schools taught byinquiry method. Therefore, H_{03} which

states that there is no significant difference in the mean performance scores of students taught Mathematics using inquiry method in the urban and those in the rural schools in Niger state was rejected.

4.4 Summary of the Major Findings

The following are the major findings of the study:

1. Performances of students taught Mathematics byInquiry Method was found to be better than those taught by Expository Method.
2. There was no much difference in the mean performance scores between the male and female students taught Mathematics using Inquiry Method.
3. Students in the urban schools performed better over those in the rural schools when taught Mathematics using Inquiry Method.

4.5 Discussion

As stated earlier, this work sought to investigatethe effects of inquiry method on the performance of students in senior secondary school mathematics. Three null hypotheses were formulated and tested at 0.05 level of significance.

This study aimed at finding out whether there is any significant difference in the performance of students taught using inquiry and those taught using expository, male and female and urban and rural schools. The analysis of hypothesis I from the study revealed that students taught Mathematics using inquiry method performed better than those taught by expository method. This however, agrees with the findings of(Team of Mathematics Teachers, 2013), which indicated that variation in Mathematics performance was found to be significantly influenced by the type of

teaching method. The interactive teaching method was found to be superior to the traditional approach, especially with respect to achieving higher order cognitive skills.

Analysis of hypothesis II which states that there was no much difference in the mean performance scores of male and female students taught Mathematics using Inquiry Method however contradicts the works of Ekeh (2003),Maduabum and Odili (2007) and Abubakar (2010), but agrees with the work of Jegede (2007) and that of Kolawole and Ajetunmobi (2014), which indicated that there is no marked difference in the performance of male and their female counterpart. Also, Adeneye (2011) revealed that there was no statistically significant difference; that is, the performance of male and female students did not differ in either co-educational schools or urban schools. There is no marked difference in the performance of males and their females' counterpart. In most cases, the male students claim to do better in mathematics than females, but this finding has shown that gender has nothing to do with learning of Mathematics at large.

The result obtained from analysis of hypothesis III which states that there wassignificant difference in the mean performance scores of students taught Algebra, statistics, Geometry and Trigonometry using inquiry method in the urban and those in the rural schoolsaligns with the work of Onah (2011), and Owoeye (2002) which states that students from the urban schools performed better than their rural counterpart, but disagree with the work of Bosede (2010) which stated that location has no effect on students' academic performance. The urban schools performed significantly better than their rural counterpart. Emergence of this may be attributed

to the fact that positive impact of western education is more felt and seen in the urban areas than the rural areas.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This study investigated the effect of inquiry method on mathematics performance of senior secondary school students in Niger State, Nigeria. The instrument used in conducting the study was Mathematics Performance Test. A t-test statistics was used to analyze the data and consequently test the null hypothesis raised in the study. Therefore, this chapter deals with the summary, conclusion and recommendation based on the findings from the investigation conducted.

5.2 Summary

This study investigated the effect of Inquiry Method on mathematics performance of senior secondary school students in Niger state, Nigeria. The population of the study was one thousand, one hundred and thirty three (1,133) students from six (6) selected schools in the three (3) educational zones in Niger state, which are Bida, Minna and Kontagora zones. The respondents were SS 2 students from selected secondary schools in each of the three educational zones in Niger state. A total number of two hundred and ninety one (291) students were selected using Krejcie and Morgan table for determining sample size. The instrumentemployed for the study was researchers' Mathematics Performance Test. Hypotheses I, II and III were tested using statistics measuring difference (T-test). Statistical treatment and analysis was performed using the statistical package for

social sciences (SPSS) version 20.0. Based on the findings, the study revealed that the performance of secondary school students in Algebra, Statistics, Geometry and Trigonometry was not good enough. Some of the students have difficulty in interpreting graph, difficulty in differentiating questions in geometry and trigonometry and thereby using the wrong formula.

The following are the findings:

1. There was significant difference in the performance scores of students taught Mathematics using Inquiry Method and those taught using Expository Method. This is to say that students taught using Inquiry Method performed better than those taught using Expository Method.

2. There was no significant difference in the performance score of male and female students taught Mathematics using Inquiry Method. This shows that male students did not perform better than their female counterpart.

3. There was difference in the performance scores of students taught Mathematics using Inquiry Method in the urban and those in the rural schools. This is to say that students in the urban schools performed better than those in the rural schools.

5.3 Implication of the Study

1. Students taught Mathematics using Inquiry Method will be better than those taught using Expository Method in WAEC. This implies that Inquiry Method is a better Method of teaching Mathematics over Expository Method.

2. Though the difference between male and female students performance in mathematics using Inquiry Method is not significant. However, the mean performance of male students is higher than the female students, which implies that male students are more favored in the learning ofMathematics using Inquiry Method.
3. Urban schools are better academically than rural schools – Most urban students will outperform their rural counterparts inMathematics taught by Inquiry Method.

5.4 Conclusion

This study sought to find out the effect of Inquiry Method on mathematics performance of senior secondary school students in Niger State, Nigeria. The results obtained from the analysis of the data in this study led to the rejection of two null hypotheses while one of the hypothesis raised in the study was retained. From the findings, the following conclusions were made for the study:

1. Inquiry Method of teaching Mathematics aided in the understanding of topics such as Algebra, Geometry, Trigonometry and Statistics in mathematics and so help to improve performance of students in the subject.

2. Students' performance in mathematics using Inquiry Method is independent of gender.

3. Students' performance in Mathematics in general is dependent on location. Hence, School locations have more effect on the performance of students because, urban students performed better than their rural counterparts.

5.5 Recommendations

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

1. To improve the performance of students in mathematics, student centered instruction strategies such as inquiry method should be used in the teaching of mathematics. This method helps develop critical thinking of students and make them good problem-solvers.

2. Adequate teaching materials and trained personnel should be made available to both urban and rural schools.

3. The government should encourage the training and retraining of teachers at seminars, workshops and conferences to keep them informed of student centered instruction such as the inquiry method in this study.

5.6Suggestion for Further Studies

As the study was narrowed to only senior secondary school students and confined to only inquiry and expositorymethods of teaching, further studies that will compare inquiry method and other teaching techniques is hereby suggested so as to address the problems or questions not raised in this study.

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APPENDIX 1

APPENDIX 2

TABLE FOR DETERMINING SAMPLE SIZE FROM A GIVEN POPULATION

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	346
25	24	130	97	320	175	950	274	4000	351
30	28	140	193	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361 „
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480.	214	1700	313	15000	376
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80-	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Source: Krejcie, R. V. Morgan, D. W. (1970) Note: "N" is population size "S" is sample size.

APPENDIX3

Population and Sample Size of Selected SS2 Students from each School

S/No	Name of Schools	Population Size	Sample Size
1	Zainab Kure Day Sec. Sch	181	46
2	Gov't Day Sec. Sch, Bafo	121	31
3	Bosso Sec. Sch. Minna	275	71
4	Day Sec. Sch. Kwukuti	103	26
5	Day Sec. Sch. Kontagora	268	69
6	Gov't Day Sec. Sch. Bangi	185	48
	TOTAL	**1133**	**291**

APPENDIX 4

USMANU DANFODIYO UNIVERSITYSOKOTO

FACULTY OF EDUCATIONAND EXTENSION SERVICES

DEPARTMENT OF SCIENCE AND VOCATIONALEDUCATION

Mathematics Performance Test

Name of school:

Class:

Sex:

Instructions:

- Answer all questions.
- Circle A, B, C or D to indicate the correct answer.
- Duration: 40 minutes.

1. Solve the equation $\frac{4x-3}{3} - \frac{4x+2}{5} = 1$

(a) 1.3 (b) 4.5 (c) 2.3 (d) 1.5

2. Simply 6x+ (3y+2x-5z)

(a) 8x+3y-5z (b) 8x-3y+5z (c) 3x+8y+3z (d) 8x+3y+5z

1. Factorize $x^2 + 13x + 42$

(a) (X+3) (x+8) (b) (x-6) (x+7) (c) (x+6) (x+7) (d) (x+8) (x+6)

2. Given the expression $y = ax^2 - bx - 12$, find the values of x when a = 1, b =2 and y= 3

(a) x= - 4, 3 (b) x = 5, 4 (c) x= 5, -3 (d) x = -3, – 5

3. Simplify -2a- [3x+ (2x-2y) + x]

(a) -2a -6x+2y (b) 2a+6x-2y (c) 2a-6x-2y (d) 2x-6a+2y

4. Find the H.C.F of $3x^2 y^2$ and 5xy

(a) 3xy (b) 3x5y (c) $5y^2x$ (d) xy

5. Solve the equation $x^2 - 25 = 0$

(a) x = ± 5 (b) x = ± 4 (c) x = ± 3 (d) x = ± 6

8. Expand (m – 5) (m+6)

(a) m^2+m-30 (b) $m^2+11m-30$ (c) m^2-m+30 (d) $m^2-11m-30$

Use the numbers below to answer questions 9 – 11

8, 12, 6, 12, 4, 2

9. Find the arithmetic mean

(a) 7.3 (b) 6.9 (c) 8.4 (d) 7.6

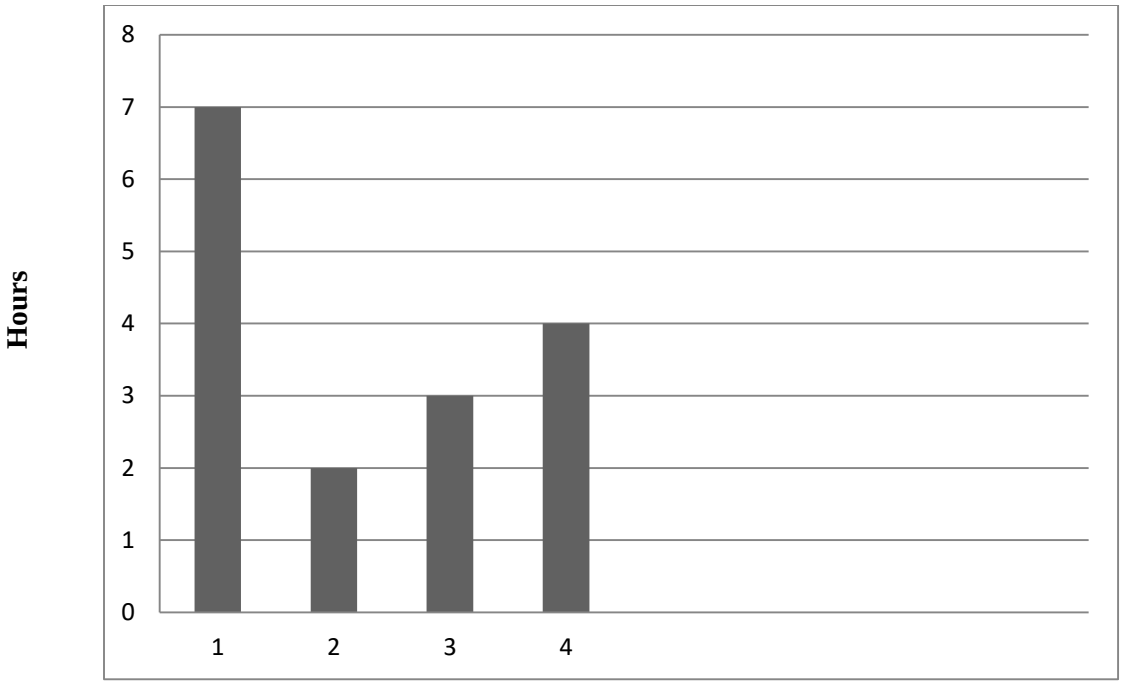
10. Find the Median

(a) 7 (b) 8 (c) 14 (d) 12

11. Find the mode

(a) 2 (b) 4 (c) 6 (d) 12

Below is a bar chart showing the numbers of each kind of program broadcast by a radio station on a certain day. Use the chart to answer questions 12 - 14



Key:

1 – Music

2 - Sports

3 - Drama

4 - News

12. Which kind of program was given most time?

(a) News (b) Music (c) Drama (d) Sports

13. How many hours were given to drama?

(a) 3 hours (b) 7 hours (c) 2 hours (d) 4 hours

14. For how many hours did the radio station broadcast?

(a) 7 hours (b) 10 hours (c) 16 hours (d)) 28 hours

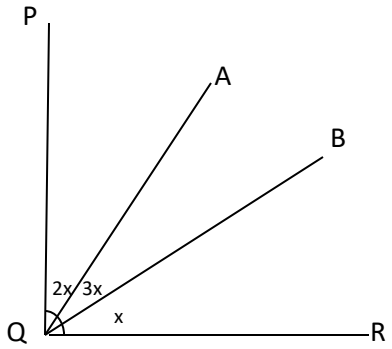
15. _____is a circular graph in which numerical data are represented by sectors of a circle

(a) Bar chart (b) Histogram (c) Polygon (d) Pie chart

16. Find the range of the data 6,6,7,9,11,13,16,21,32

(a) 20 (b) 21 (c) 26 (d) 25

17. In the diagram below, find X if PQ is perpendicular to QR



(a) 18^0 (b) 15^0 (c) 12^0 (d) 10^0

18. A polygon has the following interior angles: y^0, $(y + 10)^0$, $(y + 20)^0$, $(y + 30)^0$, $(y + 40)^0$ and $(y + 50)^0$. Find y.

(a). 75^0 (b) 720^0 (c) 95^0 (d) 570^0

19. Calculate the length of a chord of a circle of radius 13cm if the chord is 12cm from the Centre of the circle.

(a) 5cm (b) 10cm (c) 15cm (d) 20cm

20. One angle of a pentagon is 160^0. Find each of the other angles given that they are all equal to each other.

(a) 70^0 (b) 90^0 (c) 92^0 (d) 95^0

21. The sum of the interior angle of a regular polygon of n-sided is 1080^0. Calculate the value of n.

(a) 7 (b) 10 (c) 8 (d) 20

22. What is the third angle of a triangle if the other two are $(2x - 20)^0$ and $(3x – 10)^0$

(a) $(190 – 5x)^0$ (b) $(180 – 5x)^0$ (c) $(180 – 4x)^0$ (d) $(190 – 4x)^0$

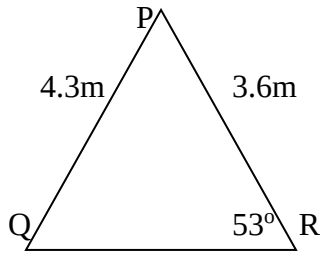
23. Calculate the length of a chord of a circle of radius 13cm if the chord is 12cm from the Centre of the circle.

(a) 5cm (b) 10cm (c) 15cm (d) 20cm

24. Calculate the length of the altitude of an isosceles triangle whose base is 24cm long and whose equal sides are 13cm long.

(a) 5cm (b) 25cm (c) 144cm (d) 30cm

25. In triangle PQR, R =53^0, q = 3.6m, r = 4.3m. Find Q



(a) 38^0 (b) 41^0 (c) 43^0 (d) 42^0

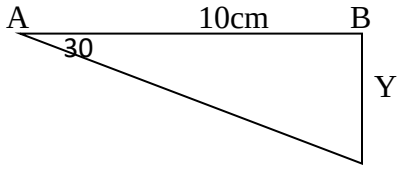
26. Convert 45^0 to radian

(a) $\pi/3$ (b) $\pi/4$ (c) $\pi/45$ (d)$\pi/90$

27. If $\sin\theta = \cos 35^o$. Find θ

(a) 35^0 (b) 90^0(c) 55^0(d) 110^0

28. In the diagram below, BAC = 30^0 and |BA| = 10cm. Find y.



(a) 5cm (b) 10cm (c) 30cm (d) 15cm

29. Convert $\pi/3$ to degree

(a) 45^0 (b) 12^0 (c) 60^0 (d) 180^0

30. Solve $\cos x = \sin (x + 22^0)$

(a) 34^0 (b) 68^0 (c) 90^0(d) 45^0

Marking Scheme

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

APPENDIX 5

LESSON PLAN I: FOR INQUIRY METHOD

Name of Teacher Onakpa Aye Blessing

Class: SS II

Subject: Mathematics

Topic: Algebraic process

Duration: 40 minutes

Reference books: New General mathematics II, comprehensive mathematics and teach yourself mathematic for SSS.

Behavioural objects: At the end of the lesson the students should be able to:

i. apply appropriate algebraic identifies to solve some problems
ii. able to know how to expand brackets some of algbebraic problems
iii. how to expand brackets of difference of two squares
iv. Find the mean, median, mode and range of any given data
v. Construct bar chart and pie chart
vi. Use bar chart and pie chart to answer any given question
vii. Differentiate between a histogram and barchart

Previous knowledge: students are familiar with algebraic operations such as a addition, subtraction, multiplication and division of numbers

Introduction: Teacher introduces the lesson by writing the topic on the board

Presentation: The teacher presents the topic by

1. Teaching the students how to find the square of sum of algebraic identifies
2. Teaching the students how to find the square of difference of algebraic identifies

Evaluation: The teacher gives the students some related questions as class work

Conclusion: The teacher explains the topic again, marks the class work and does the correction

LESSON PLAN I: FOR EXPOSITORY METHOD

Name of Teacher: Onakpa Aye Blessing

Class: SS II

Subject: Mathematics

Topic: Algebraic process

Duration: 40 minutes

Reference books: New General mathematics II, comprehensive mathematics and teach yourself mathematic for SSS.

Behavioural objects: At the end of the lesson the students should be able to:

i. apply appropriate algebraic identifies to solve some problems
ii. able to know how to expand brackets some of algbebraic problems
iii. how to expand brackets of difference of two squares
iv. Find the mean, median, mode and range of any given data
v. Construct bar chart and pie chart
vi. Use bar chart and pie chart to answer any given question
vii. Differentiate between a histogram and barchart

Previous knowledge: students are familiar with algebraic operations such as a addition, subtraction, multiplication and division of numbers

Introduction: Teacher introduces the lesson by giving students simple questions on algebraic operations to solve

Presentation: Teacher presents the lesson through the following steps:

Step I: Giving the students questions on factorization and telling them to use the knowledge of algebraic operations and attempt it.

Step II: Giving them questions on open bracket to solve

Step III: Writing Some questions on the board and calling students one after the other to come out and solve it, explaining to the class

Evaluation: Teacher evaluates the lesson by grouping the students and giving each group questions on the lesson taught to solve looking out for the fastest with the correct answers

Conclusion: Teacher concludes the lesson by giving students assignment.

LESSON PLAN II: FOR INQUIRY METHOD

Name of Teacher: Onakpa Aye Blessing

Class: SS II

Subject: Mathematics

Topic: Statistics

Duration: 40 minutes

Reference books: New General mathematics II, comprehensive mathematics and teach yourself mathematic for SSS.

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

i. Find the mean, median, mode and range of any given data

ii. Construct bar chart and pie chart

iii. Use bar chart and pie chart to answer any given question

iv. Differentiate between a histogram and barchart

Instructional materials: mathematical set

Previous knowledge: Students have been taught how to construct a frequency table

Introduction: Teacher introduces the lesson by calling out some students to make a frequency table of male and female students in the class based on the previous knowledge

Presentation: Teacher presents the lesson through the following steps:

Step I: Asking the students to find the mean of an ungrouped data

Step II: Asking the students what they understand by the word MEDIAN, MODE, RANGE

Step III: Giving some questions on mean, median and mode for the students to solve

Step IV: Asking the students the difference between a histogram and a bar chart

Evaluation: Teacher evaluates the lesson by grouping the students and giving them quiz based on the topic treated

Conclusion: Teacher concludes the lesson by explaining to the students where they got it wrong.

LESSON PLAN II: FOR EXPOSITORY METHOD

Name of Teacher: Onakpa Aye Blessing

Class: SS II

Subject: Mathematics

Topic: Statistics

Duration: 40 minutes

Reference books: New General mathematics II, comprehensive mathematics and teach yourself mathematic for SSS.

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

i. Find the mean, median, mode and range of any given data

ii. Construct bar chart and pie chart

iii. Use bar chart and pie chart to answer any given question

iv. Differentiate between a histogram and bar chart

Instructional materials: mathematical set

Previous knowledge: students have been taught how to construct a frequency table

Introduction: Teacher introduces the lesson by writing the topic on the board

Presentation: Teacher presents the lesson through the following steps:

Step I: Giving the students the definition of mean, median, mode and range

Steep II: Teaching the students how to find the mean, median, mode and range of any given data

Step III: Showing students difference between bar chart and histogram

Step IV: Solving some examples on the board

Evaluation: Teacher evaluates the lesson by giving the students class work

Conclusion: Teacher concludes the lesson by explaining the lesson again and marking their seat work

LESSON PLAN III: FOR INQUIRY METHOD

Name of Teacher: Onakpa Aye Blessing

Class: SS II

Subject: Mathematics

Topic: Geometry

Duration: 40 minutes

Reference books: New General mathematics II, comprehensive mathematics and teach yourself mathematic for SSS.

Behavioural objects: at the end of the lesson, students should be able to:

i. Know simple rules of construction

ii. Find the values of any given or not given angles

iii. Find the sum of interior angles of a polygon.

Instructional materials: improvised wooden mathematical set

Previous knowledge: students have been taught menstruation such as area and perimeter of plane shapes

Introduction: Teacher introduces the lesson by asking students questions based on the previous knowledge

Presentation: Teacher presents the lesson through the following steps:

Step I Teacher ask the students to describe how an angle can be formed

Step II: Teacher explains the different angles in a polygon to students

Step II: Teacher ask students to show with the aid of a diagram some angles in a polygon

Step IV: Teacher give students some question on angles to attempt

Evaluation: Teacher evaluates the lesson by making corrections and explaining better to the students

Conclusion: Teacher give students assignment on the lesson taught

LESSON PLAN III: FOR EXPOSITORY METHOD

Name of Teacher: Onakpa Aye Blessing

Class: SS II

Subject: Mathematics

Topic: Geometry

Duration: 40 minutes

Reference books: New General mathematics II, comprehensive mathematics and teach yourself mathematic for SSS.

Behavioural objects: at the end of the lesson, students should be able to:

i. Know simple rules of construction

ii. Find the values of any given or not given angles

iii. Find the sum of interior angles of a polygon.

Instructional materials: improvised wooden mathematical set

Previous knowledge: students have been taught menstruation such as area and perimeter of plane shapes

Introduction: Teacher introduces the lesson by asking students questions based on the previous knowledge

Presentation: Teacher presents the lesson through the following steps:

Step I: Teacher defined angle and explain to the students how angle is formed

Step II: Teacher explains the different angle in a polygon with their number of sides to students

Step III: Teacher explain interior and exterior angle to students

Step IV: Teacher gives examples on interior and exterior angles

Evaluation: Teacher evaluates the lesson by giving students class work

Conclusion: Teacher concludes the lesson by explaining more for the students and marking the class work

LESSON PLAN IV: FOR INQUIRY METHOD

Name of Teacher: Onakpa Aye Blessing

Class: SS II

Subject: Mathematics

Topic: Trigonometry

Duration: 40 minutes

Reference books: New General mathematics II, comprehensive mathematics and teach yourself mathematic for SSS.

Behavioural objects: At the end of the lesson, student should be able to:

I. Use sin, cosine and tangents ratio to calculate the length of unknown sides or an unknown angles in a right angled triangle.

II. Students should be able to evaluate for unknown angles using cosine and sin

Instructional materials: improvised wooden mathematical set

Previous knowledge: students were already familiar with Angles

Introduction: the teacher introduces the lesson by asking the students questions on the previous knowledge

Presentation: the teacher presents the lesson in the following steps:

Step I:	Asking the students to identify the opposite, Adjacent and hypotenuse of an angle as the name implies
Step II:	Giving two sides of an angle and asking Ahem to attempt and find the missing angle
Step III:	Explaining to the students with the use of the teaching aids how to identify the sides of any angle
Step IV:	Calling out students to solve question on the board
Evolution:	Teacher evaluates the lesson by making corrections and explaining it more for the students
Conclusion:	Teacher concludes the lesson by giving students Assignment

LESSON PLAN IV: FOR EXPOSITORY METHOD

Name of Teacher: Onakpa Aye Blessing

Class: SS II

Subject: Mathematics

Topic: Trigonometry

Duration: 40 minutes

Reference books: New General mathematics II, comprehensive mathematics and teach yourself mathematic for SSS.

Behavioural objects: At the end of the lesson, student should be able to:

I. use sin, cosine and tangents ratio to calculate the length of unknown sides or an unknown angles in a right angled triangle.

II. Students should be able to evaluate for unknown angles using cosine and sin

Instructional materials: improvised wooden mathematical set

Previous knowledge: students were already familiar with Angles

Introduction: the teacher introduces the lesson by asking the students questions on the previous knowledge

Presentation: the teacher presents the lesson in the following steps:

Step 1: Teaching the students the properties of a right-angled triangle

Step II: Teaching the students how to identify opposite, adjacent and hypotenuse of a given right angled triangle

Step III Solving some examples on the board for students for more understanding.

Evaluation: The teacher gives students some relevant questions as class work

Conclusion: The teacher concludes the marking the class work and do correction

APPENDIX6

RESULT OUTPUT

```
GET DATA /TYPE=XLSX
  /FILE='C:\Users\sheiktsagem\Documents\OTHER PEOPLE WORKS\Onakpa
Blessing Data.xlsx'
  /SHEET=name 'Sheet1'
  /CELLRANGE=full
  /READNAMES=on
  /ASSUMEDSTRWIDTH=32767.
EXECUTE.
DATASET NAME DataSet2 WINDOW=FRONT.
DESCRIPTIVES VARIABLES=InqMExpM M F UrbRur
  /STATISTICS=MEAN STDDEV.
```

Descriptives

[DataSet2]

Descriptive Statistics

	N	Mean	Std. Deviation
Inquiry Method	150	65.10	13.355
Expository Method	141	51.42	12.794
Male	173	64.54	11.962
Female	118	63.01	13.239
Urban	187	62.78	15.329
Rural	105	48.86	13.872
Valid N (listwise)	105		

```
T-TEST PAIRS=InqM M Urb WITH ExpM F Rur (PAIRED)
  /CRITERIA=CI(.9500)
  /MISSING=ANALYSIS.
```

Paired Samples Test

	Paired Differences					T	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			

Pair 1	Inquiry Method - Expository Method	14.078	20.403	1.718	10.681	17.475	8.193	140	.000
Pair 2	Male – Female	.381	17.124	1.576	-2.741	3.503	.242	117	.809
Pair 3	Urban – Rural	12.619	19.078	1.862	8.927	16.311	6.778	104	.000