EFFECT OF PEER TUTORING ON MATHEMATICS ACHIEVEMENT AND RETENTION OF SENIOR SECONDARY SCHOOL STUDENTS' IN MINNA, NIGER STATE

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DEPARTMENT OF SCIENCE EDUCATION

FEDERAL UNIVERSITY OF TECHNOLOGY MINNA

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A PROJECT SUBMITTED TO THE DEPARTMENT OF SCIENCE EDUCATION, SCHOOL OF SCIENCE AND TECHNOLOGY EDUCATION, FEDERAL UNIVERSITY OF TECHNOLOGY MINNA, NIGER STATE, NIGERIA, IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE AWARD OF BACHELOR OF TECHNOLOGY (B. TECH) IN MATHEMATICS EDUCATION

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ABSTRACT

This is to investigate the effect of peer-tutoring on mathematics achievement and retention of senior secondary school students' in Minna, Niger State. Four research questions and four hypotheses were formulated to guide the study. The design adopted was a Quasi-Experimental. Sixty (60) students from two selected schools in Bosso and Chanchaga local government were used as research sample. The simple random sampling technique was used to select the sampled schools. The experimental group was exposed to peer-tutoring, while the control group was taught with conventional method. Mathematics Achievement Test (MAT) was used to collect data from pre-test, post-tests and post-posttest. Descriptive statistics was used to answer the research questions and t-test was used to analyze the research hypothesis at 0.05 level of significant. The instruments were validated by experts and the reliability coefficient index of 0.75was obtained using Pearson Product Moment Correlation. The data obtained were analyzed using mean and standard deviation. The findings of the study revealed that student taught with peer-tutoring method performed better in academic achievement and retention than those taught with conventional teaching method and gender has no effect on their mathematics achievement and retention. Recommendations included among others that Seminars and workshops should be organized to educate teachers on the use of peer tutoring. Government agencies whose responsibility is to design and revise the curriculum for secondary schools should incorporate the use of peer tutoring in teaching. Teachers occasionally should give students topics to go and make inquiry about, so that before the teacher teaches a new concept, students will be able to explain in their own terms what they know about the new concepts.

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CHAPTER ONE

1.0 INTRODUCTION

1.1 Background of the Study

Mathematics is very important in our society today and is inseparable from our day to day activities because of is vital usefulness to all specialists including the layman. Akinremi and Adesanya (2019), stated that, Mathematical thinking is important for all members of a modern society as a habit of mind for its use in the work place, business and finance; and for personal decisions making. Every individual both consciously or unconsciously needs and uses the knowledge of mathematics to certain extents at anytime, anywhere and in every place. The uses of mathematics to man therefore are as diverse as there exists fields of human endeavour.

Yara and Otieno (2010), defined mathematics as Creation of the human mind concerned primarily with ideas, processes and reasoning. Ugwu, (2011), stated that Mathematics is the study of all structures, whose form can be expressed in symbols, it is the grammar of all symbolic system. According to Agah (2020), today there are many students who leave the secondary school with a dislike for mathematics. One reason we can advance is that majority of students never get true understanding of real meaning of mathematics concepts. Eventually, they develop a common attitude; get the examination over with, after which they forget mathematics. This is the position in our country now. If we are to build successful programmes of mathematics in our secondary schools and if we are to provide for the continuous improvement of the learning of mathematics, it will seem that such a consideration must begin with an understanding of the very nature, the very heart of mathematics itself.

To realize the objective of learning mathematics successfully peer tutoring is an important catalyst. According to Bombardelli (2016), Peer tutoring is important for the tutor; that is, learning is encouraged through teaching. Hartman (2010), conducted an evaluation study and reported that peer tutoring increased students' motivation to learn. This result is supported by Whitman (2012) and Annis (2013), who argued that peer tutoring can be the most intellectually rewarding experience of a student's career. They found peer tutoring helped students perform better on higher order conceptual understanding scales than students who read the material simply for study purposes. Topping (2010), also asserted that peer tutoring serves as an effective way to improve self-esteem in students. Peer tutoring aids interaction among peers not only academically but also socially. It is probable that peer and cross age tutoring have been in some measure part of human existence since "hunter-gatherer" times. Formal education has a long tradition of children teaching other children. At one occasion or another nearly everyone has been engaged in tutoring, though the experience may not have been part of an organized tutoring program. It is more likely that it consisted of one person informally instructing or assisting another. This happens almost naturally with children in school settings whether or not they have been instructed to tutor. It is a scenario that is repeated many times each day in schools around the country. Individual difference cannot be neglected at any stage of human learning. Therefore, teacher should design learning activities that can better address the individual needs of students.

Some need-based learning activities are discussion, group work, private tuition, mentoring and peer tutoring. These methods are usually adopted to enhace students' learning (Ali *et al.*, 2015). As far as peer tutoring is concerned, it is a teaching strategy where a group of students interact to help each other's learning by one student occupying the role of tutor and the other the role of tutee. Peer tutoring helps to develop the skills of students to manage and plan learning

experiences, work in association, give and receive responses about their activities and finally evaluate their own learning. Peer tutoring is advantageous for students, as it provides opportunities for discussion which lead to learning in an affable environment. In the same way, peer tutoring builds up confidence and enhances cognitive levels of introvert students because it gives confidence to shy students which may enable them to express themselves in front of the class or other gatherings. Peer tutoring which evolved from tutorial instruction as the first pedagogy among primitive societies occur in modern times when the teacher uses students as resources for other students based on the assumption that the later category of students can learn better and faster from fellow students in the former category who have mastered a particular concept or skill. As far as the origin of peer tutoring is concerned, it has strong roots both in behaviorist and constructivist approaches of learning (Botty and Shahrill, 2014). Although this is certainly not a new strategy, it is periodically rediscovered and examined in classrooms throughout the world. Peer tutoring involves direct interaction between the learner student and the teacher student, this will help them to promote the active learning along with the interpersonal skills, with which they can actually bid adieu to the-so called boring classes or topics.

Mathematics is described as fundamental to national prosperity in providing tools for understanding science, engineering technology and economics Akinremi and Adesanya (2016). Mathematics literacy, which is the gateway to achieve scientific and technological advancement and economic survival, is achievable through mathematics education. Towards revolutionizing Nigerian educational system, the Federal Government of Nigeria (FRN, 2004) emphasized that "the teaching and learning of mathematics education should be based on its process and principles leading to fundamental and applied research in mathematics at all levels of education".

The National Mathematics Advisory Panel (NMAP) cited in (Anselm 2010), argued that to continue to progress in mathematics achievement, we must improve the quality of mathematics instruction received by all secondary students. Although many factors affect a student's mathematics learning, one factor over which schools have the most immediate control is the choice of mathematics program to be implemented by teachers, administrators and curriculum developers.

Therefore, a successful teacher should always be prepared to assess the students' abilities, values and levels of difficulties so as to make the necessary adjustment in remedial teaching. The level of students' performance in Mathematics determines the level of her/his difficulties in learning. For instance, if a student's score in Mathematics is very low, it indicates the level of his/her learning difficulty in the subject. Obviously, the traditional mathematics teacher-as-information-giver, or textbooks-guided classroom instruction has failed to bring about the desired outcome of producing well-thinking mathematics students to meet the present global challenges (Oludipe and Awokoya, 2010). Onabanjo and Okpala (2010) ascertained that: the traditional approach to teaching mathematics (the lecture method) has failed to deal effectively with the problems of individual differences in mathematics. It has also failed to provide for the students' appreciation and understanding of learning as a continuing aspect of modern learning theory which stresses students' active involvement in the teaching learning process".

There is therefore need to search for more effective instructional strategies that are likely to improve achievement and retention in secondary schools mathematics. Many studies have been undertaken to measure the impact of mathematics support services on student retention. Factors such as past examinations, student grades, diagnostic tests, and whether or not students make use

of a range of available mathematics support were used. The last factor was found to be important as it seems students who make use of mathematics support tend to perform better in mathematics. Studies into the effectiveness of mathematics support in improving student progression and retention involved more complex issues than academic performance variables alone. It was concluded that in order to improve student progression and retention, diagnostic tests should be followed by mathematics study support provision (Faridhan *et al.,* 2013).

Several researches Kurumeh *et al.* (2012), Ajayi and Ogbeba (2017) have revealed unimpressive students' academic achievement and retention at the senior secondary school level in Nigeria. Several studies have attributed the observed students' poor academic achievement and retention to the use of inappropriate and ineffective teaching methods such as lecture and discussion methods. Also (Edoho *et al.,* 2020) low achievement and retention of students particularly among sexes is as a result of instructional modality adopted by teachers. Thus, inappropriate teaching methods used by mathematics teachers invariably translates to students' poor achievement and inability to retain and put into practice what is learnt in reality has become a hydra headed problem. In most cases what is taught in classroom cannot be transferred to real life situation by students. This problem, if not tackled, will have adverse consequences on the students and the society at large, given the importance of mathematics in Nigeria's scientific and technological development. There is therefore need to explore other methods for effective teaching of mathematics so as to enhance students' academic achievement and retention in the subject. One of such innovative methods is the peer tutoring.

It is one thing to be taught mathematics via appropriate strategy; it is another thing to remember it after some reasonable period of time must have elapsed that is retention. Retention is the

ability to recall things. For the purpose of this study, retention is defined as the ability to keep or retain the knowledge of mathematics learnt and to be able to recall it when required. Retention in mathematics is not acquired by mere rote-memorization but through appropriate teaching method. In this regard, the researcher sees the need to find out if peer tutoring could improve both male and female students' academic achievement and retention in mathematics. The term gender is often used to indicate the distinction between human beings based on masculinity and femininity in relation to their expected roles in the society. Gender is ascribed to attitude which differentiates feminine from masculine in achievement and retention due to inequality which has caused a lot of concern to educators. In this regard, the difference between male and female with respect to students' academic achievement and retention in mathematics have received a lot of attention in recent years. Some studies indicated that boys have higher achievement and retention than girls (Asante, 2010), either no difference (Ajayi, 2017) or girls have higher achievement and retention than boys (Bala, 2011; Ajibola, 2014). Studies on gender difference in achievement and retention in mathematics continue to yield inconsistence results and it has been usually attributed to unequal exposure of boys and girls to learning instructions relevant to mathematics learning. In this regard, this study examined the effect of peer tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State.

1.2 Statement of the Research Problem

The poor achievement and retention of students in mathematics at senior secondary school have given mathematics teachers a high level of concern. A lot of research efforts have been focused on identifying factors that inhibit the learning of mathematics. According to Anselm (2010) Poor motivation, and lecture method have been highlighted as problems. The approached used by many mathematics teachers is one which does not give room for students to develop their

intuition, imagination and creative abilities. As a results of this, mathematics educators are constantly interested on how and when to optimally adopt different mathematics instructional strategies in order to achieve the stated mathematics educational objectives. Obviously, the traditional mathematics teacher as information giver or textbook guided classroom has failed to bring the desired outcome of producing well thinking mathematics students to meet the present global challenges.

Therefore, there is need to search for more effective instructional strategies that are likely to improve students' academic achievement and retention in mathematics of senior secondary school. The teacher as the pivot of the educational process is expected to employ measures that would impact favorably on classroom activities. He is expected to create a conducive atmosphere for meaningful interaction between students, and between the student and himself in the teaching and learning process in the classroom. This can be achieved in many ways including individualizing the instruction using peer tutoring (Akubue, 2010).

Hence, this study seeks to investigate on the effect of peer tutoring on Mathematics achievement and retention of senior secondary school students in Minna Niger State.

1.3 Aim and Objectives of the study

The aim of this study is to investigate the effect of peer tutoring on Mathematics achievement and retention of senior secondary school students' in Minna, Niger State.

The objectives of the study are to:

1. Determine the effect of peer tutoring on the academic achievement of secondary school students in mathematics.

2. Determine the retention of senior secondary school students in mathematics when taught using peer tutoring.
3. Ascertain the difference in academic achievement of secondary school students' taught mathematics using peer tutoring among gender.
4. Ascertain the difference on retention of secondary school students taught mathematics using peer tutoring based on gender.

1.4 Research Questions

The following research questions have been formulated to guide this study.

1. What is the effect of peer-tutoring on student's academic achievement of secondary school students in Mathematics?
2. What is the effect of peer-tutoring teaching strategies in student's retention on Mathematics?
3. Does Gender have any influence on the Academic Achievement of Students in Mathematics using Peer-tutoring?
4. Does Gender have any influence on retention of Students in Mathematics using Peer-tutoring?

1.5 Null Research Hypotheses

The following null hypothesis has been formulated to guide the study.

$H0_1$: There is no significant difference between academic achievement of students' taught mathematics using peer tutoring and those taught using conventional method.

$H0_2$: There is no significance difference between students' retention when taught Mathematics using Peer tutoring and those taught with conventional method.

$H0_3$: There is no significance difference between Male and Female academic achievement in Mathematics when taught using peer tutoring.

$H0_4$: There is no significance difference between Male and Female retention in Mathematics when taught using peer tutoring.

1.6 Significance of the Study

The significant of the study will be of benefit to the teachers, students and the society at large.

Students, slow learners improve and develop their performance and get a better understanding of the terms of the lessons. Peer teaching helps both fast learners in developing important values such as sharing, self-esteem, and self discipline. Peer tutoring enhances the student's level of creativity in expressing ideas as well as grabbing new concepts, as the student may not feel hesitant to clear his queries. This will uplift his knowledge limit and thus allow a greater level of his understanding. Feeling at ease with a peer tutor, allows a student to concentrate better on the task of the lesson, which may transfer into higher achievements in the future. To an extent, the student will start questioning his own doubts, and will later find a way to resolve it himself, which will enable the student to improve his critical thinking.

Teachers, it will ease the teacher's burden of responsibility because she is sharing her duties with her students which are beneficial to them. But on the other hand it will increase the teacher's role in monitoring and administering the students.

Society at large, in era of online learning, it can be key to making struggling students feel more connected to their college community and better able to tackle academic challenges. Also in remote areas where teachers only goes there to teach twice or so in a week, peer tutoring can be

used to solve the problem where the peer tutors help their tutee becomes better learners and thereby helping the community.

1.7 Scope of the Study

The geographical scope is Senior Secondary Schools Students in Minna, Niger State. Two independent variables (peer tutoring method and conventional method), two dependent variable (achievement and retention) will be investigated in this study. The study is restricted to SS I mathematics students. This class of student was chosen because the concept "quadratic equation" selected as a topic is taught at this class. Quadratic equation is selected because it is relevance to the major variable of the study. This study will last for 4 weeks.

1.8 Operational Definition of Major Terms

Peer Tutor: A student who assists peer tutees to attain proficiency in basic mathematical skills and to learn more advanced skills by assisting with homework, assignments, providing instruction, and fostering good study habits. In this study, it refers to a specially selected student whose grade in mathematic is above 70. They are selected by the researcher to assist the predetermined tutees assigned to him.

Effectiveness: It means producing a desired effect. In this study, it refers to a possible result of peer tutoring in enhancing the mathematical achievement of Senior Secondary School Students.

Peer Tutoring: It is an approach in which one child instructs another child in area on which the first is an expert and the second is a novice. Also according (Thomas 1993) it is the process by which a competent pupil, with minimal training and with a teacher's guidance, helps another student at the same grade level learn a skill or concept. In this study, the students are grouped in

order to share, participate and listen to the peer tutors who are selected by the researcher. The peer tutors are assigned only in the experimental group.

Achievement: This refers to something achieved or won by exertion and some actions carried out with courage or unusual ability. In this study, it refers to the test results given at the end of the experiments on the subject areas covered.

Mathematics: This refers to one of the subjects offered in the general secondary curriculum in the public and the private schools. It is a subject held daily from Monday to Friday and it is a core subject.

Mathematics Achievement is Student outcome/performance in a mathematics class.

Retention is defined as the ability to keep or retain the knowledge of mathematics learnt and to be able to recall it when required.

CHAPTER TWO

2.0 REVIEW OF RELATED LITERATURE

2.1 Conceptual framework

2.1.1 The Concept of Peer Tutoring

Peer-tutoring otherwise known as peer mentoring or peer assisted learning strategy is an effective and affordable way of providing students with academic and personal support from other students (Jibrin, Ibrahim & Zayum, 2016). In peer-tutoring technique, a higher performing student is paired with a lower one to review critical academic or behavioural concepts. Peer mentoring improves the learning experiences of both the tutors and tutees. When peer tutors participate in these schemes, they not only improve their own understanding of the subject areas, they also develop important communication and teamwork skills. Peer-assisted learning also provides a more comfortable learning environment to allow students to feel at ease and be more focused on the content, which leads to overall better performance in class. Consequently it has been argued that peer-tutoring learning strategy improves the academic achievement of students. The study of Sam *et al.* (2016) shows that through the use of peer-tutoring learning strategies, the knowledge of business mathematics students and biology students improves. Peer tutoring according to (Topping, 2015) is defined as a flexible teaching strategy in which half of the students serve as academic tutors and the other half serve as academic tutees. In this methodology a higher achieving student (tutor) provides assistance with academic content to a lower achieving student (tutee). Several benefits have been documented across the literature for both tutors and tutees during peer tutoring experiences (Moliner, 2020). Through this approach, students would be more happy to explain their opinion in group. Learning with peer tutoring approach, students selected as tutors are students who have been a greater ability than the other

students in the group, were willing to train, and coached friends in the group Sari and Aisyah (2016).

The main purpose of this study was to determine the difference in performance between students taught with peer tutoring and conventional instructional strategy in mathematics. A second purpose of the study was to investigate whether any difference in the performance of students taught with peer tutoring was a result of their gender, thereby finding out if peer learning favors males over females or vice-versa.

2.1.2 History of Peer Tutoring

Bruffee writes in his article that in the 1970's many students were not succeeding in their college classroom environments, and were refusing help from campus tutors and counselors because that help simply meant extra work for them. "What they [college students in the `70's] needed, it seemed, was help that was not an extension of but an alternative to traditional classroom teaching. To provide that alternative some colleges turned to peer tutoring" (Bruffee, 86). The idea of peer tutoring developed because of students' need for aid in schoolwork, but reluctance to go to faculty for help. Students feel comfortable going to other students for help, especially within the context of the writing center. Peer tutoring is not a new idea, it is possibly as old as any form of collaborative or community action and has probably always taken place implicitly or vicariously (Abdullahi, 2016). But in a changing Higher Education landscape, more formalized and even assessed forms of peer teaching are becoming ever more popular. Indeed Peer tutoring schemes appear to be becoming strategized; developing to meet calls for accountability, better assessment, and improved outcomes for students (Anselm, 2010).

For many years peer tutoring has been used to facilitate the learning process. The first to use this method of teaching was Quintillion in the first century A.D. In his work Institution Oratorio he describes a methodology of older children tutoring younger ones. The writings of Aristotle also depict tutoring as an integral part of the educational framework. The earliest documentation of someone using a peer tutoring approach was Dr. Andrew Bell in the late 1700s. His monitorial system was implemented in a school in Madras, India where it was noted that miscreant behavior decreased and there was an increase in the students' academic progress. Bell also observed that this progress was not limited to the tutees but the tutors also increased knowledge. Joseph Lancaster, a British educator in the late 18th century also perceived the relevance of the peer education approach. He established supervised programs where disadvantaged youth taught the primary subjects to their peers (Osguthorpe, *et al.* 1999).

Peer tutoring is a very old practice traceable back at least as far as the ancient Greeks. Archaic Definitions of peer tutoring perceived the peer tutor as a surrogate teacher in a linear model of the transmission of knowledge from teacher to tutor to tutee. Later it was realized that the peer tutoring interaction was qualitatively different from that between a teacher and a student, and involved different advantage and disadvantages (Razia, 2012).

Peer (student-to-student) tutoring is not a new concept. In the US during the 19th and early 20th centuries, most American students attended a one-room schoolhouse. A single teacher was responsible for teaching reading, arithmetic, history, and geography to six to forty students in first through eighth grades! It became common practice for teachers to enlist the help of older students to help teach younger ones. This fluid practice of matching older or more advanced students with those needing help became more difficult to implement as the industrial age

progressed, cities grew, and education adapted by segregating students into same age, same grade classrooms.(Ray and Sherri 2018).

2.1.3 Peer Tutoring in Mathematics

The last studies in the field conclude that students' interactions during peer tutoring have positive significant effects on students' mathematics learning (Alegre *et al*., 2019). Several literature reviews and meta-analysis have documented the academic benefits of this methodology from Preschool to Higher Education (Riccomini *et al.*, 2017). Peer tutoring has been considered to report similar academic benefits across these educational levels (Perrott *et al.*, 2013). Nevertheless, recent literature reviews and meta-analysis state that Peer Tutoring in Mathematics is more effective primary or elementary education (ages 7–12 years) than in secondary education or middle school and high school (ages 13–18 years) from an academic perspective (Alegre-Ansuategui *et al*., 2018). Several authors such as Brown *et al*. (2019), Henderson Pinter *et al.* (2018), and Myers *et al.* (2020) state that, to improve academically in mathematics, it is crucial to research on instructional practices in different educational levels that foster students participation during their learning.

2.1.4 Effectiveness of peer tutoring

According to Jibrin, *et al.* (2016), the most appropriate pedagogical approaches is that promotes students' academic performance. The study of Ishaq (2011) and Tran (2014) revealed that almost all the traditional teaching approaches used in schools around the world include lectures and demonstration which have negative effect on learning outcome of the students. (Joel *et al.,* 2015) argued that teachers centred methods (lectures and demonstration) are not appropriate for skill subjects. Based on this, some teaching methods and strategies have been proved to be efficacious

in the teaching and learning of abstract and difficult concepts in different skills subjects than the conventional method. To this end, literature revealed the effectiveness of peer-tutoring method. For example, The assertions of researchers such as Adamu *et al.,* (2015) indicates that despite the shortcomings of interactive methods of time consuming, it helps to improve the academic performance and retention ability of students.

A study conducted by Ajuba (2011) found that peers are more sensitive than adult readers to picking up on non-verbal cues, students being tutored may give to reveal that they may not understand what a tutor is trying to communicate. In peer tutoring class each student gets more attention from the tutor and more time to speak while others listen. This allows the students take active part in constructing their knowledge. Zakaria *et al.* (2010) opine that to achieve effective and efficient teaching and learning, acquisition of knowledge should not merely focus on dispensing rules, definitions, and procedures for students to memorise, but should be inclined to actively engage students as primary participants. One approach to achieve that is peer tutoring, which is the focal point of this study. Peer tutoring can increased student learning outcomes by improving the understanding of students with mastery of concept (Saumi and Anom (2014).

2.1.5 Tutoring Models

There are mainly two types of peer tutoring namely incidental peer tutoring (IPT) and structured peer tutoring (SPT). Incidental peer tutoring often takes place, either at school or while students are playing after school or when they are socializing. Whenever children are cooperating, playing or studying and one guides the others, such is regarded as incidental peer tutoring. Structured peer tutoring on the other hand refers to peer tutoring implemented in specific cases and for specific subjects, following a well-structured plan prepared by the teacher. Structured peer tutoring is spontaneously used by experienced teachers who are able to plan well in advance

and are familiar on how to combine tutors and tutees appropriately in order to have good results. Varieties of the SPT exists, this include, Cross-age Peer Tutoring (CAPT), Peer Assisted Learning Strategies (PALS), Reciprocal Peer Tutoring (RPT), Same-age Peer Tutoring (SAPT) and Class wide Peer Tutoring (CWPT). The Class wide peer tutoring (CWPT) which was adopted in this study involves dividing the entire class into groups of two to five students with differing ability levels. Students then act as tutors, tutees, or both tutors and tutees (Ogundamola, 2017).

i. **Cross-age Peer Tutoring (CAPT):** This type of tutoring occurs between students of differing ages where the older student tutors the younger student. For example, a middle school student might get paired with an elementary grade student to help the younger student with reading or math skills.

ii. **Peer Assisted Learning Strategies (PALS):** PALS is a version of Class-Wide Peer Tutoring (CWPT) designed to supplement already existing math and reading curriculum. Teachers create student pairs based on individual needs of the students. A student that needs help in a particular area is paired with a partner who can best help that student in learning that content / skill. Over time, partners change in order to address other needs.

iii. **Reciprocal Peer Tutoring (RPT)**: In this setting, paired students alternate roles as tutor and tutee. This alternating of roles often occurs within the same tutoring session where each student in the pair takes turns acting as tutor and tutee for a defined period of time. In a different scenario, a student's role within a tutoring session may remain the same until he / she engages in a new tutoring session with a different partner.

iv. **Same-age Peer Tutoring (SAPT):** In this model, tutoring occurs between students of the same age or grade level. Peer tutoring can be conducted among students within the same classroom as well as students from different classrooms.

v. **Class wide Peer Tutoring (CWPT):** A model based on reciprocal peer tutoring that incorporates a game format where each student is paired with another and assigned to a team. This results in the formation of two teams of equal ability, with each team consisting of high, average and low skill level students. Student pairs practice academic tasks during a tutoring session with each member of the pair getting an opportunity to tutor and be tutored while acquiring points for his / her team. The team with more points after a tutoring session wins.

2.1.6 Strategies for Implementation of Peer Tutors

Friska (2017), peer tutoring was a method in which one of the students became tutors from other members in the group. There are six strategies that need to be considered in the implementation of peer tutors, that:

1. Defining and planning a peer tutoring program
2. Training peer tutors
3. Monitoring daily results
4. Assessing peer tutoring
5. Finding support for peer tutoring
6. Sustaining a peer tutoring program.

2.1.7 Benefits of Peer Tutoring

Vasay (2010) reported that peer teaching is helpful for fast learners and slow learners as well. It helps fast learners to master the concepts related to the course and confidently express their

ideas. Slow learners improve and develop their performance and get a better understanding of the terms of the lessons. Peer teaching helps both, fast learners and slow learners in developing important values such as sharing, self-esteem, and self-discipline. One of the advantages of the peer tutoring method was appropriate students will be assisted in its shortcomings, a weak student can tell the tutor area he/she did not yet understand. Implementation of peer tutoring methods and mind mapping was expected to increase the activity and understanding of the students in the learning process. The difference of the research such as Nurdin research (2012) that was early concept of students. Nurdin research accentuated on self-efficacy, but in this research accentuated of early concepts of students. According to (Ray and Sherri 2018), the benefits school administrators can expect to see include:

a) Student tutees get free help from a peer at the same school, who has likely taken the same class with the same teacher
b) Student tutors reinforce their own understanding of the subject and are often eligible to receive volunteer hours for their efforts
c) Student tutors and tutees often form positive relationships that extend outside the tutoring experience, helping reduce the isolation, stress, and competition many students feel at school today
d) The workloads of overburdened teachers are reduced

2.2 Theoretical Framework

2.2.1 Social Constructivist Theory

The concept of learning through peer tutoring is based on a social constructivist view of learning that emphasizes the role of the students to generate learning where students coach peers through social interaction within their zones of proximal development (Vygotsky, 1978 as cited

Abdullahi 2016). Rather than applying a stimulus/response process, users are actively engaged in making meaning through cognitive accommodation and/or assimilation. (Piaget, 1969, as cited Abdullahi 2016). Social constructivist approaches can include reciprocal teaching, peer collaboration, cognitive apprenticeships, problem-based instruction, web-quests, anchored instruction and other methods that involve learning with others (Kim, 2001).

Holt and Willard-Holt (2000) emphasize the concept of dynamic assessment, which is a way of assessing the true potential of learners that differs significantly from conventional tests. Here the essentially interactive nature of learning is extended to the process of assessment. Rather than viewing assessment as a process carried out by one person, such as an instructor, it is seen as a two-way process involving interaction between both instructor and learner. The role of the assessor becomes one of entering into dialogue with the persons being assessed to find out their current level of performance on any task and sharing with them possible ways in which that performance might be improved on a subsequent occasion. Thus, assessment and learning are seen as inextricably linked and not separate processes (Holt and Willard-Holt 2000).

Vygotsky argued that learning comes about through social negotiation within a cultural context, with language as the primary enabling tool. This social constructivist philosophy has been expanded on recently, introducing the notion of cognitive apprenticeship (Brown, Collins, & Duguid, 1989 as cited Abdullahi 2016) through which students learns in a manner similar to traditional apprenticeships. The students access expertise through mentors, whose role is to facilitate rather than teach, and the aim of learning is to solve realistic and practical problems in an authentic setting. For a peer tutor, this setting is a very realistic human setting. Just as in traditional apprenticeships, learners engage in activities ‘on-the-job’ rather than through the

didactic teaching of abstract concepts. The argument is that students are better equipped to approach non-familiar problems and produce solutions that are appropriate to a given culture.

2.2.2 Perry's theory of cognitive development

Perry's theory of cognitive development may be seen as an extension of Piaget's childhood development model. A key concept of any theory of cognitive development, and one that is frequently lost in such conversations, is that cognitive development may be understood as the way individuals make meaning of the world around them. The critical distinction here is between how a person thinks and what they are actually thinking about. In employing cognitive development theory, it is essential to focus on the "how" rather than the "what." The context in which Perry developed his model is also important to recognize, particularly because of its distinctions with contemporary campus life. He developed his theory while working as a professor at Harvard during the 1950's and 1960's (Love & Guthrie, 1999 as cited Abdullahi 2016).

2.3 Empirical Studies on Peer tutoring

Abdullahi (2016) investigated on the "effect of peer-tutoring teaching strategy on secondary school student academic achievement in Mathematics". Three research questions and three hypotheses were formulated to guide the study. The design adopted was a Quasi-Experimental. Two hundred (200) students from four selected schools in Edu Local Government Area were used as research sample. The simple random sampling technique was used to select the sampled schools. The experimental group was exposed to peer-tutoring, while the control group was taught with conventional method. Mathematics Achievement Test (MAT) was used to collect data from both pretest and posttests. A reliability coefficient of 0.73 was obtained. The data were

analyzed using t-test. The hypotheses were tested at 0.05 level of significance. The findings of the study are student taught with peer-tutoring strategy performed better than those taught with conventional teaching method and gender has no effect on their mathematics achievement scores. It was recommended that Government agencies whose responsibility is to design and revise the curriculum for secondary schools should incorporate the use of peer tutoring in teaching. The cited work shows that student taught with peer-tutoring strategy performed better than those taught with conventional teaching method. The present work seeks to find out the Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State.

John (2016) investigated effects of classwide and reciprocal peer tutoring strategies on students' mathematical problem-solving achievement in electricity concepts in physics. The design of the study was experimental; specifically the randomized post-test only control group design. The sample consisted of one hundred and twenty senior secondary two (SS2) physics students drawn using simple random sampling technique from three out of the eight public secondary schools in the study area and randomly assigned as the two experimental groups and one control group respectively. Three research questions and three hypotheses guided the study. Treatment consisted of teaching electricity concepts to the experimental groups using the classwide peer tutoring and reciprocal peer tutoring strategies while the control group was taught using a format not structured after the above strategies. Electricity problem solving test in physics (EPTP) was the instrument used for data collection. A One-way Analysis of Variance (ANOVA) was used to test the hypotheses at 0.05 level of significance. Results revealed a significant difference in the mathematical problem-solving achievement of students among the groups. Post hoc multiple comparison using LSD t-tests was carried out, showing that physics students exposed to

classwide peer tutoring strategy performed significantly better than students that had been exposed to reciprocal peer tutoring strategy and control group strategy. Based on the findings, some recommendations were made. The cited work shows that physics students exposed to classwide peer tutoring strategy performed significantly better than students that had been exposed to reciprocal peer tutoring strategy and control group strategy. The present work seeks to find out the Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State"

Abdurahman (2016) carried out a study to measured teachers' attitudes toward implementation of peer tutoring strategies in teaching students with ADHD in Saudi Arabia. The study moreover examined the relationship between teachers' attitudes of implementation of peer tutoring strategies and variables of demographic characteristics. Five hundred thirty eight teachers employed at public schools in Riyadh City responded to a survey questionnaire. The results of the study showed teachers realized the benefits of implementing a peer tutoring strategy, they considered there to be a lack in implementing this strategy, they were unsure of the barriers faced by teachers, and they supposed there to be teachers' needs. The study found significant differences in teachers' attitudes regarding teachers' gender, teaching position in schools, and previous teaching experience. No significant differences were found in the school level of teaching. Implications are discussed. The cited work measured teachers' attitudes toward implementation of peer tutoring strategies in teaching students with ADHD in Saudi Arabia. The study showed teachers realized the benefits of implementing a peer tutoring strategy, they considered there to be a lack in implementing this strategy, they were unsure of the barriers faced by teachers, and they supposed there to be teachers' needs. The present work seeks to find out

"The Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State"

Friska (2017) carried out a study to determine the significant influence of peer tutoring learning method to increase student interest and learning outcomes on environmental chemistry material. This study was conducted to determine the effect of peer tutoring learning method on environmental chemistry and described the learning interest student in followed the lecture. The research was quasi experiment by taking saturated sample of chemistry education department students accounted for 50 students. In this study used non-equivalent control group design. Technique of collecting data used test instrument and questionnaire. Based on data analyze obtained from the average score pre-test in the experimental class at 47.80 and post-test at 83.80. Pre-test score of control class was 55.60 and post-test score was 77. Hypothesis analysis was done by using t-test two parties with α=0,05 and obtained thitung was 3.623 and ttable 1.672, therefore was thitung> ttable that Ho rejected and Ha accepted, it can be concluded that peer tutoring learning method can improved student results in environmental chemistry material with learning outcomes improved was 76.3 percent. Pearson's correlation test was also conducted to see the relation between interest and student learning outcomes and obtained correlation number was 0.537>0.05 with sig.(2-tailed) were 0.006, so it can be concluded that there was a relation between interest and student learning outcomes. Student mastery learning value with the KKM> 80 was 76 percent, so by developed peer tutoring learning method was able to activate students in the learning process. The cited work was conducted to determine the effect of peer tutoring learning method on environmental chemistry and described the learning interest student in followed the lecture. It shows that peer tutoring learning method can improved student results in environmental chemistry material with learning outcomes. The present work seeks to find out the

Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State.

Adamu (2018) examined the effect of peer tutoring teaching method on students' performance in financial accounting in Federal unity Colleges of in North-East, Nigeria. The study had three objectives, three research questions and three null hypotheses. Quasi experimental design was used for the study. The population of the study was 130 SS II Financial Accounting students. An intact two classes of 46 students were used for the study. Two instruments were used for data collection were validated by four experts. The instrument had the coefficient of 0.87 and 0.89. The difficulty index of instruments stood at 0.76 and 0.81. The discriminating index of the items range from 0.5 to 0.7. Data collected were analyzed using mean and mean difference to answer the research questions. T-test was employed in testing the hypotheses at 0.05 level of significance. The findings revealed among others that there was significant difference between the mean performance of financial accounting students in experimental group and those in control group. It was concluded that using of peer tutoring strategy will help to improve the performance of financial accounting students. It was recommended among others that, accounting teachers should develop habit of using interactive methods which allows students to actively participate in the teaching and learning excise. The cited work examined the effect of peer tutoring teaching method on students' performance in financial accounting in Federal unity Colleges of in North-East, Nigeria. He concluded that using of peer tutoring strategy will help to improve the performance of financial accounting students. The present work seeks to find out the Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State.

Abdulraheem *et al*. (2017) examined the effect of peer tutoring and the moderating effect of gender on the academic performance of economics students in Ilorin-South Local Government of Kwara State, Nigeria. Two intact classes in two different secondary schools were elected for this study. The experimental (peer tutoring) group had a population of 40 students while the control (conventional instruction) group had a population of 38 students. A 50-item multiple-choice objective test titled Economics Performance Test (EPT) was used to measure academic performance. Students in the peer tutoring group obtained higher EPT scores than students in the conventional instruction group. This effect was not moderated by gender. We recommend that teachers adopt peer tutoring instructional strategies in the classroom so as to develop students' generic skills. The cited work was conducted to examine the effect of peer tutoring and the moderating effect of gender on the academic performance of economics students in Ilorin-South Local Government of Kwara State. The present work seeks to find out the Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State.

Muhammad *et al.* (2018) aimed at analyzing the effects of peer tutoring on the academic achievement of students in the subject of biology at secondary level. The objectives of the study were: (1) To find out the effects of peer tutoring on the academic achievement of students in the subject of biology; and (2) To examine the effects of peer tutoring with respect to knowledge, comprehension and application levels in cognitive domain of Bloom Taxonomy. All 433,405 male students at secondary level of 10th grade of Khyber Pakhtunkhwa were the population of the study. Forty students were taken as the sample of the study from the Allied National Software Institute (ANSI) Mardan. The Posttest-Only Equivalent Group Design was used. The data collected from pretest and posttest was analyzed through an independent sample t-test. It

was found that the mean score of the experimental group was significantly better than that of the control group. It was concluded that peer tutoring enhanced the academic achievement of students in the experimental group significantly as compared to the control group; hence, it was an effective method of instruction for teaching biology at secondary level. It was suggested that peer tutoring may be incorporated along with other teaching methodologies for the subject of biology and it may be given due consideration in all teacher education practices in the country. The cited work analyzed the effects of peer tutoring on the academic achievement of students in the subject of biology at secondary level. It was concluded that peer tutoring enhanced the academic achievement of students in the experimental group significantly as compared to the control group; hence, it was an effective method of instruction for teaching biology at secondary level.

The present work seeks to find out the Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State.

Joe (2018) conducted a research to determine the effectiveness of peer tutoring on the mathematics performance of fourth year slow-learners. This study made use of modified experimental design 10, otherwise known as the non-equivalent control group design. It involved one hundred twenty two (122) fourth year high school students of Daniel R. Aguinaldo National High School at Matina, Davao City for the School Year 2003-2004. Out of these numbers, sixty (60) students served as the experimental subjects and sixty two (62) students from other class served as the control subjects. Based on the findings of this study, the following conclusions are drawn: The use of remedial instruction indicates an increase in the student's achievement. The Peer Tutoring Approach as remedial instruction in the Experimental Group showed that there is no difference in the achievement result in the Control Group. The researcher offered the

following recommendations: Teachers who do remediation activities in any subject may try Peer Tutoring as an alternative approach with the same outcomes as the traditional instruction approach. School Administrators like the Principals and Head Teachers should allocate at least 30 minutes, three times a week meetings for remedial instruction. The cited work determined the effectiveness of peer tutoring on the mathematics performance of fourth year slow-learners. This study made use of modified experimental design 10, otherwise known as the non-equivalent control group design. It was concluded that the use of remedial instruction which is the peer tutoring approach increase student's achievement. The present work seeks to find out the Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State.

Timo *et al.* (2010) analyzed the effects of grade repetition on science and mathematics achievement and on self-concept in mathematics using longitudinal data from a representative sample of 9th graders in Germany. Same-age comparisons were applied between three groups: (a) the retained students, (b) a matched group of promoted students, and (c) the entire group of promoted students. The results show that the retained students have a higher self-concept in mathematics after one year of retention than before. Summarizing these empirical findings concerning achievement, we conclude that retention in the 9^{th} grade does not reduce the gap in academic achievement to the regular promoted students. The cited work analyzed the effects of grade repetition on science and mathematics achievement and on self-concept in mathematics using longitudinal data from a representative sample of 9th graders in Germany. He concluded that the retained students have a higher self-concept in mathematics after one year of retention than before. The present work seeks to find out the Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State.

Moliner (2020) examined the effects of peer tutoring on students' mathematics self-concepts. The Marsh questionnaire was used to measure students' mathematics self-concepts before and after implementation of a peer tutoring program. A pretest posttest control group design was employed. Study participants included 376 students from grades 7 to 9 (12 to 15 years old). No statistically significant differences were reported between the pretest and the posttest for any of the control groups. Statistically significant improvements were reported for all grades for the experimental groups. An average increment of 13.4% was reported for students in the experimental group, and the overall effect size was reported to be medium (Hedges' $g = 0.48$). No statistically significant differences were reported across grades for the experimental group. The main conclusion of this study is that same-age and reciprocal peer tutoring may be very beneficial for middle school students' mathematics self-concepts. Several recommendations for field practitioners emanated from the study: use same-age and reciprocal tutoring over cross-age and fixed peer tutoring; schedule tutoring programs for four weeks or less with two to four sessions of 25 minutes or less per week for each tutoring session; and, include a control group in research studies. The cited work examined the effects of peer tutoring on students' mathematics self-concepts. He concluded that same-age and reciprocal peer tutoring may be very beneficial for middle school students' mathematics self-concepts. The present work seeks to find out the Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State.

Edoho *et al.* (2020) investigated on Improving Senior Secondary School Students' Academic Achievement and Retention in Mathematics and Basic Science using Collaborative Concept Mapping Instructional Strategy (CCMIS) in Mkpat Enin Local Government Area of Akwa Ibom

State. It adopted a quasi-experimental pretest posttest control group research design. A sample of ninety seven (97) senior secondary school students was drawn in two randomly selected intact class from a population of 16 public secondary schools and 2185 SS2 students in Mkpat Enin Local Government Area of Akwa Ibom State of Nigeria. The study made use of Geometry Achievement Test (GAT) as instrument for data collection. The GAT was validated by two experts. The GAT was subjected to KR-20 reliability estimation which yielded a reliability coefficients of 0.87. Mean and Standard Deviation scores were used to answer the researchquestions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses. The study revealed that there is significant difference in the mean achievement scores between students taught geometry using collaborative concept mapping instructional strategy and those taught using discussion method. The study also revealed that there is significant difference in the mean retention scores between students taught geometry using collaborative concept mapping instructional strategy and those taught using discussion method. It also found no significant difference between the mean achievement scores of male and female students in geometry taught using collaborative concept mapping instructional strategy and those taught using discussion method. It was recommended among others that CCMIS should be adopted while teaching geometry concepts in Improving Senior Secondary School Students' Academic Achievement and Retention in Mathematics and Basic Science using Collaborative Concept Mapping Instructional Strategy (CCMIS). The cited work investigated on Improving Senior Secondary School Students' Academic Achievement and Retention in Mathematics and Basic Science using Collaborative Concept Mapping Instructional Strategy (CCMIS) in Mkpat Enin Local Government Area of Akwa Ibom State. He concluded that students taught geometry using collaborative concept mapping instructional strategy performs better than those taught

using discussion method. The present work seeks to find out the Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State.

Oyedele *et al.* (2019) examined the effects of peer tutoring and think-pair-share instructional strategies in improving students' academic performance in Chemistry. It also compared the effects of peer tutoring and think-pair-share strategies in improving students' attitude towards Chemistry. These were with a view to highlighting which of the teaching strategies that can improve students' academic performance in Chemistry. The study adopted a non-equivalent pre-test, post-test control group experimental research design. The population for the study consisted of all public senior secondary class one (SS 1) science students in Osogbo. Out of the two local government areas in Osogbo, Olorunda Local Government was selected using simple random sampling technique. Three senior secondary schools were selected in the Local Government Area and one intact class was selected from each of the schools using simple random sampling technique. The total sample size was 113 (38, 37 and 38 from each of the three schools). The schools were randomly assigned to three groups (Peer Tutoring, Think-Pair-Share and Teacher Expository) using simple random sampling technique. Two instruments, the Chemistry Achievement Test (CAT) and Questionnaire on Attitudes of Students towards Chemistry (QASTC) were used to collect data for the study. Data collected were analysed using Analysis of Covariance (ANCOVA).The results showed that, there was a significant difference in the performance of students exposed to peer tutoring, think-pair-share instructional strategies and those exposed to teacher expository teaching strategy ($F= 28.970$; $p< 0.05$). The results also indicated that, there was no significant difference in the attitude of students towards Chemistry when exposed to peer tutoring and think-pair-share ($F= 2.865$; $p> 0.05$). The Think-Pair-Share

Teaching Strategy (TPSTS) had best significant effect on student academic performance than Peer Tutoring Teaching Strategy (PTTS) and Teacher Expository Teaching Strategy (TETS). Students exposed to TPSTS had a mean difference of 1.8904 when compared with PTTS and 4.1287 mean difference when compared with TETS. The cited which examined the effects of peer tutoring and think-pair-share instructional strategies in improving students' academic performance in Chemistry. He concluded that think-pair-share was a better teaching strategy in improving students' academic performance in Chemistry than peer tutoring teaching strategy and the teacher expository teaching strategy respectively. The present work seeks to find out the Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students in Minna, Niger State.

2.4 Summary of Literature Reviewed

This research work was proposed to find out the effect of Peer Tutoring on Mathematics and Retention of Senior Secondary Schools in Minna, Niger State. In this chapter, effort has been made to review as much as possible literature related to this study. This was initiated by considering the theoretical framework. Theories found to be most relevant were Social Constructivist Theory and Perry's theory of cognitive development.

The conceptual framework, which aimed at emphasizing on the various concepts that are relevant to the study: "Effect of Peer Tutoring on Mathematics Achievement and Retention in Senior Secondary School Students" was discussed. The review also covered some empirical research findings on gender as it affects achievement and retention of peer tutoring. However, many studies have actually been carried out in the area of peer tutoring. But none of these researchers have conducted research on effect of peer tutoring on Mathematics Achievement and Retention of Senior Secondary School Students' in Minna, Niger State. Thus the study is geared

towards filling this gap. Therefore, this study investigated Effect of Peer Tutoring on Mathematics Achievement and Retention of Senior Secondary School Students' in Minna, Niger State.

CHAPTER THREE

3.0 RESEARCH METHODOLOGY

3.1 Research Design

The design adopted for this study was a quasi-experimental, a pretest, posttest, non-equivalent group design which entails the use of non-randomized group where the researcher cannot randomly sample and assign subject because intact class were used to administered the treatment. The design was considered appropriate for this study because intact classes were used instead of randomly composed samples. The format for the research design is shown below:

Fig. 3.1 Design

Group	Pretest	Treatment	Posttest
E:	**O_1**	**T**	**O_2**
C:	**O_3**	**-**	**O_4**

E = Experimental Group

O_1 = is the first observation (pretesting) of experimental group before treatment

T = Treatment

O_2 = is the second observation (post-testing) of experimental group after treatment by administering posttest.

C = Represent the control group exposed to the routine teaching

O_3 = is the first observation of the control group by administering pretest.

O_4 = is the second observation (post testing) of the control group.

This type of research design enabled relevant information to be collected from the respondents through the use of Mathematical Achievement Test.

3.2 Population of the Study

The population of the study was all the SSI students in two secondary schools in Minna Niger State. The two schools are Upper Niger River Basin staff School which is in Bosso local government and Queen View Academy which is in Chanchaga local government. The total number of the population was 97.

3.3 Sample and Sampling Techniques

Thirty students were randomly selected from senior secondary school (SSI) classes of each school, sampling a total of 60 students from the two schools.

3.3.1 Names of schools with their corresponding number of (SS1) students

	NAMES OF SCHOOLS	NO OF STUDENTS IN SSI
1.	Upper Niger River Basin Staff School	65
2.	QueenView Academy	32

3.4.2 Distribution of Students from the sampled class (SS1)

Name of Schools	Number of Students		Groups		Total
	Male	Female	E	C	
Upper Niger River Basin Staff School	15	15	15	15	30
Queen View Academy	15	15	15	15	30
Total	30	30	30	30	60

3.4 Research Instrument

There are two instruments for this study, they include:

I. Mathematics Achievement Test

II. Peer Tutoring Teaching Strategy.

Mathematics Achievement Test is a test designed to measure the knowledge and proficiency of an individual or student in something that has been learned or taught.

Peer-tutoring Training involves guiding the students that will serve as the tutor after the teacher taught a particular concept. Typically, a higher performing student is paired with a lower performing student to review critical academic or behavioural concepts.

3.5 Validity of the Research Instruments

The instrument used in this research was all validated by two experts in department of Science Education from Federal University of Technology Minna Niger State and some teachers from the sampled schools. They all offered useful advice to enable the researcher elicit the required information and data for the study. Their suggestions and corrections were properly utilized.

3.6 Reliability of the Research Instrument

To ascertain the reliability of the instrument, a test retest was used at two weeks interval to the experimental and control groups. The result of the test was analyzed using Pearson Product Moment Correlation Coefficient statistics. The correlation coefficient was found to be r= 0.75 which establish the reliability of the instrument.

3.7 Method of Data Collection

Queen view Academy was used as the experimental group while Upper Niger River Basin was chosen to be the control group. The first week, the researcher visits the sampled schools for

introduction and the purpose of the study to take permission to use the schools, sampled the classes and the students to be involved in the study.

On the first day of the second week, the researcher visits the school for the control group which is Upper Niger River Basin Staff School and Pretest was then administered to all the students involved. On the second day the researcher personally teaches the control groups using his first lesson plan, the third day with the second lesson plan and the fourth day with the third lesson plan. At the end of the second week, three (3) lessons were taught altogether. On the first day of the third week, the researcher visits the school he uses for experimental group which is Queen View Academy and then pretest was then administered to all the students involved. On the second day the researcher personally teaches the experimental groups using his first lesson plan, the third day with the second lesson plan and the fourth day with the third lesson plan. At the end of the second week, three (3) lessons were taught altogether. Same pretest and lesson plans were used for both the control and experimental groups in both schools. After a week, Posttest was administered on all the students involved in the study in the two schools for both experimental and control groups, to determine their achievement and retention of the study. The marks obtained from the tests were added together to form the data for the study, and the average determined.

3.8 Method of Data Analysis

Descriptive statistics of mean and standard deviation (SD) was used to answer the research questions and the influential statistics of the t-test was used to test the hypothesis at 0.05 level of significance using Statistical Package for Social Science (SPSS) version 23.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Answers to Research Questions

Research Question One:

What is the Effect of Peer-Tutoring on Student's Academic Achievement of Secondary School Students in Mathematics?

To answer this research question, Mean and Standard Deviation was used and the result is presented in Table 4.1.

Table 4.1: Mean and Standard Deviation of pretest and post-test Achievement scores of Experimental and Control group

		Pretest		Posttest			
Group	**N**	$(\bar{X})$	**SD**	$(\bar{X})$	**SD**	**Mean Gain**	**Mean Diff**
Exp.	30	8.93	2.50	12.10	2.95	3.17	
Control	30	6.67	2.33	7.70	2.74	1.23	1.94

The pretest mean value for experimental group is 8.93 as against 6.67 of the control group. Also their posttest mean are 12.10 and 7.70 respectively. Hence, the mean gain score are 3.17 for experimental group and 1.23 for the control group.

Research Question Two:

What is the effect of peer-tutoring teaching strategies in student's retention on Mathematics?

To answer this research question, Mean and Standard Deviation was used and the result is presented in Table 4.2.

Table 4.2: Mean and Standard Deviation of student retention on Mathematics when taught using peer tutoring

		Posttest		Post-post test			
Group	**N**	$(\bar{X})$	**SD**	$(\bar{X})$	**SD**	**Mean Gain**	**Mean Diff**
Exp.	30	12.10	2.95	13.10	2.81	1.00	1.47
Control	30	7.70	2.74	10.17	3.07	2.47	

The mean value for the post test of the experimental group is 12.10 as against 7.70 of the control group. Also their post-posttest mean are 13.10 and 10.17 respectively. Hence, the mean gain score are 1.00 for experimental and 2.47 for the control group.

Research Question Three:

Does Gender have any influence on the Academic Achievement of Students in Mathematics using Peer-tutoring?

To answer this research question, Mean and Standard Deviation was used and the result is presented in Table 4.3.

Table 4.3: Mean and Standard Deviation of Male and Female on the Academic Achievement of students' in Mathematics using peer tutoring

		Pretest		Posttest			
Group	**N**	$(\bar{X})$	**SD**	$(\bar{X})$	**SD**	**Mean Gain**	**Mean Diff**
Male	15	9.13	2.45	12.40	3.44	3.27	
Female	15	8.73	2.63	11.80	2.46	3.07	0.20

The mean value for pretest of the Male is 9.13 as against 8.73 of the female. Also their posttest mean are 12.40 and 11.80 respectively. Hence, the mean gain score are 3.27 for male and 3.07 for the female.

Research Question Four:

Does Gender have any influence on retention of Students in Mathematics using Peer-tutoring?

To answer this research question, Mean and Standard Deviation was used and the result is presented in Table 4.4.

Table 4.4: Mean and Standard Deviation students' retention in Mathematics Achievement scores of Experimental and Control group

		Male		Female			
Group	**N**	$(\bar{X})$	**SD**	$(\bar{X})$	**SD**	**Mean Gain**	**Mean Diff**
Exp.	15	13.40	3.18	12.80	2.46	0.60	
Control	15	10.67	2.99	9.67	3.18	1.00	0.40

The mean value for male experimental group is 14.73 as against 12.19 of the female in the group. Also the female experimental group mean are 12.67 and 9.87 respectively. Hence, the mean gain score are 2.06 for experimental and 7.68 for the control group.

4.2 Testing of Research Hypothesis

Hypothesis one

$H0_1$: There is no significant difference between academic achievement of students' taught mathematics using peer tutoring and those taught using conventional method.

Table 4.5: Summary of t-test Analysis Comparing Students Academic Achievement using Peer-tutoring and conventional method

Group	No	Df	Mean ($\bar{X}$)	SD	t-value	p-value
Exp.	30	58	12.10	2.952	6.252	0.000
Control	30		7.70	2.744		

Table 4.5 shows the t-test results on the comparison of mean academic achievement scores using peer tutoring and conventional method. The result indicates t= 6.252 Df=58, p=0.000<0.05. The result shows that there is significant difference between academic achievements of students' taught mathematics using peer tutoring than those taught using conventional method. Therefore, the null hypothesis is rejected.

Hypothesis two

$H0_2$: There is no significance difference between students' retention when taught Mathematics using Peer tutoring and those taught with conventional method.

Table 4.6: Summary of t-test Analysis Comparing Students retention when taught mathematics using Peer-tutoring and conventional method

Group	No	Df	Mean ($\bar{X}$)	SD	t-value	Sig.
Exp.	30		13.10	2.808		
		58			4.243	0.000
Control	30		10.17	3.074		

Table 4.6 shows the t-test results on the comparison of mean score of student's retention when taught with peer tutoring and conventional method. The result indicates t= 4.243 Df=58, p=0.000<0.05. The result shows that there is significant difference in student retention when taught mathematics using peer tutoring than using conventional method. Therefore, the null hypothesis is rejected.

Hypothesis Three

($H0_3$): There is no significance difference between Male and Female academic achievement in Mathematics when taught using peer tutoring.

Table 4.7: Summary of t-test Analysis Comparing Male and Female Student academic achievement in Mathematics when taught using peer tutoring

Group	No	Df	Mean ($\bar{X}$)	SD	t-value	Sig.
Male	15		12.40	3.439		
		28			0.472	0.644
Female	15		11.80	2.455		

Table 4.7 shows the t-test results on the comparison of mean score of Male and Female academic achievement in Mathematics when taught using peer tutoring. The result indicates t= 0.472 Df=28, p=0.644>0.05. The result shows that there is no significant difference in Male and Female academic achievement in Mathematics when taught using peer tutoring. Therefore, the null hypothesis is accepted.

Hypothesis four

$H0_4$: There is no significance difference between Male and Female retention in Mathematics when taught using peer tutoring.

Table 4.8: Summary of t-test Compared Male and Female retention in Mathematics when taught using peer tutoring

Group	No	Df	Mean $(\bar{X})$	SD	t-value	Sig.
Male	15		13.40	3.180		
		28			0.518	0.612
Female	15		12.80	2.455		

Table 4.8 shows the t-test results on the comparison of mean score of Male and Female retention in Mathematics when taught using peer tutoring.

The result indicates t= 0.518 Df=28, p=0.612>0.5. The result shows that there is no significant difference in Male and Female retention in Mathematics when taught using peer tutoring. Therefore, the null hypothesis is accepted.

4.3 Discussion of Findings

The results showed that students taught with peer tutoring had mean score higher than those taught with conventional teaching method. The experimental group result performed better than the control group. The hypothesis earlier posited was tested and the null hypothesis was rejected as the sample t-test has revealed a statistically reliable difference between the mean of the study group and control group respectively. The factors that could cause this include: mode of instruction, freedom of speech, mode of interaction and flexibility of the lesson. This finding also revealed that, there is no significance difference in male and female academic performance when taught using peer-tutoring. Furthermore gender did not influence the obtained result.

The research also revealed that peer-tutoring is more effective in student retention when taught mathematics than the conventional teaching method of instruction because there is no significant difference between male and female retention. The findings of this study was in agreement with the findings of Abdullahi (2016) who found out that student taught with peer-tutoring strategy performed better than those taught with conventional teaching method. Other studies revealed that the female students achieved higher than the male students but their difference was not significant Uloko (2014).

A study conducted by Ajuba (2011) found that peers are more sensitive than adult readers to picking up on non-verbal cues, students being tutored may give to reveal that they may not understand what a tutor is trying to communicate. In peer tutoring class each student gets more attention from the tutor and more time to speak while others listen. This allows the students take active part in constructing their knowledge.

A study conducted by Uloko, (2014) revealed that achievement difference as found in this study between the experimental and control groups of the learning-challenged students in statistics and the difference in the achievement of male and female learning-challenged students in statistics which was also found not significant in this study all depend on the strategy of teaching.

4.4 Summary of Findings

1. There was significance difference between the control group and the experimental group in their entry behaviour of the treatment.
2. There was significance difference between academic achievements of student taught mathematics using peer-tutoring than those taught using conventional method.

3. There was significance difference in male and female academic achievement in mathematic when taught using peer-tutoring method.
4. There was no significance difference between students retention when taught mathematics using peer-tutoring teaching method.
5. There was no significance difference between the male and the female retention in mathematics when taught using peer tutoring.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

From the results obtained, the research concluded that peer tutoring instructional method is one of the effective methods of teaching, and that tutees/students respond better to their peers than to their teachers and tend to obtain companionship from the students that tutor them. Tutees also receive more teaching, and individualized instruction than in classroom setting. Therefore if peer tutoring is effectively utilized, it will produce great positive impact on participants. It makes for better understanding of the topics; helps tackle difficult problems and topical issues as well as encourage reading habit and optimal use of time by students. Efforts need to be channeled to enhance its efficiency and effectiveness in our secondary schools.

5.2 Recommendation

The following recommendations based on the findings were made:

i. Intensive training and retraining of teachers is proper in implementation of peer tutoring in our secondary schools.
ii. Seminars, workshops should be organized to educate teachers on the use of peer tutoring
iii. Instructors who monitor tutoring sessions should also provide a reward system to reinforce on task behaviour and participation.
iv. Government agencies whose responsibility is to design and revise the curriculum for secondary schools should incorporate the use of peer tutoring in teaching
v. Teachers occasionally should give students topics to go and make inquiry about, so that before the teacher teaches a new concept, students will be able to explain in their own terms what they know about the new concepts.

5.3 Limitation of the study

The research work will be limited to the analysis based on the achievement test, and relevant text (literature). The topics covered are quadratic equations using: factorizations, difference of two square and constructions of quadratic equations using roots of an equation. Other limitation of the study was inability of the researcher to cover the entire population of the study.

5.4 Suggestions for further studies

i. Similar investigation need to be carried out in other states of the Federation.

ii. Effects of peer tutoring on mathematics achievement and retentions of Tertiary Institution Students

REFERENCES

Abdullahi I. (2016) Effect of Peer Tutoring Teaching Strategy On Secondary School Students Academic Achievement In Mathematics.

Adamu, I., Bashir. A. U. & Haruna J. A. (2015). Comparative Effects of Jigsaw Leaning Technique and Conventional Method on Academic Achievement and Retention of Ahmadu Bello University Students in Business Mathematics in Nigeria. *Journal of Information, Education, Science and Technology* (JIEST), 2(2).

Adamu, I., Haruna J. A. & Bshir. A. U. (2013). Effects of Jigsaw and Lecture Based Techniques on Class Attendance, Participation and Proficiency of Undergraduate Students in Business Mathematics in Nigeria. *Technical & Vocational Education Journal*. 5(1).

Adigun, J., Onihunwa, J., Irunokhai, E., Sada, Y., & Adesina, O. (2015). Effect of gender on students' academic performance in computer studies in secondary schools in New Bussa, Borgu Local Government of Niger State. *Journal of Education and Practice, 6*(33), 1–7.

Ajayi, O. V & Angura T. M (2017). Improving senior secondary students' retention in electrolysis using collaborative concept mapping instructional strategy (CCMIS). *Greener Journal of Educational Research, 7(6), 87-92.* Hornby, A. S. (2001). *Oxford advanced learners' dictionary of current english*. Italy oxford University press.

Ajayi, O. V. (2017). Effect of hands-on activity-based method on interest of senior secondary students in organic chemistry. *Scholarly Journal of Education, 6(1), 1-5.*

Ajibola, A. (2014.) Effects of two methods of teaching on students' retention in basic science and technology. *Journal of Education and Practice, 3(3), 12-18.*

Ajuba, B. (2011) Impact of Peer Tutoring on the Academic Achievement on Science Among Secondary School Students within Bauchi Metropolis.Unpublished Bachelor Project. Abubakar Tafawa. University, Bauchi.

Akinremi T.A and Adesanya T. (2019) *Effect and Relationship of Mathematics Anxiety in Senior Secondary School Student Achievement in Mathematics.* A case study of Government College School Surulere Lagos State, Nigeria.

Alegre, F., Moliner, L., Maroto, A., & Lorenzo-Valentin, G. (2019c). Peer tutoring in mathematics in primary education: A systematic review. *Educational Review, 71*(6), 767–791.

Alegre, F., Moliner, L., Maroto, A., & Lorenzo-Valentin, G. (2019). Peer tutoring in mathematics in primary education: A systematic review. *Educational Review, 71*(6), 767–791.

Alegre-Ansuategui, F. J., Moliner, L., Lorenzo, G., & Maroto, A. (2018). Peer tutoring and academic achievement in mathematics: A meta-analysis. *Eurasia Journal of Mathematics, Science and Technology Education, 14*(1), 337–354.

Anselm J. (2010). Effect of Classwide Peer tutoring on Mathematics Students Achievement in Secondary School. Available at: https://www.academia.edu/5689965/effect_of_classwide_peer_tutoring_on_mathematics students_achievement_in_secondary_school.

Bala, B. (2011). Quality and students achievement. A review of state policy evidence. *Educational Policy Analysis, 8(1), 39-43*.

Bowman-Perrott, L., Davis, H., Vannest, K., Williams, L., Greenwood, C., & Parker, R. (2013). Academic benefits of peer tutoring: A meta-analytic review of single-case research. *School Psychology Review*, *42*(1), 39–56.

Brittany Hott, Jennifer Walker, George Jasneen Sahni, "counsel of learning disability: peer tutoring" (April, 2012)

Brown, B. A., Boda, P., Lemmi, C., & Monroe, X. (2019). Moving culturally relevant pedagogy from theory to practice: Exploring teachers' application of culturally relevant education in science and mathematics. *Urban Education*, *54*(6), 775–803.

Edoho, Emmanuel Asuquo, Asuquo, Inyang Maurice, Anditung, Peter Agbudu & Abasi, Andrew Umo (2020) Improving Senior Secondary School tudents' Academic Achievement and Retention in Mathematics and Basic Science using Collaborative Concept Mapping Instructional Strategy (CCMIS)

Faridhan, Y. E., Loch, B., &Walker, L. (2013). Improving retention in first-year mathematics using learning analytics. In H. Carter, M. Gosper and J. Hedberg (Eds.), electric dreams proceeding ascilite 2013 sydney . (pp.278-282)

Gamlem, S. M. (2019). Mapping teaching through interactions and pupils' learning in mathematics. *SAGE Open*, *9*(3). https://doi. org/10.1177/2158244019861485

Ishaq A, M.(2011) Accounting In Nigerian Secondary Schools: A Case Study of Gombe State. *Electronic Journal ·*

Jibrin A. G..M, Ibrahim, A. & Zayum S .D. (2016) Effect Of Peer Tutoring On The Academic Achievements Of Upper Basic Students In Basic Science In Dengi Metropolis Of Plateau State. *International Journal of Vocational and Technical Education Research*, 2 (3), 25-35. From www.eajournals.org.

Kareem J. Thompson, (1999) A Study of the Effectiveness of Peer Tutoring on Mathematics Achievement of Fifth Grade Students, Dr. Randall Robinson, thesis advisor, Rowan University Master of Science in Teaching Elementary Education

Kurumeh, M. S., Onah, F. O., & Mohammed, A.S. (2012). Improving students' retention in junior secondary school statistics using ethno-mathematics teaching approach in Obi and Oju Improving Senior Secondary School Students' Academic Achievement and Retention in Mathematics and Basic Science using Collaborative Concept Mapping Instructional Strategy (CCMIS)

M. Saumi and K. W. Anom (2014), "Peningkatan Hasil Belajar Kimia Melalui Peran Tutor Sebaya Siswa Kelas X . A SMA."*J. Pen.Pend.Kim*, vol1, no 1, pp.43-50,.

Moliner, L. & Alegre, F. (2020) Effects of peer tutoring on middle school students' mathematics self-concepts. PLoS ONE 15(4): e0231410. https://doi.org/10.1371/journal.pone.0231410

Nigerian Educational Research and Development Council (2008). *9-year Basic Education Curriculum, Economics for Senior Secondary School SSS 1-3*.Lagos, Nigeria: NERDC Press, Lagos.

Othman, A.S. (1997). *Peer-tutoring at the Elementary School. Pupils as tutors: Toward a balanced peers tutoring approach*. Dissertation Abstracts International. A-58/05. 1594.

R. Sari & S. Aisyah, "Penerapan Peer Instruction With Structured Inquiry (Pisi) Untuk Meningkatkan Hasil Belajar Kimia Siswa,"EduChem, vol. 1, no. 2, pp. 176–188, 2016.

Razia R. (2012) The Effect of Peer tutoring on Student Achievement in the subject of English at Secondary Level in the light of Vygotsky's Theory**.** A thesis submitted for partial fulfilment of the requirements of the degree of Doctor of Philosophy in Education. Foundation University College of Liberal Arts and Sciences Islamabad- Pakistan

Sam L. (2016*).* Gender Differences in Academic Performance of Financial secondary school students in Akwaibom state,Accounting Students in Selected Senior High Schools in the Central Region of Ghana.

The Evolution of Peer Tutoring Programs: Past, Present, and Future by Ray Liu and Sherri Bealkowski (2018)

Topping K, Duran D, Van Keer H. (2015) Using peer tutoring to improve reading skills: a practical guide for teachers. Routledge. https://doi.org/10.4324/9781315731032

Tran V. D. (2014). The effects of cooperative learning on the academic achievement and knowledge retention, *Int. J. of Higher Educ.* 3(2), 131-140

Ugwu PN. Reappraising the current national policy on education for functionality and self – reliance: Issues and challenges for mathematics education. Journal of Qualitative Education. 2011;7(1):143–144.

Uloko, E. (2014) Effect of Peer-Tutoring Strategy and Gender on Achievement of Learning - Challenged Students in Junior Secondary School Statistics. SCSR Journal of Pure and Applied Sciences (SCSR-JPAS), Volume 1, Issue 1 (June, 2014), pp 12 - 18

Webb, N.M. (2001). *Task-related verbal interaction and mathematics learning in small groups*. Journal of Research in Mathematics Education. 22. 366-389.

Yara P. O, Otieno K. O. (2010) Teaching/learning resources and academic performance in mathematics in secondary schools in Bondo District of Kenyan. Asian Social Science. 6(12).

Zakaria, E., Chin, C. L. & Daud, Y. (2010). The effect of cooperative learning on students' mathematics achievement and attitude towards mathematics. *Journal of Social Sciences*, *6*(2), 272-275. doi:10.3844/jssp.2010.272.275 An investigation into mathematics performance of senior secondary school students in sokoto state (Galadima, i. & yusha'u, m.a. 2007) ABACUS, Pages 24 – 33, Vol. 32, No. 1, 2007

APPENDIX A

MATHEMATICS LESSON PLANS

LESSON PLAN 1

CLASS: SS1

SUBJECT: MATHEMATICS

TOPIC: Quadratic Equation by Factorization

DURATION: 40 minutes

SEX: Mixed

BEHAVIORAL OBJECTIVE: At the end of the lesson, the students should be able to: (i) Solve quadratic equation by factorization.

ENTRY BEHAVIOR: The students have learnt factorization.

REFERENCE: Mathematical Association of Nigeria: MAN Mathematics for Senior Secondary Schools Book 1, New Edition, University Press Plc, Ibadan, 2012. Pages 79-80.

INTRODUCTION: The teacher introduces the lesson by explaining Quadratic equation as follows:

Quadratic equation is of the form $ax^2 + bx + c = 0$, where a,b,c are real numbers and x is a variable. Some examples are

a) $x^2 - 4 = 0$
b) $x^2 - 8x + 16 = 0$
c) $2x^2 + 4x + 6 = 0$

PRESENTATION: The teacher presents the lesson through the following examples:

EXAMPLE 1: The teacher solves the first example together with the students. Solve the quadratic equation $x^2 + 3x + 2 = 0$

Solution

We look for two numbers such that their product is the last term and their sum is the middle term. Note that from the question given $x^2 + 3x + 2 = 0$, the first term is x^2, the second term is $3x$ and the third term is 2.

By trial and error, these numbers are +2 and +1. Hence we obtain the factors as $x + 2\ and\ x + 1$ i.e, $x^2 + 3x + 2 = (x + 2)(x + 1) = 0$

Solving we obtain,

$x + 2 = 0$ or $x + 1 = 0$

i.e $x = -2$ and $x = -1$

Hence $x = -2\ or\ x = -1$

EXAMPLE 2: The teacher solves the second example together with the students. Solve the quadratic equation $p^2 - 7p + 12 = 0$

Solution

We look for two numbers such that their product is the last term and their sum is the middle term. Note that from the question given $p^2 - 7p + 12 = 0$, the first term is p^2, the second term is $-7p$ and the third term is +12.

By trial and error, these numbers are -3 and -4. Hence we obtain the factors as $x - 3\ and\ x - 4$ i.e, $p^2 - 7p + 12 = (x - 3)(x - 4) = 0$

Solving we obtain,

$x - 3 = 0$ or $x - 4 = 0$

i.e $x = 3$ and $x = 4$

Hence $x = 3\ or\ x = 4$

EVALUATION: The teacher evaluates the lesson by having the students work through exercise 1 and 2 on the first activity worksheet with assistance from the tutor as needed.

CONCLUSION: The teacher have tutee individually work through exercise 3 and 4 on the activity worksheet.

LESSON PLAN 2

CLASS: SS1

SUBJECT: MATHEMATICS

TOPIC: Quadratic Equation by Factorization

DURATION: 40 minutes

SEX: Mixed

BEHAVIORAL OBJECTIVE: At the end of the lesson, the students should be able to: (i) Solve quadratic equations where the coefficient of the highest power is greater than 1.

ENTRY BEHAVIOR: The students have learnt quadratic equation where the highest power of the unknown is less than 1.

REFERENCE: Mathematical Association of Nigeria: MAN Mathematics for Senior Secondary Schools Book 1, New Edition, University Press Plc, Ibadan, 2012. Pages 81-86.

INTRODUCTION: The teacher introduces the lesson by explaining the coefficient greater than one: Quadratic equation of the form $ax^2 + \mathrm{b}x + c = 0$. Here "a" is coefficient of the highest power in the equation.

PRESENTATION: The teacher presents the lesson through the following examples:

EXAMPLE 1: The teacher solves the first example together with the students. Solve the quadratic equation $2x^2 - 3x + 1 = 0$

Solution

We multiply the coefficient of x^2 by the last term i.e. 2(+1) = 2

We look for two numbers such that their product is the sum equal to the coefficient of x. By trial and error, these numbers are -3 and -4. Hence we rewrite the original function as $2x^2 - 2x -$

$x + 1$. Factorizing, we have $2x(x-1) - 1(x-1)$. The equation now becomes $(2x-1)(x-1) = 0$ solving either $2x - 1 = 0\ or\ x - 1 = 0$ i.e. either $x = \frac{1}{2}\ or\ x = 1$

EXAMPLE 2: The teacher solves the second example together with the students. Solve the quadratic equation $2y^2 - 11y - 21 = 0$

Solution

We multiply the coefficient of y^2 by the last term i.e. 2(-21) = 42

We look for two numbers such that their product is the sum equal to the coefficient of y. By trial and error, these numbers are -14 and +3. Hence we rewrite the original function as $2y^2 - 14y + 3y - 21$. Factorizing, we have $2y(y-7y) + 3(y-7)$. The equation now becomes $(2y+3)(y-7) = 0$ solving either $2y + 3 = 0\ or\ y - 7 = 0$ i.e. either y= $1\frac{1}{3}\ or\ y = 7$

EXAMPLE 3

The teacher solves the third example carrying along the students. Solve the equation $x^2 + 25x = 0$

Solution

We factorize the common factor between the first and second terms which is x im the common term, we have that $x(x+25) = 0$. We simplify further to say $x = 0\ or\ (x+25) = 0$. Either $x = 0\ or\ x = -25$

EVALUATION: The teacher evaluates the lesson by having the students work through exercises 5 and 6 on the first activity worksheet with assistance from the tutor as needed.

CONCLUSION: The teacher have tutee individually work through exercise 7 and 8 on the activity worksheet.

LESSON PLAN 3

CLASS: SS1

SUBJECT: MATHEMATICS

TOPIC: Forming Quadratic equations with given roots

DURATION: 40 minutes

SEX: Mixed

BEHAVIORAL OBJECTIVE: At the end of the lesson, the students should be able to: (i) Form Quadratic Equation with given roots.

ENTRY BEHAVIOR: The students have learnt solving of quadratic equation by factorization.

REFERENCE: Mathematical Association of Nigeria: MAN Mathematics for Senior Secondary Schools Book 1, New Edition, University Press Plc, Ibadan, 2012. Pages 87-88.

INTRODUCTION: The teacher introduces the lesson by explaining what given roots are all about: Given roots are the two solutions of any quadratic equation.

PRESENTATION: The teacher presents the lesson through the following examples:

EXAMPLE 1: Find a quadratic equation with roots 2 and 3

Solution

Let $x = 2 \; and \; x = 3$

We have that: $x - 2 = 0 \; or \; x - 3 = 0$

Thus $(x - 2)(x - 3) = 0$

$x(x - 3) - 2(x - 3) = 0$

$x^2 - 5x + 6 = 0$ is the required equation.

EXAMPLE 2: Find a quadratic equation with roots $\frac{1}{4}$ and $\frac{1}{3}$

Solution

Let $x = \frac{1}{4}\ and\ x = \frac{1}{3}$

We have that: $x - \frac{1}{4} = 0\ or\ x - \frac{1}{3} = 0$

$4x - 1 = 0\ or\ 3x - 1 = 0$

Thus $(4x - 1)(3x - 1) = 0$

$12x^2 - 4x - 3x + 1 = 0$

$12x^2 - 7x + 1 = 0$ is the required equation.

EXAMPLE 3: The teacher solves example 3 together with the students, solve the equation $y^2 - 3^2$

Solution

If we observe carefully the question we'll see that the first term is a square likewise the second term, in this case we have a name for it which is *"difference of two square"*. The solution is thus: $(y - 3)(y + 3)$. If we expand it we shall get back our question which is $y^2 - 3^2$

Checking:

$(y - 3)(y + 3)$

$= y(y + 3) - 3(y + 3)$

$= y(y + 3) - 3(y + 3)$

$= y^2 + 3y - 3y - 3^2$

$= y^2 + 0 - 3^2$

$= y^2 - 3^2$

Note 1: Sometimes the first or second term could be without square but a perfect square for example:

$x^2 - 16$ which can be written as $x^2 - 4^2$

$25 - k^2$ which can be written as $5^2 - k^2$

Note 2: The method above in example 3 can only be applied if the first and second term is a square and a negative sign between them.

EVALUATION: The teacher evaluates the lesson by having the students work through exercise 9 and 10 on the first activity worksheet with assistance from the tutor as needed.

CONCLUSION: The teacher have tutees individually work through exercise 11 and 12 on the activity worksheet.

APPENDIX B

MATHEMATICS ACHIEVEMENT TEST (MAT)

1. Factorize this quadratic expression $x^2 - 10x$

A. $x(x-10)$ B. $(x-10)(x-x)$ C. $10(x-10)$ D. $(x-10)(x+10)$

2. Factorize $x^2 - 25$

A. $(x-25)(x+25)$ B. $x(x-5)$ C. $(x-5)(x+5)$ D. $(x^2-5)(x^2+5)$

3. Expand the expression $x^2 - 8x - 9$

A. $(x^2 - 9x - x - 9)$ B. $(x^2 + 9x + x - 9)$ C. $(x^2 - 8x + x - 9)$

D. $(x^2 - 9x + x - 9)$

4. Solve the equation $x^2 - 16 = 0$

A. $x = 8\ or\ x = -8$ B. $x = 8\ or\ x = -4$ C. $x = 4\ or\ x = -8$ D. $x = 4\ or\ x = -4$

5. Solve the equation $x^2 + 6x - 7 = 0$

A. $x = 1\ or\ x = -7$ B. $x = 1\ or\ x = 2$ C. $x = -1\ or\ x = 7$

D. $x = 9\ or\ x = 7$

6. Find the quadratic equation in x whose roots are 4 and 2

A. $x^2 - 3x - 2 = 0$ B. $x^2 - 6x + 8 = 0$ C. $x^2 - 9x + 12 = 0$ D. $x^2 + 8x + 7 = 0$

7. Find the quadratic equation in x whose roots are $-\frac{1}{3}\ and\ -2$

A. $3x^2 + 7x + 2 = 0$ B. $3x^2 - 9x + 12 = 0$

C. $5x^2 - 9x + 14 = 0$ D. $7x^2 - 5x + 12 = 0$

8. Solve the equation $(2y + 1)(y + 7) = 0$

A. $y = \frac{1}{2}\ or\ y = -17$ B. $y = 7\ or\ y = -\frac{2}{1}$ C. $y = -\frac{1}{2}\ or\ y = -7$

D. $y = \frac{1}{2}\ or\ y = 7$

9. Solve by factorization $9x^2 - 6x + 1 = 0$

A. $x = 4 \; or \; x = 3$ B. $x = 6 \; or \; x = 9$ C. $x = \frac{1}{3} \; or \; x = 9$ D. $x = \frac{2}{7} \; or \; x = \frac{1}{3}$

10. Solve $5y^2 = 6y$

A. $y = 0 \; or \; y = 1\frac{1}{5}$ B. $y = \frac{6}{8} \; or \; y = 4$ C. $y = 0 \; or \; y = 5$ D. $y = 6 \; or \; y = \frac{5}{6}$

11. Solve the quadratic equation by factorization $x^2 + 5x + 6 = 0$

A. $x = 2 \; or \; 6$ B. $x = -2 \; or \; -3$ C. $x = -2 \; or \; 3$ D. $x = 5 \; or \; -4$

12. Solve by factorization $x^2 - 9$

A. $(x + 3)(x + 3)$ B. $(x + 2)(x - 6)$ C. $(x + 4)(x - 4)$ D. $(x + 3)(x - 3)$

13. Find the quadratic equation whose roots are -1 and -3

A. $2x^2 + 6x + 3$ B. $x^2 + 4x + 3$ C. $x^2 + 4x + 5$ D. $3x^2 + 9x + 7$

14. Factorize $2y^2 - 11y - 21$

A. $(x - 7)(2x + 3)$ B. $(x - 4)(x + 1)$ C. $(x - 2)(2x + 9)$ D. $(x - 4)(3 + 3)$

15. Construct a quadratic equation for $\left(1, \frac{1}{5}\right)$

A. $5x^2 + 4x + 3$ B. $x^2 - 6x + 7$ C. $4x^2 - 7x + 1$ D. $5x^2 - 6x + 1$

16. Solve the equation $x^2 + 3x = 18$

A. $x = 13 \; or \; -12$ B. $x = 4 \; or \; -11$ C. $x = 5 \; or \; -6$ D. $x = 3 \; or \; -18$

17. Find the root of the quadratic equation $21x - x^2 = 0$

A. $x = 10 \; or \; 11$ B. $x = 14 \; or \; 1$ C. $x = 13 \; or \; 6$ D. $x = 0 \; or \; 21$

18. Solve the equation $(x - 7)(7 - 6x) = 0$

A. $x = -7 \; or \; x = \frac{7}{6}$ B. $x = 7 \; or \; x = \frac{6}{5}$ C. $x = 3 \; or \; x = \frac{1}{6}$ D. $x = -4 \; or \; x = \frac{7}{9}$

19. Factorize the expression $8c^2 - 14c + 3$

A. $. x = -9 \; or \; \frac{1}{4}$B. $x = \frac{3}{2} \; or \; \frac{1}{4}$ C. . $x = \frac{3}{2} \; or \; -\frac{1}{4}$ D. . $x = 7 \; or \; 2$

20. Solve the equation $(2 + 7y)^2 = 0$

A. $x = \frac{2}{7} twice$ B. $x = 2 \; or \; \frac{2}{7}$ C. $x = -\frac{2}{7} \; twice$ D. $x = \frac{7}{2} \; or \; 7$

APPENDIX C

SCORING GUIDE FOR MATHEMATICS ACHIEVEMENT TEST (MAT)

1. A
2. C
3. D
4. D
5. A
6. B
7. A
8. C
9. C
10. A
11. B
12. D
13. B
14. A
15. D
16. D
17. D
18. A
19. D
20. C

APPENDIX D

PEER TUTORING TRAINING

LESSON PLAN 1

OBJECTIVE: At the end of the lesson, the students should be able to identify the appropriate manner in which to speak and to listen to their tutoring partner when orally asked.

PRESENTATIONS:

1. Discuss how the tutors and tutees are to address each other during the peer tutoring sessions.
2. Discuss active listening; an approach where the tutor and tutee listen as their partner is speaking whether the conversation pertains to instructional information or a partner asking for help.
3. The tutors and tutees are to respect each other, and always be courteous to their partner.
4. Discuss how questions are to be asked during peer tutoring sessions.

EXPLANATIONS:

1. Explains the manner in which the partners will speak to one another during the peer sessions through role-play.
2. Explains active listening with a partner in an instructional situation as well as in a situation where one partner is helping another with a problem.
3. Explains courteous behavior, and will display the proper way to ask a question during a peer tutoring session.

EVALUATION:

1. Orally question the students on the manner in which they should address their peer partner during the sessions.
2. Discuss how the students should speak and listen to their partners during peer tutoring.

PEER TUTORING TRAINING

LESSON PLAN 2

BEHAVIORAL OBJECTIVE: At the end of the lesson students should be able to give examples of three compliments to give to their peer partner during tutoring sessions.

PRESENTATIONS:

1. Discuss various ways in which the students are to complement their partner during tutoring sessions.

2. Discuss the tutor giving compliments to the tutee on their level of improvement, on how well they solved the problems during a session, and on the manner in which their working.

EXPLANATIONS:

1. Explain the manner in which each student should complement one another during tutoring sessions.

2. Explain how praising improves students, giving positive feedback on their partners work habits, and compliments on how well they solved problems during a session.

EVALUATION:

The students will be orally asked to give three examples of compliments that they can say to their peer partner.

APPENDIX E

CLASS ACTIVITIES

ACTIVITY ONE

ALL WORK IS TO BE DONE DIRECTLY ON THE GIVEN WORKSHEET.

IF YOU HAVE ANY QUESTIONS, RAISE YOUR HAND FOR ASSISTANCE FROM THE TEACHER

Tutor and Tutee Instruction

1. Explain to your partner that together the two of you will work on exercise 1 and 2 on this activity worksheet.

2. The tutees are to complete the remaining exercise 3 and 4 by themselves, but they may ask you for help if they are having difficulty.

3. Do all your workings and solutions on this worksheet.

A. Solve the following quadratic equation by factorization

1. $x^2 - 8x - 9 = 0$
2. $d^2 + 5\mathrm{d} + 6 = 0$
3. $x^2 + 8x + 7 = 0$
4. $r^2 + 3r - 10 = 0$

ACTIVITY TWO

ALL WORK IS TO BE DONE DIRECTLY ON THE GIVEN WORKSHEET.

IF YOU HAVE ANY QUESTIONS, RAISE YOUR HAND FOR ASSISTANCE FROM THE TEACHER

Tutor and Tutee Instruction

1. Explain to your partner that together the two of you will work on exercise 5 and 6 on this activity worksheet.

2. The tutees are to complete the remaining exercise 7 and 8 by themselves, but they may ask you for help if they are having difficulty.

3. Do all your workings on this worksheet.

B. Solve the following quadratic equation by factorization

1. $3x^2 + 10x - 3 = 0$
2. $4y^2 - 4y - 3 = 0$
3. $6t^2 + 12t + 6 = 0$
4. $4x^2 - 13x - 1 = 0$

ACTIVITY THREE

ALL WORK IS TO BE DONE DIRECTLY ON THE GIVEN WORKSHEET.

IF YOU HAVE ANY QUESTIONS, RAISE YOUR HAND FOR ASSISTANCE FROM THE TEACHER

Tutor and Tutee Instruction

1. Explain to your partner that together the two of you will work on exercise 9 and 10 on this activity worksheet.

2. The tutees are to complete the remaining exercise 11 and 12 by themselves, but they may ask you for help if they are having difficulty.

3. Do all your workings and solutions in this worksheet.

C. Find the quadratic equations whose roots are

9. 4 and 1

10. $-\frac{1}{2}$ and 4

11. -5 and 1

12. $\frac{1}{3}$ and 9

APPENDIX F

SOLUTIONS TO CLASS ACTIVITIES

SOLUTIONS TO ACTIVITY ONE

1. $x^2 - 8x - 9 = 0$

   $x^2 - 9x + x - 9 = 0$

   $x(x - 9) + 1(x - 9) = 0$

   $(x - 1)\ (x - 9) = 0$

   $x + 1 = 0\ or\ x - 9 = 0$

   $x = -1\ or\ x = 9$

2. $d^2 + 5\mathrm{d} + 6 = 0$

   $d^2 + 3\mathrm{d} + 2d + 6 = 0$

   $d(d + 3) + 2(d + 3) = 0$

   $(d + 2)\ (d + 3) = 0$

   $d + 2 = 0\ or\ d + 3 = 0$

   $d = -2or\ d = -3$

3. $x^2 + 8x - 7 = 0$

   $x^2 + 7x + x + 7 = 0$

   $x(x + 7) + 1(x + 7) = 0$

   $(x + 7)\ (x + 1) = 0$

   $x + 7 = 0\ or\ x + 1 = 0$

   $x = -7\ or\ x = -1$

4. $r^2 + 3\mathrm{r} - 10 = 0$

$r^2 - 2\mathrm{r} + 5r - 10 = 0$

$r(r-2) + 5(r-2) = 0$

$(r-2)\,(r+5) = 0$

$r - 2 = 0\ or\ r + 5 = 0$

$r = 2\ or\ r = -5$

SOLUTIONS TO ACTIVITY TWO

1. $3x^2 + 10x - 3 = 0$

   $3x^2 + x + 9x + 3 = 0$

   $x(3x + 1) + 3(3x + 1) = 0$

   $(3x + 1)\ (x + 3) = 0$

   $3x + 1 = 0\ or\ x + 3 = 0$

   $x = -\frac{1}{3}\ or\ x = -3$

2. $4y^2 - 4\mathrm{y} - 3 = 0$

   $4y^2 + 2y + 6y - 3 = 0$

   $2y(2y + 1) - 3(2y + 1) = 0$

   $(2y - 3)\ (2y + 1) = 0$

   $2y - 3 = 0\ or\ 2y + 1 = 0$

   $y = \frac{3}{2} or\ y = -\frac{1}{2}$

3. $6t^2 + 12\mathrm{t} + 6 = 0$

   $6t^2 + 6\mathrm{t} + 6t + 6 = 0$

   $6t(t + 1) + 6(t + 1) = 0$

   $(6t + 6)\ (t + 1) = 0$

   $6t + 6 = 0\ or\ t + 1 = 0$

   $t = -1\ or\ t = -1$

4. $4x^2 - 13x - 1 = 0$

   $4x^2 - 4x + x - 1 = 0$

   $4x(x - 1) + 1(x - 1) = 0$

   $(4x + 1)\ (x - 1) = 0$

$4x + 1 = 0 \; or \; x - 1 = 0$

$x = -\frac{1}{4} \; or \; x = 1$

SOLUTIONS TO ACTIVITY THREE

1. Let $x = 4 \; or \; x = 1$

   $(x - 4) \; or \; (x - 1) = 0$

   $(x - 4)(x - 1) = 0$

   $x^2 - 5x + 4 = 0$

2. Let $x = -\frac{1}{2} \; or \; x = 4$

   $\left(x + \frac{1}{2}\right) \; or \; (x - 4) = 0$

   $\left(x + \frac{1}{2}\right)(x - 4) = 0$

   $x^2 - 4x + \frac{x}{2} - \frac{4}{2} = 0$

   $x^2 - \frac{7}{2}x - 2 = 0$

   $2x^2 - 7x - 4 = 0$

3. Let $x = -5 \; or \; x = 1$

   $(x + 5) \; or \; (x - 1) = 0$

   $(x + 5)(x - 1) = 0$

   $x^2 - x + 5x - 5 = 0$

   $x^2 + 4x - 5 = 0$

4. Let $x = \frac{1}{3} \; or \; x = 9$

   $\left(x - \frac{1}{3}\right) \; or \; (x - 9) = 0$

   $\left(x - \frac{1}{3}\right)(x - 9) = 0$

   $x^2 - 9x - \frac{x}{3} + 3 = 0$

$$x^2 - \frac{28}{3}x + 3 = 0$$

$$3x^2 - 28x + 9 = 0$$