EFFECTS OF FAST-DRAW AND POLYA MODELS ON ATTITUDE PERFORMANC AND RETENTION IN ALGEBRAIC WORD PROBLEMS SOLVING AMONG JUNIOR SECONDARY STUDENTS IN KANO STATE, NIGERIA.

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A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES,
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DECLARATION

I, Maitama Yusuf BELLO (P15EDSC9024) declare that the work of this thesis titled **'Effect of Fast-Draw and Polya Models on Attitude, Performance and Retention in Algebraic Word Problem Solving Amongst Junior Secondary Students in Kano State, Nigeria** has been carried out by me in the Department of Science Education under the supervision of Professor Mamman Musa, Dr M. O. Ibrahim and Dr Umar A. Ginga. All the information derived from the literature has duly been acknowledged in the text and lists of references were provided. No part of this work was previously presented for another higher degree or diploma at this or any other institution of learning.

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Maitama Yusuf BELLO **Date**
P15EDSC9024

CERTIFICATION

This thesis titled 'Effects of Fast-Draw and Polya Models on Attitude, Performance and Retention in Algebraic Word Problems Solving Amongst Junior Secondary Students in Kano State', Nigeria by Maitama Yusuf BELLO (P15EDSC9024) meet the regulations governing the award of the Doctoral Degree of Mathematics Education of the Ahmadu Bello University, Zaria and is approved for its contribution to knowledge and literary presentation

Prof. M. Musa Chairman, Supervisory Committee	Date
Dr. M. O. Ibrahim Member, Supervisory Committee	Date
Dr. A. U. Ginga Member, Supervisory Committee	Date
Prof. S. S. Bichi Head of Department	Date
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DEDICATION

This study titled “Effects of Fast-Draw and Polya Models on Attitude, Performance and Retention in Algebraic Word Problems Solving Amongst Junior Secondary Students in Kano State, Nigeria” is dedicated to my late brothers Bello Inuwa and Bashir Bello, My Allah in his infinite mercy forgive all their sins and reward them with Janna, and also to all those who contribute in one way or the other to the success recorded in my education carrier, Amen.

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TABLE OF CONTENTS

Table **LIST OF TABLES**

LISTS OF APPENDICES

APPENDIX:

OPERATIONAL DEFINITION OF TERMS

Academic Performance: Refers to the results obtained from algebraic word problem tests administered immediately after treatment.

Attitude; refers to interest, aspiration and behavior exhibited by Junior Secondary School Students (JSS) towards studying and learning of algebraic word problems solving.

Fast-Draw Model: Find-Ask-Set up-Tie down-Discover-Read-Answer-Write. It is one of the cognitive approaches used in teaching word problem solving. It is a model devised to help students find the important information in a problem, set the mathematics procedure up in the right way, and solve the problem.

Lecture Method of Teaching: The method of teaching where the teacher does most of the Talking and the learner passively listen most of the time and may copy notes.

Model of Teaching: A model is a design or a framework that can be used to bring about the desired change in learning outcome.

Retention: The ability to retain what has been learnt, which aided students' participation and involvement.

Polya Model: A four step of word problems solving; understand the problem, devise a plan, carry out the plan and look back.

Intact Class: The class that contains all the members of a particular class.

ABBREVIATIONS

BECE	Basic Education Certificate Examination
NERDC	Nigeria Educational Research and Development Council
JSS	Junior Secondary School
KERD	Kano Education Resource Department
ANOVA	Analysis of Variance
AWPSPT	Algebraic Word Problem Solving Performance Test
AWPSAQ	Algebraic Word Problem Solving Attitudinal Questionnaire
CM	Conventional Method
SUBEB	State Universal Basic Education Board
SSS	Senior Secondary School
FI	Facility Index
WAEC	West African Examination Council
MAN	Mathematics Association of Nigeria
STAN	Science Teachers Association of Nigeria
NERDC	Nigerian Educational Research and Development Council

ABSTRACT

The study investigated the Effects of Fast-draw and Polya Models on Attitude, Retention and Performance in Algebraic Word Problems Solving among Junior Secondary Students in Kano State, Nigeria. Pre-test Posttest Quasi-experimental (control group) design was used for the study using intact classes. Purposive sampling technique was used to select the schools while simple random sampling technique was used to select the classes. From the total population of five thousand three hundred and thirty seven (5337) junior secondary school students in the state, a sample of three hundred and twenty six (326) were drawn to participate using simple random sampling. The selection was based on the fourteen (14) educational zones in the State. Four groups were formed, three experimental and one control in the study. Five research questions and six null hypotheses were formulated and tested. Three research instruments with reliability coefficients of 0.84; and 0.72 respectively were developed and used for data collection on students' attitude, retention ability and performance in mathematics word problems solving. The independent sample t-test and two-way ANOVA statistics were used for data analysis at $\propto=0.05$. The results indicated that there were statistically significant differences in the mean scores of the experimental and control groups in attitude, retention ability and performance. Differences also exist between the mean performance scores of male and female in the experimental and control groups. Further the findings showed that there was a significant difference in the mean effect of teaching method on performance in the experimental groups. Based on the findings some recommendations were made; the use of fast-draw and polya models of teaching word problems in particular should be encouraged in Nigerian Junior Secondary schools as well as Senior Secondary School classes. All teaching in junior secondary school should be activity oriented as these will enhanced the understanding of concept better. Teachers should be encouraged to adopt problem solving models in our school system since it has been prove to be an effective method of teaching word problem solving. Teachers should use fast-draw model in combination with other models in teaching word problems solving. As such, they need to conceptualize their role as facilitators in the development of the student's mathematical construction rather than sole source of mathematics knowledge while employing fast-draw in the classroom.

CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

The importance of mathematics cannot be over emphasized. The prosperity of any country depends on the volume and quality of mathematics offered in her school system. In Nigeria, the Federal Government is quite aware of this indispensable role of mathematics and has thus made the subject compulsory at virtually all pre-tertiary level of education. For instance, mathematics is used in cryptography which is the study of finding information for security reasons such as security of ATM cards and computer passwords. Fadare (2010) has this to say "show me a man who does not need mathematics and computer, and I will show you a man that is dead but not yet buried".

Mathematics has been regarded as one among the important tools that help in moving a nation to achieved its greatness in the development of human being and advancement of knowledge, but statistics have shown here in Nigeria that students' achievement in mathematics in both internal and external examinations is consistently low and over 50% of the candidates that registered for mathematics in Senior Secondary Certificate Examination (SSCE) on yearly basis failed to obtain a credit pass (Obodo, 2001; Olulaye, 2010 in Abakpa and Igwue, 2013, WAEC, 2017). One may be tempted to ask, 'what may be the reasons for the apparent apathy, poor performance, negative attitude and lack of interest in mathematics among students in spite of its usefulness and wide *applicability*?'Adeniyi in Obaniyi (2005) noted that involvement in the marking of SSCE mathematics is enough to get any concerned person sad about learners' performance in mathematics in schools today. Some candidates submitted blank scripts; many only recopy the questions and a good number of those who attempted answering the questions ended up scoring blow pass mark as reported by WAEC chief examiners.

In similar vein, a reports from the examination unit, Kano Education Resource Department (KERD), Kano State Ministry of Education for the period of nine years (2010 --

2018) have shown that the achievement of students in mathematics in Basic Education Certificate Examination (BECE) is less than 50%. The following Table 1.1 shows statistical evidence of Kano state low achievers in Basic Education Certificate Examination (BECE) Mathematics for the period of nine years.

Table 1.1 Students Performance in Mathematics in BECE (2010—2018.)

Year	% A—C	% Below C
2010	32.7	67.3
2011	31.0	69
2012	28.7	71.3
2013	59.3	40.7
2014	33.2	66.8
2015	48.8	51.2
2016	56.7	43.3
2017	44.9	55.1
2018	39.3	60.7

Saucers: Kano Education Resource Department (KERD), Ministry of Education, Kano State (2018)

This showed that there are some urgent needs to contribute in addressing some of the issues confronting the teaching and learning of mathematics for the betterment of future educationist, administrators and scientist in the state and the country, Nigeria in general. Based on the report indicated in Table 1.1 the study intends to contribute some possible solutions to the persistent low performance among junior secondary school two mathematics students of different abilities. In this study students' attitude, retention and performance towards teaching and learning of algebraic word problems solving were investigated.

Most countries including Nigeria, mention variety of problems that leads to poor performance in mathematics including language problem, automatic promotion, poor base provided at primary and junior secondary school level, poor method of instruction, ambitious content of the curriculum, overcrowded classroom and many other problems. Mills (2013) and Simmons (2015) stated that instructional strategy employed by the teacher is the most important factor affecting learning outcomes among others and also the one that can easily be manipulated by the teacher to achieve learning outcomes. Onasanya (2016) stated that, currents researches in teaching and learning

processes have undergone some significant changes as educationists now realized the need to identify why teachers do or do not succeed in some levels of educational ladder in helping the learners change positively and gain knowledge and attitude. Merely telling is not teaching and simply listening is not learning

Reports have shown that mathematics at the junior classes has often been taught as a series of steps to follow in order to get the right answer by non-professional teachers (Ekwueme 2016). A non-professional teacher here means those teachers who did not received any training in the art of teaching mathematics or did not read mathematics as one of their courses in their post-secondary education. In their classes children memorize certain algorithm in order to solve problems and while they perform the operations and follow the procedure successfully; substantial evidence and classroom experience indicate that an understanding is lacking. This is so because if the questions are twisted, the student fumbles due to lack of conceptual understanding of the problem posed. Most of the time these teachers use rhymes to help students understand mathematics properties and this ends in instrumental understanding because their effort is to memorize the rhyme or acronym and not the reason behind every part of the mathematics action or manipulation.

The early stages of schooling should be an opportunity for children to develop the learning strategies that are necessary for exploring, investigating and making sense of their natural and social world. The success of teaching efforts depends largely on the methods of teaching adopted by the teacher, among other factors of interest. Different researchers(Akinoso and Asiru, 2016, Isah, Kasim and Adamu, 2016, Ibrahim and Busari, I. 2016) has found many teaching strategies in teaching mathematics which include lecture method, inquiry method, problem solving, demonstration, fast-draw model, guided discovery, laboratory, project and many others. The theories of Bloom (1956), Bruner (1960) and Gagne (1965) have supported the use of several teaching strategies in teaching science and mathematics. At present lecture method dominate most of our classrooms today which is found to be ineffective by researchers (Aina, 2016). One of its short coming is that student's differences in comprehension or applications of mathematics

principles are not considered. Zakari and Iksan (2010) stated that lecture-based instruction is described as an activity where students passively absorbed pre-processed information and then regurgitate it in response to periodic multiple-choice or essay types examination. A problem solving approach to teaching and learning according to Jackson (1999) involves series of actions that seeks to bridge the gap between a problem state that exist and the anticipated goal. A problem solving approach therefore comprises of action taken by the learner to reach anticipated goal when faced with a problem situations. Cai and Lester (2012) stated that problem solving promote students conceptual understanding, develops students capacity to reason, enable students to communicate mathematically and cultivate their interest and curiosities

Different writers have attempted to clarify what is meant by a problem-solving approach to teaching mathematics as the emphasis has shifted from teaching problem solving to teaching through problem solving (Raymond, 2014). The focus is on teaching word problem solving through problem-solving contexts and enquiry-oriented environments; which are characterized by the teacher helping students construct a deep understanding of mathematical ideas and the processes by engaging them in doing mathematics: creating, exploring, testing, conjecturing and verifying (Lester, 2014).Word problem solving skills requires students to synthesize knowledge, such as understanding the concepts, procedure and application of strategic methods (Scheuemann, 2015). Thus, word problem solving requires a number of skills to be applied throughout the process, including reading the problem accurately, creating a strategy, determine the correct operational process, and completing all the steps to solve the problem.

Fast-Draw teaching Model is a strategy that covers the strategies of self-teaching self-monitoring and self-support. This strategy was devised to help students find the important information in a word problem, set the mathematical procedure up in the right way, and solve the problem (Reid & Lienemaan, 2006). In the model the instructor is not the authoritative sources of information and knowledge students have to take the initiative to inquire and learn; and the instructor only guide, probe and support students' initiative. Problems are used as a stimulus for

students to start the learning process. The aims of these processes were to motivate students to perform in the learning process and to help foster problem-solving skills.

Polya (1945) described problem solving as a means of finding a way out of difficulty, a way around an obstacle, attaining an aim which was not immediately attainable. Problem solving is recognized as an important life skill involving a range of processes including analyzing, interpreting evaluating and reflecting. Polya believes that irrespective of how well mathematics is imparted to students, they are bound to forget it, if they were not taught how to use that information.

One of the focal points of this study is to improve the academic performance of students' in mathematics word problems solving. Academic achievement depicts students' performance on a standard of measurement such as performance test, skill test, and analytical thinking test (Nneji 2013). Thus, academic achievement is the gain in knowledge of students as a result of taking part in a learning activity or programed.

Another focal point of this study is the students' attitudes towards word problem solving in mathematics. As defined by Amartei, Adentwi and Brefo (2011), attitude is a mental and neutral state of readiness, organized through experience, exerting a direct or dynamic influence upon the individual's response to all objects and situations to which is related. Hence, attitude can be expressed as being positive or negative towards ones' response to an object or situation. A positive attitude towards mathematics reflects a positive emotional disposition in relation to the subject, and, in a similar way, a negative attitude towards mathematics relates to a negative emotional disposition (Martino and Zan, 2012). Most of the students who experience trouble in learning mathematics have a history of failure in mathematics. As a result, they develop negative attitudes and feel insecure about their capacities to succeeding in mathematics lessons/courses.

Further, Bolaji (2005) in a study on the influence of students' attitude towards mathematics asserted that teachers' methodology and their personality greatly affect students' positive attitude towards mathematics. Attitudes affect achievement, achievement too affects attitude (Aiken,

2012). If attitude towards mathematics are highly favored, it may be an indication for strong support for learning (Adetunji, 2012). Attitude of students towards algebraic word problem solving forms an aspect of this study with aimed of establishing a difference (if any) in attitude of students before and after their exposure to the two models of instructions.

The last dependent variable that will be used in the study is retention. Retention in this context refers to the ability of the students to keep in memory what has been taught and assimilated. A student retrieves what she/he has learned in his/her memory while answering questions in tests/examinations. Therefore, his/her performance is proportional to the amount of information retained. Agreeing with this, Obodo (2011) assert that retention is measured in collaboration with achievement. Iji (2003) in Ugwuanyi (2016) stated that, to correctly and effectively use or apply whatever one had learnt, retention come to play an important role. This is because the ability of the students to retain and recall what they have been taught by their teachers depends heavenly on the clarity and appropriateness of the methods of instruction. For this reasons teachers are charged with the responsibilities of improving the ability of the students to learn, assimilate, and retain the information given to them so as to apply it while answering questions in tests/examinations for higher achievement. This way, the age long of persistence poor performance of students in mathematics may be ameliorated (Ugwuanyi, 2016). The use of these two models (Fast-Draw, Polya) in which learners construct their own understanding by relating concrete experience to existing knowledge where process of collaboration and reflection are involved are set to improve attitude and greater retention ability.

The students' poor performance in algebraic word problem solving in particular and mathematics in general which might have been caused by negative attitude or poor retention of learnt mathematics concept has been observed to affect male and female students. Thus, gender as a variable was considered in this report so as to find out whether male and female students have differential retentive ability, attitude and performance. On gender related achievement reports, quite a number of studies established gender equality in mathematics achievement after exposing both

sexes to mathematics teaching and learning (Halai, 2010 and Achor, Imoko & Ajai, 2011). In this study the performance of male and female students after exposure to both Fast-Draw and Polya Models of instruction would be determine. Investigate which of the two models is gender friendly or not. Creating a successful learning experience for any student is an important step to foster student learning. This study compares the effectiveness of two word problem solving models, Fast-Draw Model and Polya Model, on students' attitude, retention and performance in algebraic word problem solving of Junior Secondary School in Kano State, Nigeria.

1.2 Statement of the Problem

Empirical studies have shown that students perform poorly in algebraic word problems solving aspect of the general mathematics in both internal and external examinations (WAEC, 2013, 2015, 2017). Aremu and Sokan (2014) submitted that the search for the causation of poor academic performance in mathematics is unending. The debate on appropriate teaching strategy is inconclusive and open to further investigation. A lot of studies have shown that an effective teaching approach increase students' achievement, improved their attitude and retention ability in learning tasks. However students' attitude, retention and performance in mathematics especially algebraic word problems solving component is poorly attempted in both internal and external examinations (Weinfield, 2010, Kellie, 2013 Nwoye, 2017) and Basic Education Certificate of Education Examination (BECE) conducted by Kano Educational Resource Department (KERD) as reported by many findings (Ige, 2014). Word problem solving requires a number of skills to be applied throughout the process which the lecture method cannot give. This study therefore, investigate if the adoption of Fast-Draw and Polya Models approach as instructional strategies by mathematics teachers would improve performance of students, developed positive attitude and have good retention in algebraic word problems. Although student's poor performance has embedded all the component of mathematics, the researcher has observed that less research has been conducted at Junior Secondary School level on algebraic word problems solving. Therefore, the problem of this study was to investigate whether the adoption of Fast-Draw Model and Polya Model as instructional

strategies would improve the attitudes, retention and academic performance in algebraic word problems solving at Junior Secondary School level two (JSS 2) in Kano State, Nigeria.

1.3 Objectives of the Study

The objective of the study is to compare whether Fast-Draw and Polya Models learning activities will increase students' performance, improve attitude and retention ability in the learning of algebraic word problems solving concepts of Junior Secondary School two Students in Kano State. The study examine which of the two models enable junior secondary school two students perform better, have more positive attitude and improved retention ability. Good teaching methods help to establish good rapor between teachers and students. The objectives were set to:

1. investigate whether Fast-Draw and Polya Models of instruction have effects on attitude of junior secondary students two in algebraic word problems solving.
2. establish if Fast-Draw and Polya Models of teaching have impact on enhancing students' retention ability on algebraic word problems solving concepts.
3. determine whether Fast-Draw and Polya Models of teaching have effects on academic performance in algebraic word problems solving when compared with lecture method of instruction.
4. find out the effect of gender on Fast-Draw and Polya Models of teaching when students were exposed to algebraic word problems solving.
5. find out which method of instruction do students prepare to use between Fast-draw Model and Polya Model when solving algebraic word problems.
6. determine whether finding from the research provide substantial evidence for the effectiveness of Fast-Draw and Polya Models of instruction.

1.4 Research Questions

Based on the objectives stated the investigation will seek answers to the following questions.

1. is there any difference in attitude when students were taught algebraic word problems solving concepts using Fast-Draw and Polya Models of instruction and those taught with lecture method of instruction?
2. is there any difference in the mean scores of students taught algebraic word problems solving using Fast-Draw Model and the conventional lecture method?
3. is there any difference in the mean scores of students taught algebraic word problems solving using Polya Model of instruction and the conventional lecture method?
4. is there any difference in performance between Fast-Draw Model of instruction and Polya model of instruction?
5. is there any gender difference in performance when students were taught algebraic word problems solving concepts using Fast-Draw and Polya Models of instruction and those taught with lecture method of instruction?
6. what are the differences in the retention ability between students who were taught algebraic word problems solving using Fast-Draw Model of instruction and those taught with Polya models of instruction and those taught with the Conventional lecture method?

1.5 Null Hypotheses

The main objective of the study was to determine the effects of two word problems solving models, Fast-Draw and Polya Models, on attitude, retention and performance in algebraic word problems solving on JSS 2 students of Kano State, Nigeria. Based on the objectives of the study stated above, the following null hypotheses were formulated and will be tested at $\propto \leq 0.05$ level of significance.

H_{01} There is no significant difference in change of attitude when students were taught algebraic word problems solving using Fast-Draw and Polya Models of instructions and those taught with Conventional lecture method of instruction.

H_{02} There is no significant difference in the mean scores of students taught algebraic word problems solving concepts using Fast-Draw Model and the Conventional lecture method.

H_{03} There is no significant difference in the mean scores of students taught algebraic word problems solving using Polya Model of instruction and the Conventional lecture method.

H_{04} There is no significant difference between the mean scores of students taught algebraic word problems solving using Fast-Draw Model of instruction and Polya Model of instruction?

H_{05} There is no significant gender difference in the academic performance means scores between students taught algebraic word problems solving concepts using Fast-Draw and polya Models of instructions and those taught same concepts with the Conventional lecture method.

H_{06} There is no significant difference in the retention ability of students taught algebraic word problems solving using Fast-Draw and Polya Models of instruction and their counterpart taught same concepts with Conventional lecture method.

1.6 Significance of the Study

The researcher is of the view that many classroom teachers were faced with the problem of choice of instructional methodologies that fits neatly not only the topics but also learners' conceptual understanding. Since studies have shown that no one particular method of teaching will always be suitable for every student in the classroom. Solving word problems effectively and accurately is a challenge for students especially at the lower basic level (JSS). The use of these instructional strategies (Fast-Draw, Polya Models) was meant to assist students to develop word problems solving skills. It is hoped that the finding of the study would contribute to the improvement and quality of teaching and learning algebraic word problems solving and also enable mathematics students acquires the necessary competencies and skills involved in solving word problems. Specifically it is hoped to provide a more efficient method of teaching and learning

algebraic word problems in particular and mathematics in general, considering the worldwide reports about the difficulties and challenges encountered by both teachers and students in the teaching and learning of mathematics in general and word problems solving in particular.

Fajemidagba (2006) affirmed that it is the inadequate understanding of concepts featuring in mathematics word expressions and ability to choose the appropriate process that lead students to mistakes/errors when solving word problems. To enhance correct transformation of problems statements into corresponding algebraic statement or equation, for example, the problem solver needs to be equipped with adequate knowledge of mathematical words, symbols, notations, theories and so on. The finding of the study would hopefully facilitate a change in attitude of mathematics teachers and students towards a more efficient method of teaching and learning word problems solving as the Fast-Draw and polya Models. It is also hoped that Fast-Draw and Polya Models would enhances students achievement and stimulate their interest to algebraic word problems solving in particular and mathematics in general because the models are considered to be gender friendly. Hence providing teachers with relevant pedagogical content knowledge support is regarded as being crucial to promoting teacher change. The problem areas of the students identified from this report is hoped to serve as a vehicle for further research work in algebraic word problems solving in particular and mathematics in general.

In specific terms the findings of this study will be of benefit to:

State Government: The government would benefit in the outcomes of the results as the findings and recommendations offered will provide feedback to the State Government on its efforts towards improving students' mathematics performance, procurement of teaching and learning materials and the building of teachers' capacity through training and retraining. It is also hope to assist the government in realizing its mandate.

Teachers: It is hope that this study would be of help to the mathematics teachers. This is because, it aimed at providing a more efficient method of teaching and learning of algebraic word problems solving in particular and mathematics in general considering the world-wide reports about the

difficulties encountered by teachers and students in teaching and learning of mathematics especially at the lower and upper basic level of secondary school. Teachers would benefit from the results of the findings as they will be enlighten on whether or not gender differences affects students' mathematics performance among junior secondary school students, and how students' word problems solving performance is among Junior Secondary School; those who were taught using the models and those taught using the existing conventional lecture method.

Students: Students would benefit in the outcome of this research work as their performance in algebraic word problems solving might improve following the use of the models. In a mixed ability classes, teachers reported that students of all abilities have similar access to the curriculum, participate in the same activities and were taught in the same way which the models support. It would also provide equal opportunity for learning to all children, who follow the same curriculum and be provided with greater demands on the teacher and requires good curricular resources. The models (Fast-Draw and Polya) support more students' engagement and participation in mathematics lesson, and make it to be a learner-centered. Fast-Draw Model and Polya Model can go along to remove inferiority complex and timidity of some students who may be reluctant in the regular teaching approach.

Parent: Parents will benefit in the outcome of this research work as it would help acquaint them what types of contributions they are expected to give in terms of resources and support to their children's learning/education at home. This is because parental involvement and interest are important factors that determines individual out look towards anything in life.

Researchers: Researchers would benefit from the outcome of this report as it is hoped to provide and also serve as a vehicle for further research work in word problem solving and also in the literature review. The finding of this study would also serve as motivating factor to teacher education and comprehensive preparation of teacher profession in terms of change and development. Moreover this study also hope to be a source of reference for the future researchers, educators, mathematics educators, government organizations and non-government in charge of

educational research, planning and implementation who might be interested in carrying a similar study in other areas.

Policy Makers: Policy makers in education will benefit from the outcome of this report as the findings would help in generating information about improvement in mathematics performance among junior secondary school students. No doubt the summary of the findings can also be of help to the education ministry or commission in organizing orientation or seminar programs especially for the newly employed, adopted and even those teachers who appear to be losing grip of the new trend/ methods and materials for instructions in this our changing world.

Others that may find the study significant include; National Mathematics Centre who train and retrain mathematics teachers to refresh and update their mathematics teaching and learning skills. Professional bodies such as Mathematics Association of Nigeria (MAN), Science Teachers Association of Nigeria (STAN, mathematics panel) will also be beneficiaries of this report as their members meet annually to discuss, review and update their members' knowledge on current researchers in the field of science and mathematics education. The findings of this study would help teacher training institutions, like colleges of educations and universities to incorporate the strategies in to their existing curricular. It is also hope to contribute to the existing literature by providing reference materials for mathematics teachers and researchers in the area of science and mathematics teaching in schools and prepare grounds for interested researchers who may wish to conduct further research in related areas.

1.7 Basic Assumption of the Study

The study has the following basic assumptions:

1. All the students that participated in this study have similar learning characteristics; age, class, and home background.
2. The selected concepts are appropriate for the level of the students used for the study. The respondents would complete the attitudinal changed questionnaire with utmost honesty.

3. The treatment provided would serve the purpose for which they are developed, that is, the instructional strategies employed would improve students' achievement, attitude and retention ability in algebraic word problems solving.
4. All the state schools were using the same junior secondary school syllabi of Nigerian Educational Research and Development council (NERDC).
5. Effect of Fast-Draw and Polya Models on attitude, retention and performance is measurable

1.8 Delimitations of the Study

The study sought to investigate the ways in which Fast-Draw and Polya Models of instruction affects academic performance, attitudes and retention towards algebraic word problems solving of junior secondary school two students in Kano State. The scope of the study was delimited to algebraic word problems solving concepts of junior secondary school two national mathematics curriculums. Word problem solving was chosen for the study because of the many reports by expert on the students' performance and retention ability in this area, and its importance in laying a sound foundation upon which other word problems solving were built (NPE, 2014). The topics; proportion, rate, fraction, invers operation, sharing word problems were chosen due to their usefulness to the students at their homes, societies, everyday activities as well as other levels of their mathematics' education (NPE, 2014 revised). All these topics were from Junior Secondary School two national mathematics curriculums. These topics were taught using Fast-Draw and Polya Models of instructions to the experimental groups and using the lecture method (Conventional method) to the control group which covered a period of five weeks.

The research delimited the investigation to four Zonal Education Offices of Kano State (Dala, Dawakin Kudu, Minjibir and Wudil) to find the effects of Fast-Draw and Polya Models of instruction on algebraic word problem solving on JSS 2 students. The reason for the choice of the class (JSS 2) for the study was that they were not an introductory class (JSS 1) who were not yet settled or familiar with the school environment or final year students (JSS 3) who were busy preparing for their final BECE exams. It was not possible to investigate all aspects that constitute

students' poor performance, lack of good retention and negative attitude in algebraic word problems solving, but most importantly the methods by which teachers will use to impart the knowledge as she/he manage the classroom situations.

The study was also delimited to Fast-Draw Model, Polya Model and Conventional lecture method of teaching algebraic word problems solving. Due to the geographical location of the schools in the four zones, it was not also an easy for the researcher to cover all the target population. Therefore, the study delimit the sample to only seven (7) public Junior Secondary Schools of the same ranking from the four educational zones, two from each zone. In each sampled school one intact class (a class assigns to specified treatment) was used to participate in the study since it was a quasi-experimental. The instruments that would be used in the study are; Algebraic Word Problems Solving Performance Test (AWPSPT) and Algebraic Word Problems Solving Retention Test (AWPSRT) for the pre-test and post-test, which comprises of thirty (30) items multiple choice questions with four alternatives options (A-D), the Algebraic Word Problems Solving Attitudinal Questionnaire (AWPSAQ) for change in the attitude of students as a result of intervention and Lessons Guide (LG) for each of the four groups. Private junior secondary schools in the four zones were excluded in the study. The study used seven junior secondary schools of the same ranking, three male and three female and one co-exist (co-education). Only algebraic word problems solving concepts from JSS 2 national mathematics curriculum were considered. Sample size and findings available were also delimiting factors. Both parametric and non-parametric statistics would be used to answer the research questions and test the null hypotheses.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This study aimed at examining the effects of Fast-Draw and Polya Models of instruction on attitude, retention and performance in algebraic word problems solving concepts among junior secondary school two students in Kano State, Nigeria. Word problem solving is a major component of the national mathematics curriculum, but it is the core most challenging area for students from different findings. Students at JSS level mostly struggle with many of the prerequisite skills involved in word problem solving, such as reading the problem accurately, creating a strategy, determining the correct operational process and completing all the steps to solve the problem. In the past years, instructional strategies have been developed to teach word problems solving. According to Barron and Darlin-Hammond (2014) teaching method that are effectively implemented, enable students to understand the contents and become more engage in the learning processes. The researcher was not able to get sufficient studies in literature investigating the effects of the Fast-Draw Model, as a teaching strategy, on attitude, retention and performance towards algebraic word problem solving in Nigeria. Therefore, because the Fast-Draw Model is a learning strategy, the findings were related to those studies exploring the effects of learning strategies on retention, attitude and performance towards some topics in mathematics such as algebraic word problem solving. The chapter reviewed some of the studies related to Fast-Draw and Polya Models for teaching word problem solving skills to students. The literature relevant to this study was reviewed under the following sub-headings:

2.1 Theoretical and Conceptual Framework

2.2 Junior Secondary Mathematics Curriculum

2.3 Conventional Method of Instruction.

2.4 Fast-Draw Model of Instruction.

2.5 Polya Model of Instruction

2.6 Students' Attitude and performance in Algebraic word problems solving

2.7 Concept of Retention.

2.8 Retention and students' performance in word problems solving.

2.9 Gender and Performance in Fast-Draw model and Polya model.

2.10 Overview of the Related Studies

2.11 Implications of the reviewed literature on the present study

2.1 Theoretical and Conceptual Framework

A lot of studies have found that students tend to have inordinate difficulties with certain types of algebraic problems, particularly those involving the translation of proportions and relation inherent in word problems to algebraic formulae,(Naiz, 2009, Mestre and Gerace, 2010). These same studies, moreover, report that these translational difficulties are mostly likely due to a number of different factors (key, contextual features, aptitude, cognitive development and cognitive style). Improving students' performance on algebraic word problems and the fundamental skills associated with solving algebraic word problems is considered to be critically important by most math educators (NCMT, 2000), as algebra has become almost an entry level skill for most scientific, business and technical jobs in the developing countries. Further more people need for basic algebra and problem-solving is going to increase significantly and not lessen in the future.

Mathematics as is well known is always focusing on problems solving. Problem solving is the act of accepting and striving to resolve challenges, tasks whose solutions are not immediately known in advanced (NCTM, 2000). Understanding how individual organize problem information and how they go about constructing procedure storing information and retrieving from memory through problem-solving steps is important to researchers in mathematics education who are involved in modeling problem-solving procedures and characterizing types of difficulties students face when solving specific algebraic problems. Our understanding of these processes can also help researchers to investigate what measures can be taken to remediate the errors or flowers conception a learner has. Therefore, adopting models of problems solving by cognitive psychologists to a

specific domain in algebra has been seen to be critically to understanding many of the difficulties in the presentation and solving of algebraic word problems.

In the area of problems solving, several mathematics educators (Jeeman, 1973, Hayes, 1981) describe a general two stage model of problem solving that consists of a representation stage and a solution stage. In the representation stage students encode the problem into an internal memory or representation. In the solution stage students translate the representation into another form in which operators, relation and equivalence are formulated which culminates with the solution. The representation stage of the two stage model require that the problem solver possess linguistic knowledge of the English language, and about mathematical terms and words in the English used in special way in the problem solving situation, which include factual knowledge about object or events in the problem. Schematic knowledge which deals with the problem solver required knowledge structure of the component of the problem.

The solution stage can be divided into two components: namely, planning/monitoring and execution. The planning and monitoring process requires strategic knowledge about how to break the problem into sub-parts and stored these sub-parts in memory in order to recall them during the procedure. The execution processes require algorithmic knowledge, such as knowing the algebraic procedures and operation involved, students formulate an equation or compares quantities and then evaluate and assess the values of unknown in the algebraic form.

The use of problem solving model like other students-centered approaches has been motivated by recognizing the shortcoming of the conventional methods of instruction and the emergence of deeper understanding of the taught concepts (NERDC, 2000). Eze (2001) observed that a systematic approach to problem solving encourage good learning habits, develop positive attitude, contribute to clarity in thinking, enhances logical reasoning, promote intellectual development and promote retention ability. When students are involve in problem solving on topics in mathematics and many other subjects especially science, they learn to reason well, they learn to be systematic, logical and analytic because they have to be able to analyze the problem to choose

and decide on which strategies or methods are suitable to use to have better performance. Mathematics researchers and instructors recommend the use of problem solving in teaching mathematics for very many good reasons such as; improved performance, developing positive attitude and good retentive ability among others. According to Cai and Lester (2012), problem solving promotes students' conceptual understanding, develops students' capacity to reason, enable students to communicate mathematically, develop positive attitude and cultivates their interests and curiosities at the end have better performance. By this process, they discover disconnections in their understanding of the problems and these compel them to revisit the problem. As a generic skill needed by all, it builds independent thinking and encourages critical analysis of issues which are important for life-long learning.

A lot of studies have shown that an effective teaching approach increase students' achievement, improve their attitude and retention in learning tasks. This is what Mercer & Miller (1992) says before in rather technical terms, that a model/strategy promote the *restructuring of causal attributions*; if learners know that they can do something to achieve success in learning, they are less likely to attribute their success or failure to bad luck or poor ability. They can start thinking in a more positive way, they can start thinking that success can be in their hands if they make an effort and use the right strategies. In this way they are also increasing their sense of self-efficacy, self-confidence, and expectation of success-they are empowering themselves. It is as if they say to themselves: "Now I know the roles of the game. I can try harder, play better and may be won".

2.2 Junior Secondary School Mathematics Curriculum

Just as the National Policy on Education (NPE, 2014) outlines the objectives of primary education, it similarly provided those for secondary education. It stated in clear terms that junior education is one which Nigerian child is enrolled and receives just after completing primary education. It is of three-year basic education duration. The objectives of the junior secondary school mathematics curriculum provide the Nigerian child the opportunity to further progress in mathematical skills acquisition. The objectives enable students to:

i. Gain mathematical literacy needed to function in an information age

ii. Develop the thoughtful and relevance mathematics skills and concepts required to succeed in the present dynamic technological world

iii. Expand the important aspect of problem solving, communication, reasoning and connection within the study of mathematics

iv. Realize the major ideas of mathematics with the awareness of the fact that the world has ever been changing

2.3 Conventional Method of Teaching

The conventional/traditional method of mathematics teaching is synonymous to lecture method or talk and chalk method (the expository teaching). Writing on traditional method of teaching Lawton (2009), said the fundamental criticism of traditional method of teaching and learning is that too much emphasis is placed on memorizing facts with too little attention paid to understanding. "I learnt chemistry at school in just that way (memorizing the facts), learning by rote, symbols and formulas, writing, drawn account of experiment I had never performed myself, and sometimes have never seen. Having a good memory, I could do what I was required and passed an examination at the end, but of the nature of chemistry as a branch of science I understood almost nothing". His experiences, (Lawton, 2009) are not far from what you obtain in the teaching and learning of mathematics word problems in Nigerian secondary schools both junior and senior today. Bruer (1989) described it as the "factory model education" in which experts create knowledge, teachers disseminate it, and students are guided on how much of it they can absorb and retained. Numerous scientific studies have shown that traditional method of teaching mathematics not only are ineffective but also seriously stunt the growth of students mathematical reasoning and problem solving skills (Battista, 1999). According to Battista (1999) traditional method ignore recommendations by professional organizations in mathematics education and they ignore modern scientific researches on individual differences/difference abilities and on how children learn mathematics.

This method has also been described as an activity where students passively absorbed pre-processed information and then regurgitate it in response to a periodic multiple-choice or essay type examination (McCarthy & Anderson, 2000). Researches have shown that many teachers teaching mathematics at the upper or lower basic are non-professionals/adopted/borrowed teachers. You found them trying to cover the syllabus by all means within the stipulated time to the detriment of students understanding of the contents. Traditional method had been criticized from its two major pedagogical limitations and shortcomings: lecture-based instruction and teacher-centered instruction (Howie, 2002, Dochy, Segers, Bossche, & Gibels, 2003; Zakaria &Iksan, 2010). Various explanations are given for this practice as highlighted by Motsiwiri (2004). These include the following; (*1*) Teachers lack of confidence and mastery of subject matter content and basic teaching skills,(*2*) language problems for both teachers and students, (*3*) examination often do not reflect the innovative curriculum aim, (*4*) examination have dominant influence on classroom instruction. Teachers often consider exam success the top priority in teaching, perceive teaching methods as dysfunctional when they are not directly to the passing of examination, (*5)* Tension between African culture (tradition; values) and life outside the school environment and culture of inquire required in the classroom in view of more meaningful teaching. Consequently, a good teacher is perceived to be authoritarian in controlling the class lesson activities.

Adeniran (2012) observed that teachers struggle to teach mathematics against the nature of children' different learning abilities; hence, the children ended up learning to hate mathematics. He stressed further that the conventional teaching method of memorization has done much harm to the learning of mathematics. This supports Airasian and Walsh (2011) assertion that traditional teaching approach is transmission model in which teachers try to convey knowledge to students directly. It is intrinsically characterized by teachers' domination. The notion is that learning and the materials presented are heavenly dependent on what the teacher does or say. In other words the underlining assumption of this approach is that it is the teacher who knows the item of knowledge, while it is the learner who receives.

In this type of method mathematics lessons follows the process of definition or rule, examples, drill and practice. In other words a mathematics lesson begins with the teacher telling the students a fact or giving them steps in an algorithms or rule. The teacher then works textbooks examples and assigns students to work exercise from the textbook to help them remember the facts or process (Congelos, 2012). It is the process of transmitting of knowledge from the teacher to students. It is essentially a one-way process.

The lessons are void of experiences where by students discover or apply mathematics to problem they find meaningful (Fuson, 2012). It is an instructional strategy (conventional method) in which concept to be taught to the students are discussed and explained verbally using chalk and board, the students write notes with further explanatory information from verbal communication.

However, the conventional method of mathematics teaching could be advantageous as instructional strategy in the following ways;

1. Facilitate early completion of the curriculum by mathematics teachers. It is less expensive in terms of materials/resources and it affords greater number of students in a classroom
2. It could promote meaningful learning if the knowledge is linked to relevant existing concepts in the learners' cognitive structure
3. It can be easily applied even by non-professionals in the field of mathematics teaching, since it is chalks and talks affairs

The conventional method of teaching does not foster critical and creative thinking and collaborative problem solving there by improving performance and good retentive ability. Traditional classroom practice do not allow for greater participation and contribution during lesson. This practice might actually hinder the development of thinking, language and intellectual growth. Dewey (1938) theory stated that students need to be challenge to use their creativity to arrive at individual solution to problem. There abound problem solving models which problem solver can employ when solving problem. This has become necessary to seek strategies/models that ensure and enhanced better performance and good attitude and retention

ability in algebraic word problem solving for students in particular and mathematics in general hence the use of Fast-Draw Model and Polya Model in the study. They are all active learning strategies which allow students to have control over their own learning.

2.4 Fast-Draw Model of Instruction

Fast-Draw model is an activity-based strategy. In the fast-draw model the learner is the central focus of the activity. Fast-draw learning model is an acronym for Find-Ask-Set up-Tie down-Discover-Read-Answer-Write (Fast-Draw). This model was devised by Mercer and Miller (1992) for students with learning difficulties in mathematics word problems solving as stated. Fast-Draw Model helps students solve abstract mathematical word problems (Miller & Mercer, 1992). It is one of the cognitive approaches used in mathematics word problem solving (Rivera, 1997). Further, this model also helps students solve more complicated mathematical word problems (Miller & Mercer, 1997).This model covers the strategies of self-teaching, self-monitoring, and self-support. Fast-Draw Model was devised as stated to help students find the important information in the problem, set the mathematical procedure up in the right way, and solve the problem (Reid & Lienemann, 2006). Most students with learning disabilities in mathematics word problems solving become passive when they have to solve a given problem (for example they tend to guess the answer or avoid studying). When a problem solving model/strategy, like fast-Draw Model, is used for these students they can become active and independent students. It is an active learning strategy which enables the learner to become aware of and determine his/her problem solving ability and learning needs; to be able to make knowledge operative and to perform group works in the face of real life problems (Akinoglu & Tanologer, 2007). All genuine learning is active not passive. Fast-Draw process is discovery in which the student is the main agent, not the teacher. In the model the instructor is not the authoritative source of information and knowledge learners have to take the initiative to inquire and learn; and the instructor only guide, probe and support learners' initiative. Problems are used as a stimulus for learners to start the process. The aims of these processes are to motivate learners to perform in the learning process and to help foster problem solving skills.

Proponent of Fast-Draw Model holds that learning occurs when students are actively involved in learning. They argue that meaning is constructed through participation and engagement in learning activities. According to them students should be given the chance to examine, think critically and solve problems. This study compared the effectiveness of Fast-Draw Model and Polya Model of instruction in algebraic word problems solving at junior secondary school two. Fast-Draw is an acronym; Find -Ask Set – Up Tie-down- Discover – Read – Answer Write. It means:-

Find what you are solving for.

. Look for the question mark

. Underline the information that tells you what you are solving for.

. Look for keywords

. Underline keywords

Ask yourself what is the important information.

. Read each sentence

. Find number, phrases and circle them

Set up the equation.

. Write the equation with the numbers in the correct order.

Tie down the sign.

. Read the underlined sentence

. Check highlighted key words and operation signs

. Say aloud the operation and what the operation means (e.g. “addition means I Need to combine the numbers.”)

. Solve the problem if you can, or draw pictures to solve it using DRAW

Discover the sign.

. Scan the problem and find the operation sign (+, -, ÷, x)

. Circle, and say name of operation sign.

. Say what the sign means

Read the problem.

. Read the whole problem.

. Say the problem aloud as you read

Answer, or draw tallies and/or circles and check your answer.

. Answer the problem if you know how to.

. If you don’t know how to solve the problem then draw pictures to solve it.

Write the answer

. Write down the answer to the problem

The conventional teacher-centered method of teaching that is existing in most of our classrooms have not yielded the desired results of improved performance, good retention ability and positive attitude in learning word problems. Hence, there is need to explore, constructivism approach based, Fast-Draw Model, which was developed by Mercer and Miller (1992) for students mathematics word problem solving performance to determine if it will enhance understanding and acquisition of knowledge and skills in algebraic word problem solving which can bring about higher and better performance since the previous methods used by the mathematics teachers have failed to bring the desired results. Fast-Draw Model approach in algebraic word problem is intended to produce much more challenging instruction for students and, thus produce improves performance, have good retention ability and meaningful learning. Fast-Draw Model is a problem solving strategy. Problem solving strategies are the steps that one would use to find the solution of problem that are in the way to getting to one's own goal (Robin2012). This study employ the Fast-Draw Model instructional strategy which is learning strategy in which students were allowed to discovered as a result of being actively involved and participated in the learning process.

2.5 Polya Model of Instruction

Polya model is an activity-based teaching strategy. In 1945 George Polya published the book '*How to solve it'*. In this book he identifies four basic principles of problem solving; understand the problem, devise a plan, carry out the plan and look back. Polya (1945) sees problem as an art. He believes that irrespective of how well mathematical information is important to students; they are bound to forget it, if they are not taught how to use that information. In line with foregoing, Polya (1945) lays emphasis on the need for teachers, not only to illustrate the techniques of problem solving in class, but also to discuss and practice with the students. Polya further points out that, although routine problems play certain important pedagogical functions of leading students to practice specific procedures and use definitions correctly, the development of students' ability to solve problems can only come through the judicious use of non-routine problems solving (Nyala, Assuah &Tse, 2016). Polya draw a connection between problems solving as an art and teaching as an art. For that view problems solving is seen as a dynamic exercise requiring experience, taste and judgment, so practicing it cannot be programmed or mechanized. The sensitive teacher who can set

worthwhile problems and provide the appropriate guidance to solving them is a key to students' success in algebraic word problems solving. The Polya problem solving process is shown below;

Understand the problem: Do you understand all the words used in stating the problem?

- What are you ask to find or show? Can you restate the problem in your own words?
- Can you think of a picture or diagram that might help you understand the problem?
- Is there enough information to enable you to find a solution?

Make a plan: Find the connection between the data and the unknown have you seen it before?

- Do you know a related problem? Or a theorem that could be useful?
- Look at the unknown; try to think of a familiar problem having the same or a
- Similar unknown.
- Here is a problem related to yours and solved it before could you use it?
- Could you restate the problem?
- If you cannot the proposed problem, try to solve first some related problem.
- Did you use all the data? Did you use the whole condition?

Carry out the plane: carry out your plan

- Carrying out your plan of the solution, check each step.

Look back at the solution: Examine the solution obtained

- Can you check the result? Can you check the argument?

Can you derive the solution differently? Can you see it at a glance?

- Can you use the result, or the method, for some other problem?

The conventional method of teaching does not foster critical and creative thinking and collaborative problem solving there by improving performance and good retentive ability. There abound problem solving models which problem solver can employ when solving problem. This has become necessary to seek strategies/models that ensure and enhanced better performance and good attitude and retention ability in algebraic word problem solving for

students hence the use of Polya Model in the study. It is an active learning strategy which allows students to have control over their own learning.

2.6 Students' Attitude towards algebraic word problems solving

Bandura (1971) posited that behaviors are acquired by watching another person who could be the parent, teacher or a peer group member performing the behavior. Attitude is one of the studied aspects of social functioning. Safo, Antie, Adentwi and Brafo (2011) defined attitude as a mental and neural state of readiness, organized through experience, exerting a direct or dynamic influence upon the individual's response to all objects and situations to which it is related. Attitude is used to understand and predict people's ready to change or object. According to Russel (2002) in Adewumi (2012), education functions in an atmosphere largely determines by the attitude of students; Teacher, Administrators and Parents. The "set" of the child determine his receptivity within this atmosphere, whereas the teacher and others, with their particular biases determine the materials and procedure of the education process. Attitude determines the "set" of the child. The learner acquires from the teacher's disposition to form attitude towards learning which could positively or negatively affect his performance

Hence attitude can be expressed as being positive or negative towards ones' response to an object or situations. Students' attitude towards an innovation is influence by environment, teachers' commitment, parental support and school provisions of the needed materials. Students' positive attitude is fundamental to effective learning while negative attitude will deter learning (Emefor, 2015). The learner acquires from the teacher's disposition to form attitude towards learning which could positively or negatively affect his performance

Mathematics Attitude is defined as a general emotional nature towards the school subject of mathematics. Attitude towards mathematics has a key role in both teaching and learning and accordingly, it influences mathematics achievement. McCleod (1992) stated that mathematics is linked to mathematics achievement in the classroom. Ashworth (2010) opined that the poor attitudes, fear and lack of interest towards mathematics are as a result of the fact that teachers

concentrate mostly on the teaching of the "processes and tricks" of mathematics solving rather than making mathematics more meaningful and relating it to the students background experiences and culture. It is important that mathematics teachers should endeavor to relate the mathematics teaching and learning in our classroom to the background, culture and experiences of the learner. Attitude towards mathematics is also defined as an aggregate measure of a liking or disliking of mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at mathematics and a belief that mathematics is useful or useless. In this regard, developing positive attitudes towards mathematics maximizes the achievement of the students (Bloom, cited in Yaranta & Kaspoglue, 2012).

Bauret-Puch , (1975) in Isaac and Oloniyo (2016) said, a learner's attitude has been found to affect both his scholastic achievement and his education. For example, attitude towards school subject which is a measure of the degree of the learners attraction to or repulsion from the subject-matter, influence every other things connected with the subject. It influences the student's attitude at lesson, his behavior towards all the learning activities in the subject and incidentally the person teaching him the subject-matter. Attitude towards a school subject (e.g., algebraic word problems solving) will therefore affect the students' achievement on the particular topic or subject. This is the reason why the students' attitude towards algebraic word problems solving should be assessed whether it will surely affect the mathematics students' performance and retention or not.

On the contrary negative attitude towards mathematics and lack of motivation leads to low performance. Students' negative attitude towards mathematics affects the teaching and learning of the subject. Most of the students now days, belief that mathematics is an abstract subject and difficult to understand. That is why most of them normally say that mathematics is reserved for the intellectually and gifted students. With this kind of notion by students there is no way the teaching and learning of the subject be done effectively and the goal be achieved

Burstein (2016) observed that there is direct link between students' attitude towards mathematics and his performance. Students' belief and attitude have the potential to either facilitate

or inhibit learning. Student's attitude about the value of learning mathematics may therefore, be considered as both impute and outcome variables, since their attitude towards the subject can be related to their performance. According to Shashaani (2017) attitudes towards mathematics are significant in the students' achievement and participation in the subject. Thus, mathematics attitude has a key role in mathematics learning and teaching. In addition, it impacts students' mathematics achievement. Ashish (2017) identify good attitude as one of four pillars that "play a critical and central role in determining students' academic performance".

Gordner (1995) explain that attitude research is important because decision which students make is strongly bound with their attitude such as career choice. That is why, the study of student's attitude to learning is important. It is not therefore suppressing that many studies in Nigeria and elsewhere has not only focused on attitude of students and teachers towards mathematics, science and science related subject but also on the relationship of this attitude with retention and performance. The mathematics students with positive attitudes and interest study mathematics because he/she enjoys it, he/she gets satisfaction from learning mathematical ideas and fined mathematical competence its own reward (Nnan, 2002). By implication, thus, students who do well in a subject generally have more positive attitude towards the subject and those who have positive attitude towards the subject tend to perform better in that subject. The benefit of having positive attitude towards word problem solving in mathematics cannot be overemphasized. This because according to Fritz (2008) an individual's attitude influences not only how they see the world around them but also how situations circumstances and the action of others are interpreted by individual. The use of these models which breakdown problems into steps which also promote on going practices and feedback would have greater impact on students' attitude towards word problems solving.

2.7 Concept of Retention.

Writing on retention Sogbesan (2000) said, retention is an unconscious activity, it is probably that as a result of experience and learning our brains undergo structural changes of sub-microscopic

size; so that certain of the nerve cells are more likely to be excited again given the right stimuli's. This shows clearly that retention seems to be dependent upon psychological changes, and so long as these remain uncompromised we retain the power to remember each specific thing we have learnt. If these structural changes in the brain do not persist indefinitely we slowly forget most of the materials that we have learnt. Retention is the ability to retain and consequently remember things experience or learnt by an individual at a later time (Bichi, 2001). Retention is also been described as a form of reaction to what has been presented in the past. Earlie, Eze (2001) assert that retention is a crucial construct that most classroom teachers strive to maximize among their students. This is because the ability of the students to retain and recall what they have been taught by their teachers depends heavily on the appropriateness of the method of instruction used.

Retention implies that the knowledge and skills acquired are useful only when it can be stored in the mind and reproduces for applications in the new situations (Kudu & Totu, 2002). Agreeing with this Obodo (2006) assert that retention is measured in collaboration with achievement. Iji (2007) assert that, to correctly and effectively use or apply whatever one had learnt, retention come to play an important role. It is not acquired by mere rot-memorization but through appropriate teaching method. As we can see progress in learning varies greatly among individuals as well as among kinds of learning. Just as the learners' own characteristic influence his/her learning so do they affect his/her retention of what he/she has learned. The most important of these characteristics are his/her capacity, his/her determination to remember and his/her attitude towards the materials. Retention increases if the learned materials are used (Bell, 2010). Thus, to maximize the level of retention for future recall we ought to have some insight in to factors that contribute to retention.

As posited by Nneji (2013) retention is the act of absorbing, holding or continuing to hold or have facts of things learned. In another context retention refers to the ability of the students to keep in memory what has been taught and assimilated. A student retrieves what she/he has retained in his/her memory while answering questions. Therefore, his/her performance is proportional to the amount of information retained. Hence, extent of achievement has to do with degree of retention.

Nneji (2009) in Ugwunyi (2016) affirmed that retention depends mainly on teaching/learning strategy adopted by the teacher. For this reasons teachers are charged with the responsibility of improving the ability of the students to learn, assimilate, and retained the information given to them, through effective methods of instruction, so as to apply it while answering questions in a test or examinations for higher achievement. This according to Ugwunyi the age long persistent poor achievement of students in mathematics may be ameliorated.

Thus, retention and what is retained also depends on the individual frame of reference. The issue now is how the mathematics educators and researchers can maximize the level of retention to aid future recall of what is learned, since there are variations in the process of learning and students with different learning abilities/ style? Thus, to maximize the level of retention for future recall we ought to have some insight in to factors that contribute to retention.

Several factors are known to influence retention. Bliar (1988) reports in Bichi (2001), that anything that aid learning should improve retention. While things that leads to confusion or interference among learned materials decreases the speed and efficiency of learning. Retaining the effect of learning could be possible if the learning is coded in to memory. Approximate coding of incoming information provides the index that may be consulted so that retention takes place without an elaborate search in the memory lane (Oyedokun, 2010). Generally common, familiar, meaningful and structured materials are easily retained than unrecognizable haphazard data. There should be less problems in retaining organize meaningful materials as this can be analyzed without difficulties. It is important to note that abstract ideas are difficult to retain because they are difficult to represent in memory and therefore difficult to generate for retrieval. In practical term, the teacher must try to ensure that recall is facilitated through the use of formative evaluation during lessons.

One big question is what variables affect retention? While the immediate response to such question is that, our memory for a piece of information decreases with time. It is important to consider the condition that prevail when recall is attempted, the type of materials learned and what actually happened during the interval between learning and recall. Characteristics that differentiate

learners as stated above play significant roles in the functioning of retention. Items like interest, existing knowledge, intelligence, curiosity and anxiety state affect the amount of interest the individual can put into understanding the learning materials. Yet the more a person knows about the meaning of an item stored in his/her memory the more items can be retrieved.

The following are some of the conditions under which learned materials/information can be retained;

1. Retention ability should be identified and catered for (Riding, 2009; Bell, 2010). The materials must be actually learned to begin with, since only what has been learned that can be retained.
2. The teacher can help recall by providing cues to enable the student to retrieve information from memory easily.
3. The learning should be meaningful and the materials structured so that it is self-cueing.
4. The teacher must ensure that there is an adequate revision, if the retention period is long, and can also aid memory by planning the learning programmed so that there is frequent incidental recall.
5. Children who are poor at retaining information will need more frequent revision than others.

The performance, attitude and retention of students depend seriously on the instructional strategy used by the teacher in the course of teaching and learning. In today's classroom one among the most important factors in students' performance is the student's ability to retained concepts that have been taught. Without retention there cannot be a successful transfer of knowledge from one area to another. The ability to retain learned mathematical concepts could go a long way in students' performance in mathematics. If students can retained what has been taught and still recall the idea when the need arises then such a student would do well. Eze and Egbo (2007) reported that a teaching method that promotes meaningful learning enhances the retention of the concept by the learners. This study employs the use of Fast-Draw and Polya Models in the teaching of algebraic word problem solving at JSS 2 class to improve attitude, performance and retention of students.

2.9 Retention and Students Performance in Algebraic Word Problems solving

Performance, Attitude and Retention are the key measurement variables in this context. Performance here implies the accomplishment of a goal, which is the acquisition of mathematical knowledge and skills for the solution of algebraic word problems solving. Retention is a strong component of achievement. Thus, retention can be described as the individual ability to hold in mind the acquired knowledge and skills and apply same where the need arises. Learning is intended to be a lifelong. Yashau (2004) sees achievement and retention as depending on intellectual power of thinking skills which provide learners with power of insight, understanding, conceptualization, quickness of thought and practical judgment. In addition Baumeister (2005), Butz & Baumeister (2005) in Mamman and Isa (2014) listed opportunities necessary for achievement to occur. They include attention, working memory, and mental representation among others.

Thus, academic achievement is the gain in knowledge of students as a result of taking part in learning activity or program. In another context it may be used to refer to an expression used to present students' scholastic standing (Inekwe, 2007). Academic achievement as defined by Nwagbo (2007) in Tile (2013) is the level of attainment of set objectives for an instruction. Nnaji (2013) academic achievement depicts students' performance on a standard of measurement such as performance test, skill test, and analytical thinking test as stated above. It is the gain in knowledge of students as a result of taking part in learning activity or program. Parayola (2014) opined that academic achievement is seen as the outcome of education; the extent which a student, teacher or institution have achieved educational goal. Adeyemi (2014) described academic achievement as the scholastic standing of a student at a given moment. It also refers to how an individual is able to demonstrate his/her intellectual abilities. This scholastic standing could be explained as the grades obtain in a course or group of courses taken (Daniets & Schouten, 2014; Owoyemi, 2015).

Thus, one can see that achievement implies attaining a goal. When a goal is attained through good performance, it implies that something has been accomplished. Thus, when students obtain credit passes in mathematics at West African Senior School Certificate Examination (WASSCE) or

Basic Education Certificate Examination (BECE) they have achieved a goal of learning mathematics at these levels. Achievement is also characterized by many factors which include intelligence. According to Kudu and Tutoo (2002) intelligence is the capacity to solve problems. Thus, academic achievement is a very important concept to this study because it will shows the level of success or failure of learners on the performance and retention on the given tasks as well as the use of the models of instruction in the teaching of algebraic word problems solving to JSS two students.

2.9 Gender and Performance in Fast-Draw and Polya models.

Gender is the physical or social conditions of being either male or female (Hornby, 2006). A review of the literature showed several teaching and learning strategies that address the diversity among students population. Literature about gender and academic performance, attitude and retention in mathematics exist with different views and findings in different areas. Studies conducted in many countries have shown that boys performed better than girls in mathematics (Fox,Brody & Tobin, 1980; Kaiser-Messmer, 1994 Randhawa, 1994; Hedges & Nowell, 1995 fennema, 2000;; Muthkrishna, 2010). Akintola and Popoola (2004) in their study showed no difference in the performance between male and female students in word problems solving. Asante (2010) cited studies showing that boys generally achieved higher than girls on standardized tests. However, an interesting body of international literature suggests that female students perform better shows more positive attitude than male students (Arnot, David & Weiner, 2009; Hydea & Mertzb, 2009). A large scale study in the U. S. A. by Hydea & Mertzb (2009) revealed that girls have reached parity with boys in mathematics performance and attitude at high school where a gap existed in earlier decades. They affirmed that girls are doing better than boys even for tasks that require complex problem solving.

A survey by International Institute for Educational Planning (IIEP)-UNESCO (2004) in John and Benjamin (2015) shows no significant gender differences among the students in South Africa. The same study shows that girls scored significantly higher than boys only in Seychelles. On the

other hand, in Tanzania, Kenya, Mozambique, Zanzibar and Malawi, boys scored significantly higher than girls did. Here in Nigeria a review of studies shows inconsistency on results of male and female students' achievement in mathematics at the public examinations. Students' performance and attitude in mathematics with respect to gender has continued to be of interest and remain inconclusive. Atovigba, Vershimc, O'kwu and Ijenkeli (2012), Stoet & Geary, (2013), Ali, Bhagawati and Sarmah (2014) observed that male students out perform their female counterpart in word problem solving in mathematics. Others like Ezugo & Agwagah (2002), Etukudo (2009), Onwuka & Iweka, (2010) indicated in their studies that females achieved higher than the males in some mathematics word problems solving. Studies such as Else-Quest, Hyde and Linn (2010), Linderberg, Hyde, Perersen and Linn (2010) reported that gender differentials among male and female is converging; hence they perform similarly. Meremikwu, Igiri, Opie and Enukoha (2012) reported that female students achieved greater than male students. This view was upheld by Alex and Mamman (2014) who found no statistical significant difference between the performance of male and female students in mathematics.

Studies also on various strategies on teaching and learning of mathematics word problems solving by Okigbo (2010), Nneji (2013), Tsebo and Kurumeh (2014) reported that male students achieved significantly higher than their female counterpart in mathematics word problems. Studies conducted by; Onwuka, Onwuka and Iweka (2010), Shafi and Arolu (2010), Ajai and Imoko (2015) showed that there was no significant difference between the achievement of male and female students.

In a similar argument, Paechter (2015) argues that male and female students do experience the world in different ways. Firstly, they are differently positioned in the society. The second is their different learning styles and how they perceive and process reality. These researchers emphasize that most mathematics classroom discourse is organized to accommodate male learning patterns, hence their high achievement in mathematics. Internationally, researchers have undertaken studies in various contexts to examined factors that influence gender performance under different method

of teaching. Many of such studies have focused on factors related to differences in the performance of boys and girls in word problems solving (Mahlomaholo & Sematle, 2005; Opolot-Okurut, 2005, Abiam & Odok, 2006; Zhu, 2007). Gender difference in mathematics teaching, learning and achievement have also been explained on the basis of gender differences in cognition and brain lateralization. Fennema & Leder (2005), Mutemari and Mygweni (2005) argue that the idea that mathematics is for boys may result in low motivation in girls and could widen the gender gap in mathematics performance in favor of boys.

Boaler (2016) is of the view that the different learning goals of girls and boys leave girls at a disadvantage in competitive environment. Boys and girls prepare a mathematics curriculum that enables them to work at their own pace as their reasoning was different. Girls value experiences that allow them to think and develop their own ideas, as their aim is to gain understanding. Boys, on the other hand, emphasize speed and accuracy and see these as indicators of success (John & Benjamin, 2015). Other important factors that emerge in research on gender and mathematics are attitude, cultural, family influences, socio-economic status of parent, as well as cultural and traditional influences (Kaino & Salani, 2010). Asante (2011) citing Collins, Kenway and McLeod (2000) argue that schools establish symbolic oppositions between male and female students through gendering of knowledge and defining of certain subjects as masculine. In contrast, female students are conditioned in the society to believe that problem solving in particular and mathematics in general is a male subject, and it is acceptable for them to drop it. These variations in the reports shows that there are some needs to also carry further researches to determine the effect of teaching/learning strategies on gender parity or disparity in algebraic word problems solving. This study compared the effectiveness of Fast-Draw Model and Polya Model of instruction on attitude, retention and performance in algebraic word problems solving of students in JSS 2.

The reviewed studies suggested that many factors has been associated with gender gap, including issues such as classroom interactions, students' attitudes, students' interest and self-esteem, teachers' gender attitudes, curricular materials, beliefs, social and cultural norms. These

differences put together have implications for the kind of instructional procedures that are to be adopted for setting up an appropriate teaching and learning environment for word problems solving instruction that is suitable for both genders (John & Benjamin, 2015). In this respect of inconclusive finding regarding gender performance this study is to determine the aspect of differential (if any) effect between Fast-Draw Model and Polya Model on performance, attitude and retention of male and female students in algebraic word problems solving aspect of Junior Secondary School two (JSS 2) mathematics curriculum in Kano State.

2.10 Overview of the Related Studies

This section summarizes some of the recent studies on the sequence of mathematics instruction with a view of finding ways to facilitate students' future learning. Specifically, these studies provide a rational and empirical support for the Fast-Draw Model and Polya Model of instructions. There are no sufficient studies known to the researcher in the literature investigating the effects of the Fast-Draw Model on performance, attitude and retention towards algebraic word problem solving in Kano State. Therefore, because the Fast-Draw Model is a learning strategy, the findings are related to those studies exploring the effects of learning strategies on performance, retention and attitude towards some topics in mathematics such as algebraic word problem solving as stated. Professional educators and researchers have also shared their experiences and suggested models/strategies that address the variety of students learning style, individual different learning abilities, vocational interest and educational goals. From the various studies reviewed so far, a study on the effectiveness of Fast-Draw Model and polya Model as instructional strategies on attitude, retention and performance in algebraic word problems solving among junior secondary school 2 students has not been researched.

In the research on areas of difficulties among junior secondary three students on algebraic contents Galadima (1988) found the performance of boys and girls to be generally low as a result of lack of proper understanding of the basic concepts and processes. Adegoke (1990) investigated the relationship existing between students' attitude and performance in mathematics. The result showed

that the students perceived mathematics as a difficult subject to be learned and they were not interested in any mathematics related discipline. He noted that there was also positive relationship between mathematics attitude scores and achievement scores. He concluded that students generally have poor attitude towards mathematics and there was corresponding poor performance of the students on the subject. Similarly, Inekwe (1997) while investigating algebraic and geometric reasoning difficulties affecting remediation at secondary levels found that, the general performance was below 30% mean score. Bolaji (2001), Lawery (2002) compare group instruction with text center instruction and found that the group instruction produces more positive attitude towards mathematics than text centered instruction. Saha (2007) conducted a study on gender, attitude to mathematics, cognitive style and achievement in mathematics. It was found that all the three contribute to statistically significant difference in achievement in mathematics. Potel(2007) conducted a study on mathematical ability of pupils of classes 1X and X in the context of some cognitive and attitude variables. He found that there was no significant difference with regard to mathematical ability of pupil of classes 1X and X. Szetela and Super (2007) reported that seventh grade classes were taught problem solving strategy by a teacher with special training. In 14 of the classes, the instructions were supplemented by calculators, with the result showing that each problem solving group performed significantly better than the control group. Nicoladou and Philippou (2008) revealed a significant correlation between mathematics attitude and problem solving achievement.

Cotic and Zuljan (2009) investigate on problem solving abilities aimed at answering whether students who learn through problem solving teaching strategy are better at solving problems and if there is attitude improvement towards mathematics word problem, found that the students that are exposed to problem solving approach are better at solving more difficult word problems, but there was no significant difference in the students attitude towards mathematics word problems. Emily, Robert and Michael (2009) studies revealed that if students are grouped homogeneously, there is the fear that low-ability students will be deprived of opportunities to learn and be unmotivated to learn

because of peer, personal and teachers' expectations of poor performance. On the other hand, Emily (2009) in his study reported that neither single nor mixed ability grouping class is uniformly superior for promoting achievements of students. Catsambis, Mulkey & Crain (2010) found that when young adolescent students are assigned to high-ability groups in mathematics, the academic self-concept of the males diminishes while that of the females thrives. By contrast, male placed in low ability-ability mathematics groups actually experienced increased self-concept, at least temporarily. Mckeachie and Lin (2011) studied the relationship between student's sex, teacher's instructional strategies and student's achievement and found that appropriate teacher instructional strategies resulted in higher mean achievement measured by the grade of students.

The following are some of the current studies reviewed on the teaching and learning of algebraic word problems solving in particular and mathematics in general at both junior and senior secondary school level on attitude, performance and retention.

Bolaji (1995); Conducted a study on the effects of three instructional approaches on students achievement in algebraic word problem in Junior Secondary School Student (JSS). The population of the study is all JSS from 35 schools in Zaria educational zone. A sample of 480 students from 12 JSS was used. The study involve the use of four instruments; instructional guide, academic achievement, attitude scale and teaching inter-raters items. The statistics used to analyses the data are percentage, mean score, standard deviation and t-Dunn. The finding shows that significant difference exist in the achievement of students taught by expository approach and any of the experimental approaches; guided discovery, or problem solving approach. No significant difference between the achievement of male and female JSS 3 students in each of the three groups (PSA, GDA, EM). No significant difference was found in the achievement of rural and urban students achievement in the experiment 1(PSA) and experiment 11(GDA). No significant difference exists in attitude toward algebraic word problem among JSS 3 students using expository, guided discovery and problem solving approaches. Overall it was found that experimental 11(GDA) is more effective in producing cognitive achievement gain as well as highly positive attitude towards

Algebraic word problem to JSS 3 students and the education implication of the finding having highlighted.

Galadima (2001) carried out a study on the effects of Heuristic problem solving on Senior Secondary 3 Students' achievement in algebra in Sokoto and Zamfara States. A sample of (361) students were involved in the study. Five groups were used and divided into four experimental group and one control group. The four experimental groups receive instruction based on Polya problem solving, Ruberstein, Lester, Krulik and Rudnicks problem solving models respectively. The control group received instruction based on conventional method approach. The target population was all SSS 3 in Sokoto and Zamfara. The deisgn use for the study was quasi-experiment and the use of intact class. All the groups receive treatment for a period of seven weeks. The instruments used for data collection are two; to measure and the other to measure preference to the use of the models while teaching algebraic word problem. Statistical methods such as frequency tables, polygons and histograms were employed to present the data. Other techniques used are means score, standard deviation, percentages analysis of variance (ANOVA), Shaffer's test, t-test and chi-square test.

The results after posttest indicate that significant difference exists between the achievement scores of the students in the control group and in each of the experimental groups. Thus heuristic problem solving instructional strategy produce significant difference on students achievement when compared to the conventional method of teaching. Specifically Polya model produce higher achievement level in SSS algebra. Other results showed that, mathematics teachers have preference to use Polya model of problem solving while teaching mathematics. The conclusion drawn from the finding of the study was that Polya problem solving model was the most effective and preferred model which could be used in the teaching and learning of algebra.

Bichi (2002), conducted a study on problem solving strategy and enriched curriculum on Senior Secondary School Students achievement in evolution concept in Giwa Education Zone of Kaduna State. The study was quasi-experiment prates-posttest experimental design. The population of the

study consists of all SS 3 students studying Biology in the eleven schools in Giwa Education Zone. For the sample of the study a total of 156 SS 3 Biology students drawn from five secondary schools were used as sample and were split into three groups EG_1, EG_2 and CG. One type of instrument, the Evolution Concept Test (ECT) was used to source data on three occasions during the study. The statistics used for the data analysis is the t-test. The results shows that there is significant difference in the academic achievement of the subject taught evolution concept using the problem solving instructional strategy and their counterpart taught with traditional method of teaching. There is also significant difference in the retention level. There is also a significant difference in the academic achievement between those subject taught evolution concept based on Polya model and their counterpart, also between male and female. There was no significant difference in achievement with reference to the following variables; *1) gender and problem solving strategy, 11) gender and traditional method, 111) gender and Polya model*

His – Chi and Jen – Chia (2003) carried out a study titled quasi-experimental study resounding how a problem solving teaching strategy impacts on learning outcome for engineering students. However there was a significant difference in the problem solving confidence on the attitude scale. There was significant difference between the experimental group and the control group with regard to the factor replacement diagnosis and testing as well as the strategy application of the scale of the problem solving ability. The results showed that problem solving teaching strategy help students increase their problem solving attitude and abilities.

Usman, Akor and Ebuta (2006) carried out a study titled Enhancement of students Achievement and Interest in Geometry using problem solving model. The sample consists of 214 senior secondary one (SS1) students drawn from two schools. Two instruments Geometric Achievement Test (GAT) and Geometric Interest Scale (GIS) were used to collect data for the study. Data are analyzed using the analysis of covariance (ANCOVA) and independent t-test statistics. Two hypotheses were tested at 0.05 alpha levels. The study adopted quasi-experimental design. A total of 214 students were involved in the study with an experimental group having 125

students (60 boys and 65 girls), and the control group having 116 students (55 boys and 61 girls). The result of the analysis showed that polya's problem solving approach to word problems in mathematics instruction enhanced students achievement in general than the conventional approach to word problem in mathematics instruction. It was also discovered from the results of the study that there was no significant difference in interest between students taught with Polya problem solving approach and those taught with the conventional method of teaching. Based on these results some recommendation was made on improving the student's achievement and interest in the study of Geometry at senior secondary school level in Nigeria.

Sherreen (2006) conduct a study to determine the effect of Polya problem problems solving approach on the academic achievement of students at secondary school level. The students of 10^{th} class of Government Pakistan Girls High School Rawalpindi were selected as the sample for the study. Polya's (1945) model of problem solving was adopted. The design use was quasi experimental pretest posttest. After the treatment a posttest was used to see the effects of the treatment. A two-tailed t-test was used to analyze the data which revealed that both the experimental and controlled groups were almost equal in word problem solving basis at the beginning of the experiment. The experimental group outscores the control group significantly on the posttest. The results indicate that the problem solving model need not be time consuming than the expository method of instruction at this level. When given an equal amount of time to work on tasks students using the problem solving models tend to be superior to students taught by the expository method.

Kurumeh and Iji (2009), investigate students' achievement in solving word problem using Aesthetic value approach in Makurdi Benue State. The sample consists of 240 SS1from six intact classes. One instrument was used to source data for analysis. The result shows that there is significant difference in favor of the experimental group with a mean score of 63.61 and the control 42.00, at 0.05 level of significant. The difference in the mean achievement score is 21.61. Also male students obtain higher mean achievement score67.75 than their female counterpart 59.48 in the

treatment group. This research is conducted in one local government and only one instrument was used, but the result is worth noting, this study is considering seven (7) schools from four zonal education offices, three instruments and three independent variables.

Ruddi (2010), carry out a study in the New York State with the purpose of examining the effect of teaching using Polya 4-steps word problem solving model on seventh grade students' perception and level of achievement in algebra word problem. Two seven grade classes participate in the study. One of the classes serves as control and the other as experimental. Two instruments were used to source data for analysis. Likert scale and two-tailed for two sample, t-test for two samples assuming unequal variance with ninety-five percent confidence level was used. The results of the study shows that students that were taught with Polya word problem solving model significantly improve in their level of achievement compared to those that were not. The result also shows that for the group of students that received the instruction there was a significant improvement in their posttest perception of their problem solving abilities. The result also shows that there was statistically significant difference between the mean score for the two groups after the intervention.

Moses (2010) designed a study to compare the effect of Polyas' problem solving model teaching strategy on senior secondary students' achievement in physics. A sample of 204 students was selected as the sample for the study. Two instruments were used for the experimental as well as the control groups. From the study the results shows that Polya problem solving model is better in terms of students' achievement than the conventional method and also for the development of critical thinking in the students.

Bawa (2011) carry out a research on the effect of Polya problem solving instructional strategy on academic achievement and retention in ecology among senior secondary school students with different cognitive preference in Zaria Education Zone. The population for the study consist of four senior secondary school 1 (SS 1) from Zaria and Sabon Gari area of Kaduna State. A sample of 240 students constitutes the subject for the study. The design for the study was quasi experiment pretest-posttest control design. Two instruments were used for data collection, Cognitive Achievement Test

(CAT) and Ecology Achievement Test (EAT). The statistics use for data analysis is t-test, mean scores and ANOVA from the SPSS package for social science. The results of the study shows among others that there was significant difference between the pretest mean score of the experimental and control group. The posttest mean scores of the experimental and control group were found to be statistically significant in favor of the experimental group in retention.

Adodo and Agbayewa (2011) conducted a research on the effect of homogenous and heterogeneous ability class teaching on students' interest, attitude and achievement in integrated science. The study sample 60 JSS students and assigned them to three ability levels; high, average and low. Using an instrument named 'numerical ability word r5r4 knowledge instrument'. The results shows that students in the medium ability grouping perform better and has a high mean scare also the reported attitude and interest survey of the social and emotional effect is in favor and support of heterogeneous group teaching.

Rosely (2011) in his study found that the attitude of high school students torward the learning of mathematics and their achievement in mathematics are highly correlated and that urban boys and girls have more positive attitude towards mathematics than rural boys and girls.

Achor, Imoko and Jimi (2012) use a non-equivalent pre-test posttest control group quasi experimental design on intact classes assigned to experimental and control group. The population consist of 7184 SS 1 student out of which a sample of 288 students was selected from four senior secondary. Two of the selected schools were assign as experimental group while the other two were the control group. Geometrical construction achievement test (GCAT) was the main instrument used for data collection and it is a 30 items multiple choice objective test with four options (A-D). ANCOVER was used to analyze data; that there was a significant difference between the mean achievement of the group taught Geometric construction using traditional approach and the group that inter-acted with their class teacher using problem solving approach only. F_1 287 = 117.60, ($P<0.05$). However, male and female taught did not differ in their mean achievement. There was a

significant interactive effect of gender and methods on student's achievement in Geometric construction.

Sukran and Adam (2012) conducted a research on the effect of Fast Draw Learning model on academic performance and attitude towards word problem solving in mathematics. The study was conducted with 56 third grades attending state elementary school. The effects of the strategy was investigated by comparing the post test scores of the students in the treatment group with post test score of the students in the control group. The analysis of the result shows that the treatment group mean post test score was 19.76 and the standard deviation was 7.31. The control group's mean post test score was 14.20 and the standard deviation was 6.55. This shows that the difference is statistically significant in favor of the treatment group. The analysis of post test score for the Mathematics Attitude Scale shows that the treatment group's mean post test score was 102.62 and standard deviation was 18.75,while the control group's mean post test score was 75.60 and standard deviation is 25.44. Also Tjosvold, Johnso, and Tobin (1997) in another study found that cooperative learning strategy which is a problem solving strategy promote positive attitudes towards learning of mathematics.

Emos (2013) conduct a study that examined the effect of problem solving strategy on secondary school students based on Polya problem solving model. The study was a true experimental research designed based on Solomon Four-Fold design. Two instruments were used, mathematics achievement test (MAT) and an interview schedule. The sample for the study is 160 students from three secondary schools each producing 40. The total population was 1376 that are in SS3 classes in Emuhaya District Kenya. Data analysis was done using descriptive statistics of mean and standard deviation, and inferential statistics, the analysis of variance (ANOVA) and t-test. The results show that problem solving had a significant effect on students' achievement. It was also found that students when taught word problem through problem solving had better achievement than those taught through conventional method. It also shows that attitude of students was positive when taught using problem solving than when taught using conventional approach.

Samuel (2013) conducts a study on the effect of Polya George's problem solving model on students' achievement and retention in algebraic word problem solving. Quasi experimental was adopted in the study. Eight intact classes four of which are randomly assign to experimental and the other four to control groups used for the study. Sample for the study consist of 220 SS 11 students from Ishielu Local Government Area of Ebonyi State Nigeria. Algebra Academic Achievement Test (AL A T) was used for data collection. Mean and standard deviation was used to answer the research question. While hypotheses were tested at 0.05 level of significant using the analysis of covariant (ANCOVA). Experimental group were taught using Polya problem solving model while control group was aught the same topics using expository method. Major finding of the study reveals that students taught algebraic word problems with Polya model achieve higher and retain more than those taught with expository method. There was no significant difference between the mean achievement and retention scores of male and female students in the study.

Bishau (2014). His study investigate the ways in which fast draw learning model affect the eighth grade students academic achievement and attitude toward word problem solving. The researcher use semi-experimental pattern. The study was conducted with 116 students at State elementary school in Pakistan. The study use academic achievement test and attitude scale for word problems in mathematics as data collection instruments. With the experimental class fast draw model was utilized and the control group was taught the concept according to lesson plans prepared. The finding of the study revealed that fast draw model increase students' academic achievement and their attitude towards word problems solving positively.

Salamn and Ameen (2014) conducted a study on the comparative effect of two problem solving model, Bransford and Stein and Polya, on senior secondary school students' performance in mathematics word problem. A sample of 180 SS 11 was used in the study. One instrument, the Mathematics Performance Test (MPT) was used with two instructional guides. The MPT was an essay type adapted from WAEC. The result shows that posttest mean score of the two instructional models is 2.92 at 0.013 significant level. Since 0.013 is less than 0.05 level of significant, it implies

that significant difference in performance of students exist between the two instructional models, and also respectively between Bransford and Stein and the other method. Polya and conventional method shows that there exist a significant difference, this was based on the p-value of 0.13 and 0.001which was less than $\alpha = 0.05$. Also the posttest mean scores of 2.92 and 6.63 indicated significant differences between Polya and Bransford and Stein, and the conventional method respectively when compared with the P-value of 0.013 and 0.000 which was less than 0.05 level of significant.

Lastly, the posttest mean score difference of -3.72 and -6.63 between conventional method and Bransford and Stein, Polya method difference, with suggested P-value of 0.001 and 0.000 level of significant. In conclusion the result shows that students exposed to Polya model perform significantly better followed by those exposed to the Bransford and Stein model and those exposed to conventional method had the least performance. The result of this study shows that Problem-solving Model of Instruction could enhance students' performance better in word problems than the use of conventional method. Although two models were compared with conventional method the result still shows a significant difference in the performance. The gap in the study was that it uses only one instrument, achievement, to sourcing data for comparison. The study area and the sample used were all in a metropolitan. The dependent variable was only one, performance. The present study has performance, attitude and retention and four different zonal education offices, even though the two aimed at student's improvement in word problem solving.

Adeniyi and Salman (2015) conducted a research on the effect of personalize system of instruction on problem solving ability of secondary school students in mathematics in Kwara State. The study sampled 320 male and female for the two groups, experimental and control. Two instruments and two topics, indices and logarithms, under number and numerations were used. The result shows that the students in the experimental group had a mean score of 14.89 while those in the control group had 6.01 showing a mean gain of 8.88. The summary of the finding shows that, there was statistically significant difference in the mathematical problem-solving ability of students

taught using the problem solving method compared with their counterparts in the control group taught with conventional method. The result of the study shows effects of intervention. Students' performance attitude and retention will improve better if they were exposed to an active learning process. Where they will interact, share, exchange and debate their ideas like the present study using fast draw model. The finding of the above study involves only SS classes even though it was on senior secondary school. There is needs for the same action to be taken on JSS classes for the students to improve, retain, develop good/positive attitude and perform better which this study intend using fast draw and Polya models of instruction.

Olaniyan (2015) Investigate the effect of Polya problem solving model on senior secondary school students performance in current electricity in Kwara State Nigeria. The study was design to investigate the effect of Polya problem solving model on SS performance in current electricity. It was a quasi-experimental pretest posttest designed. The study was conducted in Ilorin metropolitan in Kwara State Nigeria. Two schools were purposely selected; in each school 60 students were randomly drawn making a sample of 120 students. The experimental group was exposed to Polya problem solving model while the control group were exposed to conventional lecture method. The two groups were pretested and post tested using performance test in current electricity. Data collected after six weeks were analyze using mean, standard deviation and analysis of covariant (ANCOVA). The hypotheses were tested at alpha 0.05 levels. The finding shows that students exposed to Polya problem solving model perform better than those exposed to conventional lecture method.

Sheikh (2015); the intention of this experiment was to find the effect of George Polya's problem solving model of teaching on revised Blooms Taxonomy of Educational Objectives. A quasi experiment was performed in a school situated in urban area of Islamabad. Multistage sampling technique was used for the selection of the school. 132 eight grade students were used in the experiment. Pretest which consists of 60 items of six cognitive processes was developed. The experimental group was taught using Polya problem solving model and the other group were taught

through conventional method by research assistant. Forty lessons were taught during the 8 weeks. Posttest was administered and marked according to the rubric designed for marking. The data was analyzed by an SPSS package. One-way ANOVA and t-test were applied on the data. It was found that by teaching through Polya problem solving model students perform better compared to the conventional method. Based on the finding the use of Polya problem solving model shows significant improvement at all level of knowledge dimension. It also shows that Polya problem solving model works better than the conventional method of teaching.

Akinoso and Asiru (2016) investigated the effect of explicit instructional model, which is a learning strategy on secondary school students' attitude towards mathematics. The study covered SS 11 mathematics students drawn from four selected secondary school in Oyo State. The finding of the study revealed that explicit instruction strategy is more effective at improving students' attitude to mathematics then the conventional method of instruction. The mean score of students in explicit instructional group is more than that of the students in the conventional method group. This shows the effect of an intervention in the teaching learning process which fast draw model is aiming at.

Bishau (2016) conducted an investigation on learning strategy used by urban and rural school students in mathematics. The sample consist of 1394 senior secondary school 2 students from 24 rural and urban schools. Two research instruments were used for data collection. 12 students were selected purposively from both type of school for qualitative study. The result shows learning strategy between rural and urban differ significantly with urban students showing higher performance than the rural students. There is a significant difference between the urban and rural school students in their use of learning strategy. The school students prefer peer learning whereas rural school students use elaboration as their learning strategy. The urban school students have a greater reach in the technology and educational resources. The rural school students' uneducated family background has disables them to have such access. This indicates that though students have potential in learning differences still exist in their ability to perform and retain.

Salisu (2016) conducted a research on the impact of inquiry and demonstration methods on attitude, retention and performance of some senior secondary 11 students of varied abilities in dawakin kudu local government of Kano state. A sample of 500 students was drawn for the three groups, two experimental and one control. The results shows that there is significant difference in the mean scores of students taught wave concepts using inquiry method, inquiry and demonstration method. Also there is difference in the retention ability of students taught using inquiry and demonstration method of teaching. There is also significant difference in change of attitude when students were taught wave concepts using inquiry and demonstration method. There is also significant difference in the academic performance when students are taught wave concepts. There is significant difference in the varied ability when students are taught wave concepts using inquiry and demonstration method and lecture method of teaching.

Saha (2017) conducted a study on gender, attitude to mathematics, cognitive style and achievement in mathematics, cognitive style and achievement in mathematics. It was found that all the three contribute to statistically significant difference in achievement in mathematics.

However, all the above reviewed studies in the different areas only few were on mathematics word problems concepts at JSS level. Most of the researches above did not present any specific information on student's algebraic word problems solving at JSS level and failed to take into account some important factors, such as social, psychological, environmental and learning needs into students' performance, attitude and retention ability at JSS 2. This study wants to fill this gap using two instructional strategies, Fast-Draw Model and Polya Model of instructions, to teach some aspects of algebraic word problems solving at junior secondary school two students (JSS 2) in Kano State. The new variables introduce to make this study feasible were Fast-Draw Model, Polya Model, performance, attitude and retention on junior school secondary 2 (JSS 2) students.

2.11 Implications of the Reviewed Literature on the Present Study

The main focus of this study was to find out the most effective and viable among Fast-Draw Model, Polya Model of instructions and Conventional method in tackling algebraic word problem

solving and the relationship of these to performance, attitude and retention of JSS two students in four Education Zones of Kano State, Nigeria. The literature reviewed was done in such a way that the research works that are carried out by science and mathematics educators/researchers in the past that are similar or have direct bearing with this study as can be seen in the summaries above. The collection of theories and informed criticisms exposed by literature search has some implication for the present study. Permanent and meaning learning and the development of good skill was the ultimate goal of educational endeavors. Effective strategies and metacognitive strategies have been found to contribute immensely towards the growth and development of science and mathematics education (Ansalon & Biafora, 2004).

Bolaji (1995) conducted a study using three instructional approaches on students' achievement in algebraic word problems at Junior Secondary School (JSS) level. The population consists of 35 schools in Zaria Education Zone. A sample 480 from 12 JSS was drawn for the study. Four instruments were used to source data for analysis. The coverage was Zaria zone. Three set of experimental groups were used for the study. The overall results show that there was significant difference in the performance and positive attitude towards algebraic word problem. These shows that when students were exposed to problem solving where they interact improve better. The study consider only one educational zone even though the sample is adequate, the students were from JSS 3 and the study was conducted in 1995 which has taken longer time. The present study uses JSS two and algebraic word problem solving and involved four zones instead of one and three dependent variables, performance, attitude and retention and in Kano State, Nigeria.

Galadima (2001) uses four models of problem solving in his research on algebraic word problem in Sokoto and Zamfara on senior secondary school students' achievement. After analyzing the overall results it was found that all the four models have significant effect on students' achievement in algebraic word problems. Even though the study was in the north-west like the present one, it has taken time and the level was SS classes and contained four models. The present

study uses two models on algebraic word problem solving on students at JSS 2 classes in Kano State on performance, attitude and retention using Fast-Draw and Polya Models of instructions.

Bichi (2002) uses problem solving strategy to conduct a quasi-experimental research on students' achievement in one zone, Giwa in Kaduna State Nigeria. The study was conducted with SS 3 Biology students. Five senior secondary school of the same ranking were used. The problem solving was based on Polya problem solving model. A sample of 156 SS 3 students was involved in the actual study. The result after analysis shows that there was significant difference in the achievement between the students in the experimental group and the control group. The result also shows there was no significant difference between gender and problem solving. The gap in the above study was only one education zone, one model and one dependent variable, achievement, on problem solving with a sample of 156 of SS 3 students was considered and has taken time 2002. Present study uses two models of instruction, Fast-Draw and Polya, Models on performance, attitude and retention of students in algebraic word problems solving at JSS level in four zonal education offices (Dawakin Kudu, Dala, Minjibir and Wudil) of Kano State, Nigeria with a sample of 326 students.

Sherren (2006) consider the effect of Polya problem solving model in his research on Senior Secondary Students' (SS) academic achievement in Pakistan. At the beginning of the experiment there was no significant difference between the experimental group and the control group. After the treatment the results shows that experimental group who were taught using Polya model perform significantly better than the control group. The gap in the above study was it compares Polya and traditional method on SS students in Pakistan and only one model. Present study implores Fast-Draw Model and Polya Model of instructions on JSS two students in algebraic word problem solving in four educational zones of Kano State, Nigeria.

Usman, Akor and Ebuta (2006) conduct a quasi-experiment study on achievement and interest of senior secondary school students' in Geometry using Polya problem solving model. The sample for the study consists of 214 SS1 drawn from two schools. Two instruments were used to source

data for analysis. After analysis the results shows that there exist a significant difference in the achievement as well as in interest between the experimental group and control group. The gap in the above study was it uses only one model Polya Model on SS students', two schools; two research questions and two hypotheses were tested. This study uses two models of instruction in algebraic word problems solving, five research questions, five hypotheses, four zones and seven schools with JSS two students and 326 samples in Kano State.

Moses (2010) compares the effects of Polya problem solving model on senior secondary school students' achievement in physics. Two instruments were used to source data for analysis. The results show that Polya problem solving model produce higher achievement and develop critical thinking. One model is used on SS classes and has taken time. The gap in the above study was it uses one model, Polya Model, and one dependent variable, achievement and two instruments. Present study uses Polya Model and Fast-Draw Model of instruction on performance, attitude and retention of JSS two students in algebraic word problem solving on attitude, retention and performance and uses a sample of 326 to assess which of the two models will produce higher gain in terms of performance, positive attitude and higher retention abilities.

Ruddi (2010) Examine the effects of polya 4-steps model on seventh grade perception and level of achievement in algebraic word problems. Two classes participate in the study. Two research questions were asked and two hypotheses were formulated and tested. The results of the study after analysis shows that students that were taught with Polya problem solving model significantly improve in their level of academic achievement compared to those that were not. The gap in the above study was only Polya Model was compared with conventional method in terms of student's perception and achievement using only two SS classes. Presents study compared Fast-Draw Model and Polya Model of instructions on JSS two students on performance, attitude and retention in algebraic word problem solving from four educational zones in Kano State.

Bawa (2011) compare Polya problem solving model and conventional method of teaching on academic achievement and retention in ecology among senior secondary students with different

cognitive preference in Zaria Education Zone, kaduna State Nigeria. A sample of 240 constitutes the subject of the study. Two instruments were used to source data for analysis. After the analysis, the experimental group that was taught using Polya model achieves higher and retains more information than the control group. The gap in the above study was only one zone and one model on retention and performance was considered and two instruments on SS students. Present study compared Fast-Draw Model, Polya Model of instructions and the dominant Conventional lecture method on performance, attitude and retention of JSS two students in algebraic word problem solving from four education zones in Kano State.

Sukran and Adam (2012) examine the effects of Fast-Draw Model on academic performance and attitude towards mathematics in Pakistan. The study was conducted with a sample 56 third grade students. The effects of the model were investigated by comparing the posttest scores of the students in the treatment group. The results show that there was significant difference in the performance as well as in the attitude of the two groups, experimental and control. The gap in the above study was limited sample was considered; only 56 on JSS 3 students and only one model, and the environment differ. This study compares Fast-Draw Model and Polya Model of instructions on JSS two students' attitude, retention and performance in algebraic word problems solving from four educational zones in Kano State with a sample of 326 JSS two students.

Emos (2013) examine the effect of problem solving strategy on senior secondary school students based on Polya model. Two instruments were used on a sample of 160 students from four secondary schools with a population of 1376 students. It was a quasi-experiment pretest posttest. After the study the results of data analysis shows that problem solving had significant effect on students' achievement. It also shows that attitude of students was positive. The gap in the above study was only one model with a very limited sample, 160 and SS classes. Present used two models, Fast-Draw Model and Polya Model of instructions on JSS two classes on performance, attitude and retention in algebraic word problems solving from four educational zones of Kano State Nigeria with a sample of 326.

Samuel (2013) examines the effects of Polya problem solving on achievement and retention in algebra word problem at one local government in Ebonyi State on senior secondary school students. Quasi-experiment was adopted using eight intact classes. One instrument was used for data collection. Mean and standard deviation was used to answer the research questions. Major finding reveals that students taught with Polya problem solving exhibit greater achievement and retain more than those that were not. The gap in the above study was on SS classes, one instrument, one model, one statistical instrument and two depended variables which produces limited results. Present study examines the effects of Fast-Draw Model and Polya Model of instructions on performance, attitude and retention in algebraic word problems solving of JSS two students in Kano State using a sample of 326 students.

Salman and Ameen (2014) use two problem solving models on senior secondary school student's performance in word problem, Polya and Brainsford and Stein in Ilorin. The results after data analysis shows significant effect between the experimental and control group in favor of the experimental group on performance in word problem. The gap in the above study was that it was conducted with SS classes even though two models were used it is only on performance. Present study also utilizes two models at JSS two level on performance, attitude and retention in algebraic word problem solving in Kano State with a sample of 326.

Bishau (2014) investigate the ways in which Fast-Draw Model affect the eighth grade students' achievement and attitude in mathematics word problem solving. The sample of the study consists of 116 SS students. It was a quasi-experiment pretest posttest control design. After data analysis the results shows that students taught under Fast-Draw Model perform significantly better than their counterpart who were not. The gap in the above study was that it was conducted with SS classes on achievement and attitude as depended variables. The population and sample was limited and involve only two groups. Present study compares Fast-Draw Model and Polya Model of instructions on four groups of students at JSS two from four educational zones on performance, attitude and retention in algebraic word problem solving and involves a sample of 326 students.

Olaniyan (2015) investigate the effects of Polya problem solving model on senior secondary school students' performance in current electricity in Kwara State Nigeria. Qausi-experimental design was adopted. A sample of 120 was drawn from two schools to participate. The experimental group was exposed to Polya problem solving model while the control group were expose to conventional lecture method. After data analysis of the sourced data, the results show that there was significant difference in performance between the experimental group and the control group. The gap in the above study was it utilizes only one model, Polya Model, and conventional method on SS students in Kwara State using two schools and two groups with a sample of 120. Present study employ Fast-Draw Model and Polya Model of instructions with a population of 5377 and a sample of 326 on performance, attitude and retention on JSS two students in algebraic word problems solving in Kano State, Nigeria.

Sheikh (2015); examines the effects of George Polya's problem solving model on revised Blooms Taxonomy of Educational Objectives on senior secondary school students' performance in mathematics. It was a qausi-experiment pretest posttest control design. After data analysis the results shows that the use of Polya problem solving shows significant improvement at all level of knowledge dimension, and also shows that Polya problem solving model had works better than the conventional method of teaching. Although the above study uses all the six content knowledge on SS classes the coverage and sample size was limited, this study uses three of the revised Blooms Taxonomy of Educational Objectives: knowledge, comprehension and application in algebraic word problems solving on JSS two students from four educational zones and a sample of 326 students in Kano State.

Bishau (2016) investigate on problem solving strategy between urban and rural students' performance in word problem. It was a qausi-experiment pretest posttest control design. One instrument was used for data collection on performance. The result after data analysis shows higher performance in favor of the experimental group. It also shows that the students in the urban area have more access to learning facilities than students in the rural areas. The gap was that Bishau uses

SS class and urban and rural in his effort to find the effect of the model using only one instrument for data collection. Present study compared urban, semi-urban and rural because of the geographical location of the zones in terms of performance, attitude and retention at JSS two level using two models of instruction in algebraic word problem solving in Kano State Nigeria.

Porntipa (2016) conducted a research to compare mathematics problem solving skills and mathematics achievement before and after using Polya's problem solving process of mathematics students. The study was conducted by one-group pre-test posttest. The research instruments consist of (1) lesson plan on polya problem solving on statistics, (2) mathematics problem solving test, (3) mathematics achievement test. The data were analyzed for mean, standard deviation, percentage and t-test for independent samples. The results shows that (1) mathematics problem solving skills of students who were taught by Polya's problem solving process had mean score pretest 10.43 (34.76%) and posttest 23.63 (78.77%). The results shows posttest means score higher than pretest. (2) Mathematics achievement of students who were taught by Polya problem solving process had mean score pretest 11.5 (38.33%) and posttest 24.03 (80.10%). The result shows that posttest mean score higher than 75% and posttest higher than pretest. The gap in the above study was only one model was considered with a limited sample and coverage on achievement. Present study compares two models on attitude, performance and retention.

These studies and findings reviewed showed some strategies, through which one could possibly implore to positively help students irrespective of their interest, attitudes or abilities to acquire skills, perform better, improved their retentive abilities and attain better understanding of algebraic word problem solving concepts. The reviewed indicated that academic performance, attitude and retention are strongly related to the teaching methods employed by the teacher and the ability of the learner to understand and retained facts. The reports also have shown that the conventional method of instruction has been found to be relatively inferior to several other models and strategies in terms of effectiveness and students achievement. From the literature reviewed it was discovered that many challenges still exist in algebraic word problem solving in particular and mathematics word

problems solving teaching and learning in our senior as well as junior secondary schools in Nigeria. Most of these problems are still without adequate attention especially at the lower basic secondary school level where most of the teachers are adopted/borrowed or non-professionals.

The reviewed studies implies that the development of positive attitudes, good retention ability and interest to algebraic word problems solving rest squarely on the teacher's methods, strategies and behavior. It implies also that if mathematics educators, researchers and teachers want to develop and maintain positive attitude, interest and understanding of concepts and principles of mathematics in the classroom then more is required than simply providing theoretical facts and connections which may not be discovered by students through the use of the conventional lecture methods or teacher – centered method of instructions.

The solutions offered in these studies up till now have not yet gone a long way to addresses the problems of persistent poor performance, negative attitude and lack of interest in algebraic word problems solving in particular and mathematics in general among junior as well as senior secondary school students in Nigeria. The findings also implies that mathematics educators and teachers should reconsider the purpose of teaching and learning all aspects of word problems solving in particular and mathematics in general in their mode of teaching so that pupils/students should not be left in a state of confusion at the end of mathematics lessons.

Based on the reviewed literature this study have covered the following gaps in the teaching and learning of algebraic word problems solving at junior secondary school level which were not covered in the previous studies;

a) Teaching algebraic word problems solving concepts at junior secondary school two (JSS 2) using two instructional models; Fast-Draw Model and Polya problem solving model of teaching word problems solving to improve performance, attitude and retention ability.
b) Retention was introduce and used as variable and compared with attitude in this study between two groups, experimental and control in word problems solving, which was not researched on at JSS two levels in algebraic word problem solving.

c) Gender was introduced and used as variable in this study which was not used in other studies on algebraic word problems solving using the two models at Junior Secondary School two students.

d) The comparing of three variables; performance, attitude and retention of students at JSS 2 level was introduced and used in this study which were not researched on in other studies on algebraic word problem solving using the two models (Fast-Draw and Polya).

Thus, when these items were considered in the present study it makes it remarkably different from other studies and an improvement over the existing ones. In the light of the advantages of Fast-Draw Model and Polya Model of word problem solving as an activity-based and problem solving strategies and the realization of modern mathematics teaching and learning, mathematics educators, researchers and teachers were advise to look for more innovative models and strategies like the Fast-Draw Model and Polya Model in their teaching activities. This may go a long way in reducing some of the hatred ("an avoidable enemy"; i.e., mathematics) lack of interest and negative attitudes which ends in poor performance.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Introduction

The study investigated the effects of Fast-Draw Model and Polya Model of word problem solving on academic performance**,** attitude and retention in algebraic word problem solving among junior secondary school students in Kano State, Nigeria. Consequently the study aimed at contributing towards reducing some of the problems confronting the teaching and learning of algebraic word problems solving at JSS two level. The Chapter discusses the methodological concepts under the following sub-headings:

3.1 Research Design

3.2 Population of the Study

3.3 Sample and Sampling Technique

3.4 Instrumentation

3.4.1 Algebraic Word Problem Performance Test (AWPSPT)

3.4.2 Algebraic Word Problem Retention Test (AWPSRT)

3.4.3 Algebraic Word Problem Solving Attitudinal Questionnaire (AWPSAQ)

3.4.4 Validation of AWPSAQ, AWPSPT and AWPSRT

3. 4.5 Reliability of the instruments

3.4.6 Reliability of Algebraic Word Problem Attitudinal Questionnaire, AWPSAQ

3.5 Pilot Study

3.6 Item analysis

3.6.1 Items Discrimination

3.6.2 Items Difficulty

3.7 Administration of Treatment

3.8 Control group

3.9 Procedure for Data collection

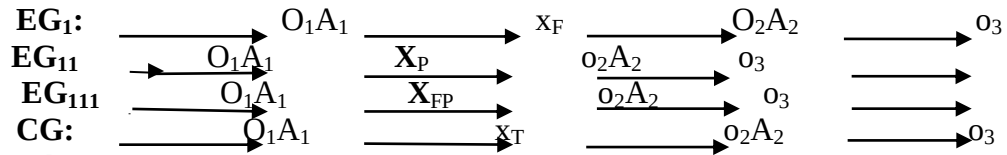
3.10 Procedure for Data Analysis

3.1 Research Design

The study investigated the effects of Fast-Draw and Polya problem solving Models on academic performance, attitude and retention in algebraic word problems solving among junior secondary school two students in Kano State, Nigeria. Quasi-Experimental pre-test, posttest design was employed in the study. The design was used to handle the two instructional models in order to determine their effects on the subjects. To answer the research questions and test the null hypotheses three instruments were developed and used. The instruments were; the students algebraic word problems solving performance test aimed at assessing the performance of both experimental and control groups before and after the treatment, the algebraic word problem solving retention test and the algebraic word problem solving attitudinal questionnaire which was used to assess student's attitude towards algebraic word problem solving at the beginning as well as at the end of the treatment. At the end of the treatments a posttest was administered to all the groups to determine the effects of treatments with regard to performance, attitude and retention ability. Two weeks after a post-posttest was administered. This is to determine the retention level of learned concepts using the three methods of instruction. The same instruments were administered as pretest, posttest and post-posttest. Since there was non-random selection of students to the groups, intact classes were randomly assigned to experimental and control groups, without disrupting the normal school programs**.**

The research questions were answered using descriptive statistics in a form of mean and standard deviation, while independent sample t-test and analysis of Variance were used to test the hypotheses at $\propto \leq 0.05$ level of significance. The Fast-Draw Model and Polya Model group's used two different instructional guides prepare by the researcher while the control group used the lesson plans in the normal conventional way also prepared by the researcher. The design is diagrammatically represented in figure 3.1

Figure 3.1 Research design



Where:

EG_1 = Experimental Group 1

EG_{11} = Experimental Group 11

EG_{111} = Experimental Group 111

CG = Control Group

X_F = Experiment (Fast-Draw)

X_P = Experiment (Polya)

X_{FP} =Experiment (Fast-Draw and Polya)

X_T= Traditional (Conventional)

O_1A_1 = Pre-test (to determine the ability level of students before treatment).

O_2A_2 = Post-test (to determine performance after treatment).

O_3=Post-posttest (to determine students' retention level in algebraic word problems solving).

3.2 Population of the Study

In Kano State some secondary schools have both junior and senior secondary section under them and some do have only junior, this study considers both. Kano State Ministry of Education have fourteen Zonal Education Offices, the study consider only four; Dala, Dawakin Kudu, Minjibir and Wudil Zonal Education Offices. They were selected purposely due to their population density and their geographical locations. They are two semi-urban, one rural and one urban. The populations for the study were junior secondary school two (JSS 2) students in the four education zones selected. Investigation from the four zones showed that there are 85 public secondary schools in the four zones in which two were coeducations and one co-exist. Out of the two schools one school was used for the pilot study. In the State there are federal, private and voluntary junior secondary schools, only State Public Junior Secondary Schools were considered in the study; the reason for this was due to their common social, economic background, admission and promotion policies, staffing and availability of teaching and learning resources and teachers' discipline. The total enrolment for this category of students in the 2018/2019 academic season in these 85 schools was five thousand three hundred and seventy seven (5377) which served as the target population for

the study. They consist of 3034 boys and 2343 girls respectively. Details of the population according to zones and schools was presented in the following Table 3.1

Table 3.1; Schools in 14 Zonal Education Offices in Kano State for 2018/2019

S/N	Zone	No. of School	Male	Female	Total
1	Bichi	22	1139	893	2023
2	Dala	23	819	613	1432
3	Dan Batta	29	1457	1115	2672
4	Dawakin Kudu	22	946	627	1573
5	Gaya	17	2125	1086	3211
6	Gwarzo	27	1284	689	1973
7	Karaye	23	1231	336	1867
8	Kura	11	896	531	1427
9	Minjibir	25	737	611	1348
10	Municipal	33	2185	1072	3257
11	Nassarawa	20	2721	1127	3848
12	Rano	10	637	488	1125
13	Tudun Wada	22	874	653	1527
14	Wudil	15	532	492	1024

Source: *Kano Education Resource Department (KERD, 2018).*

3.3 Sample and Sampling Technique

A sample was a subset of a population of which measurement has been done and from which generalization is drawn to cover the entire population. The sample for this study consisted of all junior secondary school two (JSS 2) mathematics students from the target population. Public junior secondary school two, male and female, students from Dala, Dawakin Kudu, Minjibir and Wudil Zonal Education Offices of Kano State are the samples for the study. The choice of the four zones; one urban, two semi-urban and one rural, from different locations was done to avoid interaction between the two groups during the period of treatment and, thus eliminating the effect of students' interference which might affect the results. Seven (7) junior secondary schools of the same ranking from eighty five (85) junior secondary schools in the four zones, using simple random sampling, were drawn. Samples of three hundred and fifty two (352) students were selected. The sample size was sufficient enough for the study as it conforms to the sizes recommended by Fraenkel and Wallen (2000).

Multi-Stage Sampling Techniques were adopted in order to fulfill the criteria for selection. First stage was to select schools with qualified mathematics teachers teaching Junior Secondary School two (JSS 2) classes. Secondly JSS 2 that had at least two streams and have presented students for Basic Education Certificate Examination (BECE) in the last ten years were included. Twelve schools meet these conditions in the four zones and seven were used. A simple random sampling technique was used to make sure that three (3) male schools and three (3) female and one co-exist schools were selected for the study. Male and female schools used for the study were randomly selected from the single sex schools through balloting method. See table 3.2 for the sampled schools. From each school selected a class with two or more streams was further selected for the study. Since intact classes were used, the entire students of each selected stream were used for the study. However, were there were more than two streams simple random sample was used to select a class using hat-draw technique. The main purpose for using random sampling techniques was to compose a sample that will yield research data that can be generalized to a larger population (Borg and Gall, 1991). Finally, allocation of streams into experimental and control groups was done by the flip of coin. This was merely for the convenience of the researcher. The students in both experimental and control groups were taught the same topics. The same test items administered to students in the experimental groups were also given to those in the control group in order to avoid inter-group competition. The distribution of the samples from the four zones follows in Table 3.2;

Table 3.2 Sample for the Study

Sex	Dala	Dawakin Kudu	Minjibir	Wudil	Total
Male	66	42	46	41	195
Female	42	41	40	35	157
Total	108	83	86	76	352

The average number of students in each of the class selected range between 30-68. The groups contain 195 male students and 159 female students. A total of three hundred and fifty two (352) students were distributed into experimental EG_1, EG_{11}, EG_{111} and the control group.

3.4 Instrumentation

This section contains three instruments designed to be used in the study, they are; algebraic word problem solving performance test, algebraic word problem solving retention test and algebraic word problem solving attitudinal questionnaire.

3.4.1 Algebraic Word Problem Solving Performance Test, AWPSPT

3.4.2 Algebraic Word Problem Solving Retention Test, AWP SRT

3.4.3 Algebraic Word Problem Solving Attitudinal Questionnaire, AWSPAQ

3.4.1 Algebraic Word Problem Solving Performance Test, AWPSPT

In the construction of the Algebraic Word Problems Solving Performance Test (AWPSPT), the items for the test were specifically classified to reflect the cognitive domain of Bloom Taxonomy of Educational objectives. The researcher adopted this cognitive domain which includes the objective that encompasses knowledge, comprehension and application. The constructed test items have 50 items initially. The items were pilot tested at Hajara Buhari Secondary School (co-education). After items analysis the test was reduced to 30 items. Corrected items were used for pre-test and posttest. During the development of this performance test, a table of specification was developed to assist in establishing the content validity of the instrument. See Table 3.4.1

3.4.2 Algebraic Word Problem Solving Retention Test, AWPSRT

In the AWPSRT items were constructed to be similar to the AWPSPT with questions number rearranged but require the same procedures and skills for solutions as in AWPSPT. It was administered to both the experimental and control groups as posttest and post posttest respectively. Retention was measured two weeks after the treatment since it is a strong and necessary component of achievement (Anyor, 2012). The items were set to measure students' retention abilities in algebraic word problems solving; it was described in Appendix V.

3.4.3 Algebraic Word Problems Solving Attitudinal Questionnaire (AWPSAQ)

The Algebraic Word Problems Solving Attitudinal Questionnaire (AWPSAQ) modified by the researcher was based on the student's attitude. A total of 20 items adapted from modified Fennema-sharman (2004) attitude scale was used in the study. It has two sections A and B. Section A for the background information of the students and section B determine the student's attitude towards algebraic word problems solving and method of instructions. The scale contains information on personal confidence about the subject matter, usefulness of the subject's content, method of instructions and topic perceive as a male domain or difficult. It is a five-point Likert scale model. The rating scale was; strongly agree, agree, undecided, disagree and strongly disagree. The scoring for positive items was based on 5, 4, 3, 2, and 1 and for Strongly Agree (SA), Agree (A), undecided (UD) Disagree (D), and Strongly Disagree (SD) respectively.

3.4.4 Validation of AWPSPT, AWPSRT and AWPSAQ.

The purpose of the pilot study was to validate the algebraic word problems solving performance test, algebraic word problems solving retention test and algebraic word problems solving attitudinal questionnaire. The validation was in terms of reliability and effectiveness of the instruments in identifying the performance, retention and attitude of students towards algebraic word problems solving and methods of instruction. To validate the AWPSAQ, AWPSRT and AWPSPT, the instruments were given to two Ph D holders within the department of science education of faculty of education, Ahmadu Bello University Zaria, and one expert in psychology section of the same faculty, two mathematics inspectors from Kano Educational Resource Department. The assessors were requested to examine the instruments (AWPSPT, AWPSRT and AWPSAQ) for the following features;

a) Ascertain the reliability of the instruments before use in the final study.
b) Whether the test items confirm to the subject matter they are supposed to test
c) Determine whether the tests were feasible or not.
d) To ascertain suitable time duration required by the students to complete the tests

e) Whether the questions match the ability level of the students.

f) To determine ambiguity and assess clarity of the items.

g) To determine the discrimination level and difficulty of the test items.

Difficulty and problem areas that were observed in the test items were carefully noted and corrected to enable the instruments to be used finally from the results of the pilot study. Their advices were incorporated into the items; one of such advices was on the wording/phrases used that were too long. The modified tests were administered to 50 JSS 2 students of Hajara Buhari Junior Secondary School, which is a coeducational school within the four zones which was not involved in the main study. To ensure that individual opinion was freely express respondents were requested to work on the questionnaire individually in their classroom. Response of 38 for the test and 24 for the attitude statements was recorded and items analysis was carried out. The number of the items was reduced to 30 and 20 after the assessor's advice. See Appendix V1.

3.4.5 Reliability of the Instruments

Reliability of an instrument is the consistency of that instrument over time. Reliability of an instrument could be ascertained using different techniques such as Guttman split-half, test-retest; parallel comparison, Pearson's Product Moment Correlation Formula between odd and even scores (Split half) and so on. Pearson's Product Moment Correlation Formula between odd and even scores (Split half) were employed because of the two groups involved. The pilot study was carried out in JSS 2 from the target population. The data generated from the pilot testing were used to determine the reliability coefficients of the instruments to be used in the study. The trial testing of the instruments was carried out on a sample of 50 respondents who were not part of the sampled students but part of the population. The reliability was established using split half method where the items was separated into two parts X and Y; X represents the even numbers while Y represents the odd numbers. The correlation coefficient of X and Y was determine using Pearson product Moment correlation which was later boosted by Spearman-Brown prophecy formula. It was found

to be reliable with split half of internal consistency measure of 0.72. This indicates a moderate reliability considered for the purpose of the study.

Since only half of the test items scores' were correlated with remaining half instead of the full test being used. Some errors that may likely occur in the analysis may need correcting of error which is; $r = 2 \times \sqrt{r} / 1 + \sqrt{r}$, so after this correction of error the reliability of the full test (r) is 0.84. Thus, the instruments were considered to be suitable and reliable for the study.

3.4.6 Reliability of Algebraic Word Problems Solving Attitudinal Questionnaire

The set of data use to test for internal consistency is the same data that was used for the reliability. The data generated from the pilot testing were used to determine the reliability coefficient of the instruments used in the study using Pearson's Product Moment Correlation Formula between odd and even number. The purpose of the reliability was to determine whether the instruments would produce the same result. The reliability was established using split half method where the items were separated into two parts X and Y (odd and even numbers). The result was found to be reliable with split half of internal consistency measure of 0.78. Using Pearson Product Moment correlation coefficient.

3.5 Pilot Study

Junior Secondary School two (JSS 2) students of Hajara Buhari Junior Secondary School, a coeducational school, were identified and used for the pilot testing of the instruments (AWPSPT and AWPSAQ). To analyze the test, from the pilot study for reliability coefficient, the split half method and correction formula was used. The school chosen was not part of the sample but part of the population of the study. The subjects used were the JSS 2 mathematics students. The purpose of this pilot study was to determine the characteristics of the test items which include their difficulty and discrimination indices as well as the reliability coefficient. Thirty eight (38) students participated in the pilot study. The results of the pilot study were used to;

1. Determine difficulties if any, in the answering of the questions.

2. Determine the number of material that would be effectively handled by the subjects during the main study.
3. Assess the clarity of the items of the AWPSPT and AWPSAQ.
4. Calculate the reliability coefficient of AWPSPT and AWPSAQ.

See Table 3.3 for the results of the Pilot Study, the facility index and difficulty indices were determine also using the scores of the students from the test. The following amendments were made based on the findings from the pilot study;

1. The period of treatment for the main study was adjusted because it was found that students needed more time to get used to the new instructional strategies at the initial stage.
2. The last week of the treatment was set aside for revisions and the administration of the test instruments.
3. In the results questions; 3, 6, 9, 11, 16, 24, 30, 31, 36, and 40 were dropped. The remaining thirty (30) were rearranged and used for the pretest.
4. The timing for answering a question was reviewed.

3.5.1 Items Analysis

3.5.2 Item Discrimination

Items analysis was carried out on the data generated from the pilot study to determine the facility index of the items. The facility index (FI) of a test according to Wiseamn (2002) is the percentage of candidate divided by the students that got an item right. It is determined by using the formula: FI = R/T, where R = Number of correct response and T = Total number of students. Wiseman recommend values within the range of 0.30 to 0.70 for good test item values in assessing performance. For this study 0.30 to 0.68 was chosen. After the analysis all items with difficulty indices below 0.20 were discarded as being too difficult, while those with indices of 0.20 to 0.50 were selected for the final AWPSPT instrument with some modifications. Items with indices of 0.30 to 0.65 were selected without any modification. This was done after applying the facility index (FI) formula on the items from the pilot study.

Table 3.3 Item Difficulties

Content Area;	**Knowledge**	**Comprehension**	**Application**	**Total**	
	24	**32**	**44**	**= 100**	**%**
Proportion	2	3	2	7	23.3
Rate	-	I	2	3	10
Fraction	2	2	3	7	23.3
Invers Operation	1	2	3	6	20
Sharing	2	3	2	7	23.3
Total	**7**	**11**	**12**	**30**	**100**

The Table was constructed based on the cognitive structure of Bloom's Taxonomy of Educational Objectives. A modified Bloom's Taxonomy of Educational Objectives (1956) by Yoloye (1984) was adapted. The three levels of cognitive domains for Junior Secondary School two to be considered in the study were; knowledge, comprehension and application. An initial test with 50 items was prepared through the table of specifications within the framework of predicted objectives for algebraic word problems learning field in the JSS 2 mathematics curriculum. The final test contains 30 objectives to be answered before and after the treatment. The scores were organized in such a way that one (1) point is given for correct response and zero (0) point for wrong response.

The weighting was assigned to each contents primarily based on the area of the coverage, work load and time involve. The topics Rate, Fraction, Inverse Operation, Proportion and Sharing word problems solving were used for the study because they are in the national mathematics curriculum of JSS 2 and the research assistants' can easily find them to teach using Fast-Draw Model, Polya Model of instructions and the Conventional method of teaching. The instruments in (AWPSPT) centered on the cognitive aspect of Bloom's Taxonomy, hence the above table. The items analysis results which were sorted in descending order was used to categorize the students into quartiles. The upper quartile that contains the higher ability students be the first group, the middle i.e., 50% was the second group, while the third quartile that contains the low achievers was the third group. To form a group in a class for instruction, you select a certain number from the top 25%, a certain

number from the middle 50% and a certain number from the lower 25% to form a hundred percent of a group for easy instruction. For example, to select a group of ten (10) students you may have- 2 + 6 +2 = 10, etc. This grouping is based on the recognition that children have different strength and weaknesses in learning ability and develop at different rates.

3.6 Administration of Treatment

The experiment was conducted in four zones out of fourteen zonal education offices in Kano State Ministry of Education which takes ten (10) weeks. At the beginning of the term, the researcher visited all the seven sampled schools to introduce himself and the purpose of his visit which was to carry out an investigation on the effectiveness of two word problem solving models towards improving the teaching and learning of algebraic word problem solving in the state schools. During the visit also to discuss on the number of classes and teachers that would be involved and the number of days the activities would take. In the study data would be collected within ten (10) weeks for analysis. The range of students' age at this level was between 12—14 years. A total of three hundred and fifty two (352) and seven teachers participated in the study. Research assistants were used in all the seven sampled schools. The regular mathematics teachers that were teaching both in the treatment and the control schools served as the research assistants and were given a three weeks workshop on the topics to be treated, the lesson guides and the methods of instructions. Teachers with a minimum of ten years' teaching experience and above were given a workshop on the models by the researcher to facilitate the Fast-Draw Model and the Polya Model as well as the Control group. Five out of the seven teachers were trained on Fast-Draw and Polya Models of instruction. The workshop was based on the purpose of the study, the topics to be taught, the use of the lesson guides (Appendix 1and 11) for the experimental and the lesson plans (Appendix 111) for the control group, the use of the AWPSPT and AWPSAQ as well as the general conduct of the study. It was ensured that all the teachers in the three groups used equal length of time (five weeks) to facilitate learning of the topics.

Three different treatments were maintained throughout the study; teaching algebraic word problems solving using Fast-Draw Model and Polya Model of instruction and the Conventional lecture method of teaching. Three different lesson guides addressing the same instructional objectives and, content area of algebraic word problems solving in JSS 2 curriculum was used; two for the experimental groups and the other one for the control group respectively. Firstly, the Fast-Draw Model and the Polya Model of instructions were trained through a workshop by the researcher to the teachers of the experimental groups with a prepared exemplary texts and lesson guides for three weeks as stated. The workshop was to provide the teachers with the knowledge concerning the main aspects of the Fast-Draw Model and Polya Model, and most importantly helped them to understand how to translate Fast-Draw Model and Polya Model into practice. These teachers were able to comprehend all the contents of the training because of the background they have during the Education Sector Support Programme in Nigeria (esspin) training in all the JSS in Kano State schools. Following the completion of the preparatory workshops, the problems were taught using the Fast-Draw Model and Polya problem solving Model. Fast-Draw and Polya Models to the experimental group's one and two using various activities (reading, interpreting, visualization, and solving the problem) which were based on the prepared lesson guides. The Zone/school were Fast-Draw and Polya Models were implemented, the research assistants were first to facilitate Fast-Draw Model and then assess. Then after two weeks facilitate Polya Model and assess to compare the prepared method by the students. The lesson guides for the experimental group was designed in the following sequence (a) learners were given clear idea of where they are going, (b) instruction leading to the behavior is sequenced in to small steps (c) at each step, the learner is encourage to actively respond, (d) the learners received immediate feedback concerning the correctness or appropriateness of these responses, (e) each learners mastery was evaluated over the course as a whole using formative evaluation.

At the end of each lesson, discussions and summaries were held with the teacher to review part of the lessons. At the end of the five weeks teaching all the students in experimental as well as the

control groups were given a one week revision before the post achievement test and algebraic word problems solving attitudinal questionnaire towards algebraic word problem solving and the methods of instruction.

3.7 Control Group

In the contrary, students in the control group were taught by the research assistants using lesson plans based on the conventional teacher- centered method. The features of this lessons were; general information which consist of subject, topic, the procedure, the teacher general objectives for each week and specific treatment package for each week (Appendix **111**). The lesson was mainly on normal way of using the already prepared lesson planes. The features of these were; general information which consists of subject, topic, procedure, the teacher general objective, content for each week and some exercises for each week as stated above. The students in the control group were asked to read the given problem and talk about it. Then a couple of students tried to visualize the problem. Following the instructional guides the students were asked to solve the problem on their own in their notebooks. The teacher checked the students' answers and the problems were solved by the teacher or voluntary students on the board. After the teacher or a student solved a problem on the board, the class discussed the shortcomings and faults if any, and then was corrected and exercise/homework was given thereafter. The teachers/research assistants of the control and experimental groups had similar characteristics (years of experience, education level, age). During this period the researcher would be going round all the sampled schools to monitor the progress of the research assistants. The instructional guides were given to all the research assistants/mathematics teachers as well for review, contributions and their suggestions were incorporated in the guides. See Appendices 11 and 111.

3.8 Procedure for data Collection

Data was collected during the normal school hours in three (3) steps in accordance with the research design used, and with the aid of the instruments. The steps were;

Step 1: A pre-test was administered to the two groups before the treatment in order to determine the students' level, just the position of the students before the commencement of the experiment.

Step 2: Post-test was administered after treatment to the two groups in order to determine the students' performance in algebraic word problems solving and algebraic word problems solving attitudinal questionnaire.

Step 3: A post-post-test was also administered after post-test with an interval of two weeks to both groups in order to determine students' retention ability level in algebraic word problem solving. The retention of both male and female experimental and control groups were tabulated and compared on the basis of post-posttest for retention in the data analysis.

For these purposes seven research assistants of the seven sampled schools in the four zones in the study area would serve as the data collectors. The seven research assistants were also briefed during the workshop on data collection procedure prior to their going out or completion of the tasks. During the briefing various test administration and procedures as well as the attitudinal change questionnaire administrations were discussed. As stated above the researcher visited all the seven sampled schools in the zones two weeks before the commencement of the study. During these five weeks of treatment rates and sharing were treated first, second inverse operation then followed, thirdly, fractions, fourthly, proportion. After these a week was used for revisions before post-test. Two weeks after post-posttest was administered. At the end of eight (8) weeks with repeated posttest the scripts collected from both posttest and retention test of the two groups were marked, and scored using marking schemes. This was recorded in percentages. The data collected was used to examine the differences, if any, in the performance of the experimental group that received lessons under Fast-Draw Model and Polya Model, Fast-Draw and polya and the control group that receives lessons under the Conventional teacher-centered method and these was tested and interpreted using the independent sample t-test for related samples.

3.10 Procedure for Data Analysis

The data collected from the field with the aid of the instruments were analyzed using the descriptive and inferential statistics according the research questions asked and the hypotheses formulated. The mean and standard deviations were used to answer the research questions, while t-

test for independent sample was used to test the hypotheses at $\propto \leq 0.05$ level of significant. T-test was employ in the analysis because it provides a means of ascertaining the trend of performance of the immediate and delayed retention period. It is also particularly useful in testing cases that are multiple in natures.

CHAPTER FOUR

DATA PRESENTATION

Introduction

This study investigated the attitude, performance and retention of students taught algebraic word problems solving using Fast-Draw and Polya Models of instruction and the lecture method of instruction among junior secondary school students. The chapter contains analysis of the data collected and presented it under the following subheadings: introduction, data analysis, summary of findings and discussions.

4.1. Data Presentation

This section contains the analysis of the data collected in order to address the research questions and equally test the null hypotheses. Both descriptive and inferential statistics were used for these purposes.

Research Question One: Is there any difference in the change of attitude when students were taught algebraic word problems solving concepts using Fast-Draw and Polya Models of instruction and the lecture method of instruction?

The decision rule for the overall mean and mean of individual items is as follows: 0.00 - 1.49, SD; 1.50 - 2.49, D; 2.50 - 3.49, U; 3.50 - 4.49, A; 4.50 - 5.00, SA

The results of the analysis are presented in Table 4.1.

Table 4.1 Summary of Mann-Whitney U-test Attitude Scores of Experimental and Control Group

Item	N	Mean	SD	Decision
It tells me more about myself and my environment.	326	3.93	.633	Agreed
Universities/Colleges requires good background in word problems solving	326	3.90	.641	Agreed
It helps me understand many science topics.	326	3.89	.709	Agreed
It help me become a good problems solver	326	3.87	.679	Agreed
I want to pursue a career that requires additional knowledge of mathematics word problems solving	326	3.87	.652	Agreed
It relates with real life situations.	326	3.82	.612	Agreed
I would like to be identify with the same students in the school who are good mathematics problems solvers	326	3.81	.655	Agreed
I want to be recognized in the society as good mathematician.	326	3.78	.684	Agreed
My brother is a good mathematics word problem solver.	326	3.73	.666	Agreed
All my friends try hard in word problems s[illegible]g.	326	3.64	.677	Agreed
My parent advises me to study word problem solving very well.	326	3.63	.646	Agreed
It helped me to be more active in the class activities.	326	3.58	1.128	Agreed
It Increases my interest in word problems solving.	326	3.53	1.054	Agreed
Helped me to see the logical concepts not as difficult as I thought they were to understand	326	3.45	1.208	Undecided
It helps to change my view of the word problem concepts taught.	326	3.44	1.187	Undecided
Makes me to like more word problems and gives me a sense of greater achievement and capability.	326	3.44	1.174	Undecided
Allows the sharing of ideas which has helped me to Appreciate the significant of word problems to my existence	326	3.43	1.207	Undecided
The approach the teacher use is prepared to other approaches and should continue in solving more word problems	326	3.41	1.204	Undecided
Given me the opportunity to apply in my day to day experience to learning more mathematics word problem concepts	326	3.41	1.091	Undecided
It made word problem concepts more difficult to understand	326	2.00	.738	Disagreed
Overall mean		**3.58**	**0.862**	**Agreed**

The statements; it tells me more about myself and my environment, universities/Colleges requires good background in word problems solving and it helps me understand many science topics all have agreed, with a mean range between 3.93 – 3.89 and standard deviation range between 6.3 – 6.79 This was an indication that students were able to identify with teaching methods they were using. It helps to change my view of the word problem concepts taught,

The next statements shows students decisions; help me see the logical concepts not as difficult as I thought they were to understand, Makes me to like more word problems and gives me a sense of greater achievement and capability. They were all undecided statements showing that the students were not sure of what do about them even though they were all positive statements.

The last statement is a total disagreement about it with a mean of 2.00 and standard deviation of 0.738. This tells us that the students were in total disagreement that the teaching method makes the concept more difficult to understand.

Research Question Two: Is there any difference in the mean performance scores of students taught algebraic word problems using: Fast-Draw Model and lecture method
The data collected was analyzed using descriptive statistics of means and standard deviations in order to address the research question.

The results of the analysis are presented in Table 4.2(a).

Table 4.2(a) Means and Standard Deviations on performance scores of students taught algebraic word problems using Fast-Draw Model and Lecture Method

					95% Confidence Interval of the Difference	
Treatment	**N**	**Mean**	**SD**	**Mean Difference**	**Lower**	**Upper**
Fast Draw	106	61.59	9.584	37.117	34.837	39.397
Lecture method	111	24.48	7.357			
Total	**217**	**43.04**	**8.471**			

Table 4.2 Presented means and standard deviations on performance of students taught algebraic word problems solving using Fast-Draw Model and Lecture method. The mean performance score for Fast-Draw Model instructional strategy was 61.59 (SD=9.584) and that of Lecture method was 24.48 (SD=7.357). The mean difference between the two strategies was 37.117. The 95% confidence interval of the difference was between 34.837 to 39.397.

Research Question Three; Is there any difference in the mean scores of students taught algebraic word problems solving using Polya Model of instruction and the lecture method?
The data collected was analyzed using descriptive statistics of means and standard deviations in order to address the research question.

The results of the analysis are presented in Table 4.2(b).

Table 4.2(b) Means and Standard Deviations on performance scores of students taught algebraic word problems using Polya Model of instruction and Lecture Method

			Std.	Mean	95% Confidence Interval
Treatment	**N**	**Mean**	**Deviation**	**Difference**	**of the Difference**

					Lower	Upper
Polya	109	54.37	12.462	30.058	27.353	32.763
Lecture method	111	24.48	7.173			
Total	**220**	**39.34**	**9.818**			

Table 4.3 Presented means and standard deviations on performance score of students taught algebraic word problems solving using Polya instructional strategy and Lecture method. The mean performance score for Polya instructional strategy was 54.37 (SD=12.462) and that of Lecture method was 24.31 (SD=7.173). The mean difference between the two strategies was 30.058. The 95% confidence interval of the difference was between 27.353 to 32.763.

Research Question Four; is there any difference in the mean scores of students taught algebraic word problems solving using Fast-Draw Model of instruction and Polya Model of instruction?
The data collected was analyzed using descriptive statistics of means and standard deviations in order to address the research question.

The results of the analysis are presented in Table 4.2(c).

Table 4.2(c) Means and Standard Deviations on performance of students taught algebraic word problems using Fast-Draw and Polya Models of instruction

				Mean	95% Confidence Interval of the Difference	
Treatment	**N**	**Mean**	**SD**	**Difference**	**Lower**	**Upper**
Fast Draw	106	61.59	9.584	7.331	4.343	10.319
Polya	109	54.26	12.452			
Total	**215**	**57.93**	**11.018**			

Table 4.4 Presented means and standard deviations on attitude of students taught algebraic word problems solving using Fast-Draw and Polya models. The mean performance score for Fast-Draw Model instructional strategy was 61.59 (SD=9.584) and that of Polya Model was 54.26 (SD=12.452). The mean difference between the two strategies was 7.331. The 95% confidence interval of the difference was between 4.343 to 10.319.

Research Question Five: Is there any gender difference when students were taught mathematics word problems concepts using Fast-Draw and Polya Models of instruction and lecture method of instruction?
The data collected was analyzed using descriptive statistics of means and standard deviations in order to address the research question.

The results of the analysis are presented in Table 4.3

Table 4.3 Means and Standard Deviations on gender performance scores of students taught algebraic word problems solving concepts using Fast-Draw and Polya Models of instruction and the Lecture method of instruction

					95% Confidence Interval	
Sex	**Treatment**	**N**	**Mean**	**Std. Error**	**Lower Bound**	**Upper Bound**
Male	Fast Draw and Polya	139	52.464	.761	50.966	53.961
	Lecture method	69	26.140	1.057	24.060	28.221
Female	Fast Draw and Polya	74	55.398	.768	53.887	56.909
	Lecture method	44	22.340	1.097	20.182	24.497

Table 4.3 Presented means and standard deviations on gender performance scores of students taught algebraic word problems solving using Fast-Draw and Polya Models and lecture method. The mean performance scores for male students taught using Fast-Draw and Polya Models instructional strategies was 52.464 (SE=0.761) and that of male students taught using Lecture method was 26.140 (SE=1.057). The 95% confidence interval of the difference for male taught using Fast-Draw and Polya instructional strategies was between 50.966 to 53.961, and that of male students taught using lecture method was between 24.060 to 28.221. The mean performance scores for female students taught using Fast-Draw and Polya instructional strategies was 55.398 (SE=0.768) and that of female students taught using lecture method was 22.340 (SE=1.097). The 95% confidence interval of the difference for female taught using Fast-Draw and Polya instructional strategies was between 53.887 to 56.909, and that of female students taught using lecture method was between 20.182 to 24.497.

Research Question Six: Is there any difference in retention ability when students are taught algebraic word problems solving using Fast-Draw and Polya Models of instruction and their counterpart in the control group taught with Lecture method?

The data collected was analyzed using descriptive statistics of means and standard deviations in order to address the research question.

The results of the analysis is presented in Table 4.4

Table 4.4 Means and Standard Deviations on retention ability of students taught algebraic word problems using Fast-Draw and Polya Models of instruction and those in the control group taught with Lecture method

					95% Confidence Interval of the Difference	
Treatment	**N**	**Mean**	**SD**	**Mean Difference**	**Lower**	**Upper**
Fast Draw and Polya	215	60.61	10.411	34.992	32.836	37.149

Lecture method	111	25.62	6.944
Total	**326**	**43.12**	**8.678**

Table 4.4 Presented means and standard deviations on retention ability of students taught algebraic word problems solving using Fast-Draw and Polya Models of instruction and the Conventional instructional strategy. The mean retention score for Fast-draw and Polya instructional strategies was 60.61 (SD=10.411) and that of Conventional instructional strategy was 25.62 (SD=6.944). The mean difference between the three strategies was 34.992. The 95% confidence interval of the difference was between 32.836 to 37.149.

Null Hypotheses Testing

The six null hypotheses were analyzed and tested using parametric and non-parametric statistics. Null hypothesis one was tested using Man-Whitney statistics, while two, three, four and five were tested using independent samples t-test while null hypothesis six was tested using two-way analysis of variance.

A test of 352 students was presented on the first day of the pre-test that was conducted. This serves as the initial sample for the study. At the time when the posttest was conducted only 326 students were present in the experimental and control groups due to research mortality. The possible reasons were that all the schools involved in the study were day schools as such we encountered some research mortality. This number however was the final sample used in the analysis. The algebraic word problems solving performance of male and female in the experimental and control groups were presented in the form of mean and standard deviation.

Null Hypothesis One: There is no significant difference in the change of attitude when students were taught algebraic word problems solving concepts using Fast-Draw and Polya Models of instruction and the Lecture method of teaching.

This null hypothesis was tested using non-parametric statistics. The results of the analysis were presented in Table 4.5(a)

Table 4.5(a) Summary of Mann-Whitney U-test attitude scores of male and female in the experimental and control groups

Treatment	N	Mean Rank	Sum of Ranks	Mann-Whitney U	Wilcoxon W	Z	P
Fast Draw and	215	218.39	46953.50	131.5	6347.5	-	.000

Polya						14.646	
Lecture method	111	57.18	6347.50				
Total	**326**						

The hypothesis was tested using Mann-Whitney statistics, the data collected was ordinal. The magnitude of the difference in the mean ranks 218.39 of the Fast-Draw and Polya Models in the experimental group was higher than that of the Lecture method group 57.18. The mean difference was 161.21 in favor of the experimental group. That is students in the experimental group showed more positive attitude to algebraic word problems solving than the students in the control group. Therefore, the null hypothesis which states no significant difference was rejected because of the mean difference.

Null Hypothesis two: There is no significant difference in the mean performance scores of students taught algebraic word problem solving concepts using Fast-Draw Model and Lecture method.

This null hypothesis was tested using inferential statistics of independent samples t-test. The results of the analysis were presented in Table 4.5(b).

Table 4.5(b) Summary of independent samples t-test on performance of students taught algebraic word problems using Fast-Draw Model and Lecture method

Treatment	N	Mean	SD	Mean Difference	T	df	P
Fast Draw	106	61.59	9.584	37.117	32.087	215	.000
Lecture method	111	24.48	7.357				
Total	**217**						

Table 4.5(b) Presented means and standard deviation on students' performance taught algebraic word problems using Fast-Draw Model and lecture method. The hypothesis was tested using independent sample t-test statistics. The data collected was continuous. The mean performance score for Fast-Draw instructional strategy was 61.59 (SD=9.584) and that of Lecture method was 24.48 (SD=7.357). The mean difference between the two strategies was 37.117. The 95% confidence interval of the difference was between 34.837 to 39.397. This is supported by t(215)=32.087, p=0.001. The effect size tells us the strength of the relationship, given us some practical and theoretical idea about the significant of our results. Therefore, the null hypothesis which stated no significant difference was rejected because of the mean differences. Therefore, there was a significant difference in the mean performance scores of students taught algebraic word

problems concepts using Fast-Draw and Lecture method. This implies that Fast-Draw Model practice in algebraic word problem solving produces much more challenging instruction for students and, thus produces improved performance.

Null Hypothesis three: There is no significant difference in the mean performance scores of students taught algebraic word problems solving concepts using Polya Model of instruction and Lecture method.

This null hypothesis was tested using inferential statistics of independent samples t-test. The results of the analysis were presented in Table 4.5(c).

Table 4.5(c) Summary of independent samples t-test on performance of students taught algebraic word problems using Polya Model of instruction and the Lecture method.

Treatment	N	Mean	SD	Mean Difference	t	df	P
Polya	107	54.37	12.462	30.058	21.901	217	.000
Lecture method	111	24.31	7.173				
Total	**218**						

Table 4.5(c) Presented means and standard deviations on performance scores of students taught algebraic word problems using Polya Model instructional strategy and Lecture method. The mean performance score for Polya instructional strategy was 54.37 (SD=12.462) and that of Lecture method was 24.31 (SD=7.173). The mean difference between the two strategies was 30.058. The 95% confidence interval of the difference was between 27.353 to 32.763. This is supported by t(217)=21.901, p=0.001;The effect size tells us the strength of the relationship, given us some practical and theoretical idea about the significant of our results. Therefore, the null hypothesis which stated no significant difference was rejected because of the mean differences. Therefore, there was a significant difference in the mean performance scores of students taught algebraic word problems solving concepts using Polya Model and Lecture method. This implies that Polya Model practice in algebraic word problem solving produces much more challenging instruction for students and, thus produces improved performance. The null hypothesis which stated no significant difference was rejected because of the mean differences in the performance when compared. Therefore, there was a significant difference in the mean performance scores of students taught algebraic word problems solving concepts using Polya Model of instruction and Lecture method.

Null Hypothesis four: There is no significant difference between the mean performance scores of students taught algebraic word problems concepts using Fast-Draw Model of instruction and Polya Model of instruction.

This null hypothesis was tested using inferential statistics of independent samples t-test. The results of the analysis were presented in Table 4.5(d).

Table 4.5(d) Summary of independent samples t-test on performance of students taught algebraic word problems solving using Fast-Draw and Polya Models of instruction

Treatment	N	Mean	SD	Mean Difference	t	df	P
Fast Draw	106	61.59	9.584	7.331	4.836	214	.000
Polya	109	54.26	12.452				
Total	**215**						

Table 4.5(d) Presented means and standard deviations on students' performance taught algebraic word problems solving using Fast-Draw and Polya Models. The mean performance scores for Fast-Draw instructional strategy was 61.59 (SD=9.584) and that of Polya was 54.26 (SD=12.452). The mean difference between the two strategies was 7.331. The 95% confidence interval of the difference was between 4.343 to 10.319. This is supported by t(214)=4.836, p=0.001; The effect size tells us the strength of the relationship, given us some practical and theoretical idea about the significant of our results. Therefore, the null hypothesis which stated no significant difference was rejected because of the mean differences. Therefore, there was a significant difference in the mean performance scores of students taught algebraic word problems solving concepts using Fast-Draw Model and Polya Model. This implies that Fast-Draw Model practice in algebraic word problem solving produces much more challenging instruction for students and, thus produces improved performance. The null hypothesis which stated no significant difference was rejected because of the mean differences in the performance when compared. Therefore, there was a significant difference in the mean performance scores of students taught algebraic word problems solving concepts using Fast-Draw Model of instruction and Polya Model. Therefore, there was a significant difference between the mean performance scores of students taught algebraic word problems solving concepts using Fast-Draw Model of instruction and Polya Model of instruction. This implies that Fast-Draw Model is stronger than Polya Model in solving algebraic word problems at JSS two level.

Null Hypothesis Five: There is no significant gender difference in the mean academic performance scores between students taught algebraic word problems solving concepts using Fast-Draw and Polya Models of instructions and those taught same concepts with Lecture method.
This null hypothesis was tested using inferential statistics of analysis of variance. The results of the analysis were presented in Table 4.5(e).

Table 4.5(e) Summary of analysis of variance on gender performance of students taught algebraic word problem solving using Fast-Draw and Polya Models of instruction and the Lecture method.

Source		Type III Sum of Squares	Df	Mean Square	F	Sig.
Sex	Hypothesis	13.702	1	13.702	.017	.919
	Error	828.375	1	828.375[b]		
Treatment	Hypothesis	64391.413	1	64391.413	77.732	.000
	Error	828.375	1	828.375[b]		
Sex * Treatment	Hypothesis	828.375	1	828.375	12.997	.072
	Error	20649.998	324	63.735[c]		

a. MS (treatment)
b. MS (sex * treatment)
c. MS (Error)

Table 4.5(e) Presented means and standard deviations on gender performance scores of students taught algebraic word problems solving using Fast-Draw and Polya Models and Lecture method. The mean performance scores for male students taught using Fast-Draw and Polya Models instructional strategies was 52.464 (SE=0.761) and that of male students taught using Lecture method was 26.140 (SE=1.057). The 95% confidence interval of the difference for male taught using Fast-Draw and Polya instructional strategies was between 50.966 to 53.961, and that of male students taught using Lecture method was between 24.060 to 28.221. The mean performance scores for female students taught using Fast-Draw and Polya instructional strategies was 55.398 (SE=0.768) and that of female students taught using Lecture method was 22.340 (SE=1.097). The 95% confidence interval of the difference for female taught using Fast-Draw and Polya instructional strategies was between 53.887 to 56.909, and that of female students taught using Lecture method was between 20.182 to 24.497. This is supported by F(1,324)=0.017), p=0.919, the null hypothesis which stated no significant difference in performance between gender was retained. Therefore, there was no significant gender difference in the mean academic performance scores between students taught algebraic word problems solving concepts using Fast-Draw and Polya

Models of instructions and those taught same concepts with Lecture method. Again, for treatment F (1.324) =77.732, p=0.000; the null hypothesis which stated the significant difference was retained. Therefore, there was no significant difference in the mean academic performance scores between students taught algebraic word problems solving concepts using Fast-Draw and Polya Models of instructions and those taught same concepts with Lecture method. Finally, when gender and treatment were compared F (1,324) =12.997, p=0.072; the null hypothesis which stated no significant difference was rejected. Therefore, there was a significant gender difference in the mean academic performance scores between students taught algebraic word problems solving concepts using Fast-Draw and Polya models of instructions and those taught same concepts with Lecture method. That is there was a significant difference in the way both experimental and control groups perceived algebraic word problems solving after the treatment. Therefore, it can be concluded based on the sampled, three hundred and twenty six (326) students post tested the three models used were not gender balanced

Null Hypothesis six: There is no significant difference in the retention ability of students taught algebraic word problems solving using Fast-Draw and Polya Models of instruction and their counterpart taught same concepts with Lecture method.
This null hypothesis was tested using inferential statistics of independent samples t-test. The results of the analysis were presented in Table 4.5(f).

Table 4.5(f) Summary of independent samples t-test on retention ability of students taught algebraic word problems solving using Fast-Draw and Polya Models of instruction and the Lecture method

Treatment	N	Mean	SD	Mean Difference	t	df	P
Fast Draw and Polya	215	60.61	10.411	34.992	31.923	324	.000
Lecture method	111	25.62	6.944				
Total	**326**						

Table 4.5(f) Presented means and standard deviations on retention ability of students taught algebraic word problems solving using Fast-Draw and Polya Models of instruction and the Lecture method. The mean retention score for Fast-Draw and Polya instructional strategy was 60.61 (SD=10.411) and that of Lecture method was 25.62 (SD=6.944). The magnitude of the difference is the mean effect size (mean difference 34.992). The 95% confidence interval of the difference

was between 32.836 to 37.149. This is supported by t(324)=31.923, p=0.001; It is was statistically large. That is 95% of the variance in the retention is explained by the type of teaching method. The null hypothesis which stated no significant difference was rejected. Therefore, there was a significant difference in retention ability of students taught algebraic word problems solving using Fast-Draw and Polya Models of instruction and their counterpart taught same concepts with Lecture method. This implies that active teaching strategies were prepared than passive strategies.

4.2 Summary of Findings

The aim of using the strategies, Fast-Draw model, Polya Model and Lecture method in the study was to answer six (6) research questions that relate to Fast-Draw, Polya Models and the Conventional lecture method of instructions. The answers to these questions provide the researcher with an understanding of how Fast-Draw Model, Polya Model and the Conventional method help students learn `and retain information. The findings showed that:

i. a significant difference in the change of attitude was found when students were taught algebraic word problems solving concepts using Fast-Draw and Polya Models of instruction and the Lecture method of teaching.
ii. There exist a significant difference in retention ability of students taught algebraic word problems solving using Fast-Draw and Polya Models of instruction and their counterpart taught same concepts with Lecture method.
iii. a significant difference exists in the mean performance scores of students taught algebraic word problems solving concepts using Fast-Draw Model and the Lecture method.
iv. a significant difference was found in the mean performance scores of students taught algebraic word problems concepts using Polya model of instruction and Lecture method.
v. there exist a significant difference between the mean performance scores of students taught algebraic word problems solving concepts using Fast-Draw Model of instruction and Polya Model of instruction.

vi. a significant gender difference exists in the mean academic performance scores between students taught algebraic word problems solving concepts using Fast-Draw and Polya models of instructions and those taught same concepts with Lecture method

4.3 Discussions of Findings

The purpose of this study was to evaluate the effectiveness of Fast-Draw and Polya Models of instruction on solving algebraic word problems for JSS 2 students. The findings were limited by the size of the sample of the students participating. The study was also limited due to time constraint placed upon the various phases within a 10-week period. Also the study faces regional limitation of being conducted in only four (4) zones out of fourteen education zones in Kano State. It was analyzed to see whether there would be advancement in attitude, retention and performance positively of the students following the methods of instructions. With this objective in mind, the problem of this study has been expressed as: Does Fast-Draw and Polya Models in JSS 2 have any effects on attitude, retention and performance of students' in algebraic word problem solving?

The findings from the present study revealed empirical partial consistency with the previous studies claiming that teaching strategies affect student's mathematics performance, attitude and achievement. In this present study, at the end of the experiment there has been some significant differences observed between the groups that has been exposed to the instructions of Fast-Draw and Polya Models and those that which has not been, in terms of knowledge, comprehension, skills and change in attitude. This findings support the earlier findings of (Young, & Fry, 2008, Tok, Ozgen & Dos, 2010, Moga, 2012) that showed improvement in attitude, retention and performance when students are exposed to training.

Findings from this study showed that there exist a significant difference in the change of attitude between students taught algebraic word problem solving using Fast-Draw and Polya Models of instruction and those taught with the Conventional lecture method of teaching. The attitude of the respondent in the experimental and control groups was measured in terms of

confidence in learning algebraic word problem solving, attitude towards success in word problem solving and the teachers method of instruction. This support the results of Girl (2008) which shows that when learning bring pleasant experience it is likely to generate satisfaction and when a lesson is interesting and enjoyable, it is likely that students develop positive attitudes towards learning.

Before the exposure to Fast-Draw, Polya Models and Conventional lecture method, the overall attitude towards algebraic word problems solving of the participants in the experimental and control groups were moderately favorable. Data revealed that the mean ratings of the experimental groups in terms of attitudinal domain have improved after the study. This means that the participants in the experimental groups benefited from the Fast-Draw and Polya Models when it comes to boosting their confidence, reducing frustration in learning algebraic word problems solving and developing more positive attitude. It has been shown through this study that mathematics attitude is the most powerful predictor of mathematics achievement among JSS 2 students

The results also indicate that a larger percentage of the participants respondent favorably to most of the items on the attitudinarian given before the study. This suggests that students felt positive attitude towards the particular items. The participants also expressed favorable response to the same items on the attitudinarian after the study, most often indicating an increase in positive attitude. This is interesting as it provides evidence that students in the experimental groups may have already identified with the word problems they were learning. It is also interesting to note that, that nearly all the response on the attitudinarian increase. This support the submission of Akinsola, Olowojaiye (2008) that students attitude towards word problems solving could be enhanced through effective teaching strategies. It has in fact been confirmed that effective teaching strategies can create positive attitude on the students towards school subject (Girl, 2008).

The overall attitude of the participants in the experimental groups after they were exposed to the Fast-Draw and Polya Models was highly favorable. These results might be explained by supporting environment created by the teachers and the inclusion of hands-on activities. The findings also confirmed the research results of Depoalo and McLaren (2006) that attitude of the students towards quantitative course improved after they were exposed to hands-on activities and were given real world examples to motivate them. Thus, it can be concluded that improved attitude are related to increase performance. This is against the motion of some researches (Schibein, 2009 cited in Adewuyi (2014) who justified that the students' attitude does not influence students' achievement. In other words it shows that one's attitude to mathematics may not be changed irrespective of the school teaching instruction and or method used. This shows that there is need to develop genuine attitude change as it may bring about interest, and positive attitude towards the subject. Therefore, if teacher's are aware of and address negative attitudes pupils/students may have more success with algebraic word problems solving in particular and mathematics in general.

The findings from the study shows that there exist significant difference in the retention ability of students taught algebraic word problems solving using Fast-Draw and Polya Models and their counterpart in the Conventional method group. These findings agree with the findings of Idris (2016) and Aminu (2017) that there was a significant difference in the retention level in Algebra and Algebraic Processes concepts respectively between the experimental groups and the control groups showing that the teaching strategies have considerable impact on improving retention level of students. There was also significant difference in the retention level between Fast-Draw Model and Polya Model and between Polya Model and Conventional groups as observed from the results. The possible explanation for these low performance among the control group on the retention test is that when their recall facts to achieve a goal in problem solving, they did not possess either the strategy. In

fact their memorization of facts, which was synonymous to rote-recall and practice, did little to promote computational efficacy.

These findings were in line with studies carried out by Chiasonn, Kurumeh and Obida (2011) and Colbum (2015) who found that only 15% of the students were paying attention after the lecture method of teaching had passed ten minutes and only few students could retain what was discussed. Traditional methods of teaching word problems solving mainly relies upon lecturing facts, forcing students to memorize resulting in lack of motivation, and poor content knowledge (Burra, 2013, Papadimitrious, 2014). The findings of the study also agrees with that of Idris (2016) who discovered that the ability to remember takes place more effectively when experiences are passed across to the learner through appropriate instructional methods. These findings opposes the findings of Ozomadu (2014) who revealed no significant interaction between teaching method and gender on students' retention in word problem solving.

Findings from the study showed that there exist a significant difference in the mean performance scores of students taught algebraic word problems solving concepts using Fast-Draw Model and Conventional lecture method. An activity based lesson in word problems solving stimulate students thinking, and encourage students to discover new knowledge through hands-on. This confirms the findings of Kajuru, Bolaji and Kauru (2014) that there was significant difference in the performance of the students taught Trigonometry concepts due to treatment. The findings revealed the efficacy of the use of Fast-Draw Model in enhancing students' performance in word problems solving. These findings contradict Visser (2012) who found that students in the lecture-based group performed significantly better than the treatment group in word problem solving. These findings were in conformity with the findings of Akinbola and Ado (2016), that skills and knowledge acquisition are not passive and rote learning, but involved active participation of the learner through construction, hands-on and minds-on activities.

The investigator of this present study observed that in the control group where conventional method of teaching was used, students were busy in taking notes to internalize the information and only 30 to 40% of the students retained what was discussed. The results of this study support the work of Mercer and Miller (1997) which showed that the Fast-Draw Model increased the students' achievement and retention in word problems solving. In addition Cassel and Raid (2009) have investigated the effects of Fast-Draw Model strategy in developing the mathematical skills of 56 students. The result of the study revealed that the problems solving skills of both students have improved. Moreover, it can be argued that this strategy has an impact on academic performance, since it guides students into discovering the important information in a problem, setting up the arithmetic operation, in a right way and solve the problem (Raid and Lienemann, 2006). From the results of this study it shows that to solve a word problem successfully, students must not only be able to perform the necessary computation but must also understand the question that are being asked, identify the relevant information within the problem, and determine the specific operation needed to solve the problem. In this intervention students learn algebraic word problems solving through an 8-step strategy and 4-step strategy for solving word problems, along with self-regulation procedure to assist them in completing the strategies successfully.

The findings from the study showed that significant difference exist in the mean performance scores between Polya Model group and traditional method group. Based on the findings the potency of Polya Model of word problems solving method was revealed. Traditional methods of teaching word problems solving mainly relies upon lecturing facts, forcing students to memorize resulting in lack of motivation, poor content knowledge. These findings corroborates those of Adeniran, (2011), Eze (2012), Burra, (2013), Papadimitrious, (2014), This indicate the efficacy of the teaching model as reliable for improving the academic performance of students particularly in the teaching of algebraic word problems solving These findings were also in support of the work of Anamuah Mensah (2015) who declare that the use

of word problems solving approaches in mathematics lessons are limited in most of our basic schools because teachers spend most of their mathematics teaching time to lectures and writes notes for the students to copy.

According to McIntosh and Jarreh (2016) problem solving lessons in mathematics requires the teachers to make complex decision such as, matching the level of students to the level of difficulty of problems to be assigned, choosing the appropriate time and strategies to asses students as well as ensuring that students retained the sense of ownership of the strategy used to solve problems. From the research results it was found that Polya's Model problems solving can contribute significantly to the outcome of mathematics learning. The four steps process of Polya Model for problems solving helps students to keep in mind the common sense nature of mathematics and mathematical problem solving. These findings support the assertion of Richardson (2016) that practical knowledge is acquired through experience. Findings of Nneji(2013) also showed that students taught with Polya George Model of problems solving achieved higher and retained more than those taught with expository method.

Findings from this study also showed that there was a difference between the performance scores of students taught algebraic word problems solving using Fast-Draw Model and those taught same concepts with Polya Model. The results showed that scores increased when Fast-Draw strategy was used compared to those in the base line, which may indicate that the Fast-Draw Model strategy can be used with success to improve students' algebraic word problem solving skills. This study adopted miller and Mercer's (1992) theory of Fast-Draw which breaks a word problem into eight components that students could follow to solve a given problem which can results into a higher percentage of correct answers and therefore, an increase in test scores. The study indicated the existence of significant difference between the performance of students in the Fast-Draw group and those in the Polya group in favor of those exposed to Fast-Draw Model as shown in table 4.10. The participant demonstrates a positive attitude towards using the technique. They reported that the strategy of Fast-Draw Model helps them to solve

more word problem better. This implies that Fast-Draw Model was more effective than Polya Model in teaching and learning of algebraic word problems solving aspect of general mathematics at JSS level.

The findings of the study also showed that students taught using Fast-Draw Model of instruction perform better in the algebraic word problems solving posttest administer than their counterparts taught using Polya Model. This showed that the Fast-Draw Model of instruction is the most effective method of instruction out of the three instructional models used in the study. The experimental group taught using Polya Model was the next group that performs higher in algebraic word problems solving posttest administered, while the control group that was taught using the Conventional Method had the lowest performance. The observed low performance in respect of the control group might be due to the fact that they did not have the opportunities to explore their problems with the teacher.

The use of Fast-Draw Model either as a technique, strategy or self-learning device was more effective in word problem solving then either Polya Model or the Conventional method. Furthermore, the superiority of Fast-Draw Model strategy over Polya Model and the Conventional Method could be attributed to the logical and sequential manner with which instructions are presented in Fast-Draw Model technique and practical skills in teaching. A student who is exposed to this type of strategy is more likely to possess a meaningful in-depth knowledge of the content area. Such students would be able to organize their thought in an orderly manner that is essential for problems solving and acquisition of basic practical skills in mathematics.

The findings from this study also showed that significant gender difference exist in the mean performance scores between students taught algebraic word problems solving concepts using Fast-Draw and Polya Mdels of instruction and those taught same concepts with Conventional lecture method of instruction. From the results obtained, male students performed better than female students taught by Fast-Draw, Polya or the conventional method. The findings were in

line with the findings of Duyilemi and Bolajoko (2014) who observed that male students had high achievement scores than their female counterparts in the experimental group. The study differs with that of Iji (2013) who showed no significant difference between students exposed to problem solving strategy and those exposed to conventional teaching method. The result is in disagreement with the findings of Abubakar and Ogugue (2011) and Wabuke (2013) who found no significant difference in science achievement of boys and girls exposed to activity-based method of instruction. The findings of this study was at variance also with the findings of Achor, Imoko and Jimin (2012) who reveals that male and female students mean gain in the group taught with active learning strategy did not significantly differ. These findings were supported by the findings of several researches on the interactional effects of treatment given to students and their gender with respect to their mean scores in science and other fields (Nwagbo and obiekwe, 2010, Ameh and Dantani 2012, Abubakar and Bada 2013, Ajai, Imoko and O'Kwu 2013). These findings were in line also with the earlier findings of Daluba (2013), Omwirhiren and Khalil (2016). These researches noted in their separate studies that the male students in the experimental groups who were allowed to interact and allowed to carry out activities individually or in groups obtained higher learning outcome than the female in the control groups, who were mere passive listeners in their classes.

This study is in contrast with the findings of Rabab'h, Veloo and Perumal (2014) who conclude that female students perform better than male counterpart in mathematics word problems solving. These findings were at variance with the findings of Adaramola (2014), Onwuka (2015), Bot and Iliya (2015) where it was found that there was no significant gender difference among the subjects in mathematics when they were taught with certain strategies and technique. The findings contradict the findings of Ginga (2017) which showed that there was no significant difference between the performance of male and female SS 11 students taught algebraic processes using social constructivism instructional strategy and those taught using Conventional method of teaching.

All genuine learning were active not passive. It is the process of recovery in which the students were the main agent not the teacher. The findings from this study revealed that adoption of appropriate teaching approaches in teaching algebraic word problems solving enhances students' performance, attitude and level of retention in mathematics learning. The findings were in line with assertion of Inyang (2013) that activity based teaching and learning allows students to explore their environment and discover nature. Students were encouraged to ask their own question, explained analogies and come to their own conclusion, and as a result; they make better grades. This implies that teaching approaches had effect on attitude, performance and retention abilities. This agrees with Harbor Peter (2011) assertion that low achievement of students in mathematics could therefore be attributed to non-utilization of appropriate teaching approaches. Thus, different teaching approaches, technique, methods and ways can influence the outcome in mathematics learning.

CHAPTER FIVE
SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

The purpose of this study was to compare the effectiveness of two word problem solving models, Fast-Draw and Polya, on Junior Secondary School Students (JSS). This Chapter

presented summary, purpose of the study, problem of the study, describes the results and states recommendations for further research. The study aimed at comparing experimentally the effects of two models of instructions on students' attitude, retention and performance in algebraic word problem solving.

Summary
Conclusions
Contributions to Knowledge
Recommendations
Scope of the Study
Suggestions for Further Studies

5.2 Summary

The study compared the learning resulting from a Fast-Draw Model of instruction in which students were guided through eight-steps of algebraic word problem solving and four-steps of Polya Model of instruction. In the Fast-Draw Model learning opportunities were organize in a manner in which the students were guided through the eight-steps and activities which encourage application of knowledge by the students.

Specifically the study attempted to establish the level of cognition function (ability to recall facts and applying knowledge) retention and attitude of JSS 2 students in classes taught by two different models of instruction, Fast-Draw and Polya Models, and compared it with Conventional lecture method. Six research questions and six hypotheses were formulated and subjected to statistical tests. Fifteen lessons with accompanying teaching guides for each model of instruction were developed, pilot tested and reviewed b xperts to assure content validity and validity of the methods employed as well as to test the accepıability of the lessons for JSS 2 levels. The researcher and research assistances who were the teachers of the respective schools administered the three treatments. Each of these teachers taught in a class using one of the three methods.

. The experiment took place in four (4) educational zones with JSS 2 students on topics in algebraic word problems solving with a total of three hundred and fifty two (352) students in seven (7) classes. Schools that were selected randomly met the criteria of having ten years of presenting students for BECE, qualified teachers of ten years teaching experience, having at least two arms.

Plans were made for each class to have five contact periods in a day, five weeks were used, and one week for revision and after two weeks was used for retention test.

Data was gathered for each student in the study. An attitudinal device was administered on the first and last day of the treatment in each school, before any teaching had been done, and at the culmination of the treatment in each classroom. The items were the same for pre and posttest administered. All measures were taken after two weeks after the treatment to test retention and long-term transfer.

The algebraic word problems solving attitudinal questionnaire was made up of a knowledge subset, comprehension and application subset which were used to assess students' ability to comprehend, recall facts and to apply knowledge as a result of the model of instruction received. The independent variables of interest in this study were the two models of instructions: Fast-Draw and Polya Models. The subjects, three hundred and twenty six students (326), in both experimental and control classes were given separate treatment and findings were reported for each.

a. Significant difference in the change of attitude was found as a result of the three treatments,

b. Significant difference exists in retention ability of students in the three groups taught algebraic word problems solving.

c. There was significant difference in the mean performance scores between the students in the Fast-Draw Model and Conventional method group in favor of the Fast-Draw group.

d. Significant difference was found in the mean performance scores between the students in the Polya Model group and Lecture Method group in favor of the Plya Model group.

e. There was significant difference in the mean performance scores between the students in the Fast-Draw Model group and the Polya Model group in favor of Fast-Draw Model group.

f. Significant gender difference exists in the mean academic performance scores between students taught algebraic word problems solving concepts using Fast-Draw and Polya Models of instructions and those taught same concepts with Conventional lecture method.

5.3 Conclusion

The results of this study were additions to empirical evidence available on the difficulties in the teaching and learning of algebraic word problems solving through problems solving approaches in particular and mathematics in general. Solving word problem is typically an area of concern for middle school students, especially for those at lower basic level. The National Policy on Education revised (NPE, 2014) mathematics curriculum requires JSS students to attain proficiency in mathematics problem solving. Therefore, it is vital that students at lower basic level to learn strategies and methods to help them solve these challenging problems. The data from this study support the literature to the extent that when students were able to develop a connectedness through real life experience, they are able to apply that learning to other situations.

It is evident from the findings of this study that the use of Fast-Draw Model strategy could provide a good way for students to learn algebraic word problems solving. The high academic performance scores as indicated by the posttest results for the Fast-Draw Model group students immediately following the units of instruction indicated that. In the Fast-Draw Model more than Poly Model or the Conventional lecture method; orderly arranged ambient as well as positive attitude generates advantageous for learning process and enable students learn better. The students maintain the eagerness for longer period of time and participate effectively in group activities. The results also indicate that students under Fast-Draw Model work through a series of steps and utilize mathematics reasoning skills to organize their thinking and better prepare for problems solving.

This study provide ample evidence that Fast-Draw Model approach of teaching algebraic word problems solving create active learning environment which is more effective then Polya Model and Conventional method for promoting academic performance, enhancing conceptual understanding, higher order thinking skills and developing a more positive attitude towards algebraic word problems solving. These showed that active learning instructional strategies can be created and used to engage students in (a) thinking critically or creatively (b) speaking with a partner, in a group, or with entire class, (c) expressing ideas through writing, (d) exploring personal attitudes and values, giving and receiving feedback, and (f) reflecting upon the learning process.

Gender inequality in the teaching/learning mathematics is a task that will still take some time if teachers continue using the teacher-centered method of teaching. When the effect of gender on students' performance was investigated it was found that there was significant difference between male and female with regard to performance in algebraic word problems solving using fast-draw and Polya models and the conventional method. This however showed that fast-draw and Polya problem solving models are gender bias. The results show interaction between the instructional strategies and gender in terms of student's performance.

Teachers must be equipped with the skills that are necessary for improving students' attitude, retention and performance in order to successfully teach and accommodate the needs of all pupils/students. Understanding and using specific models/strategies will allow teachers to improve students' attitude, level of retention and performance; provide wider range of instructional alternative and promote diversified learning methods for any degree of students' abilities. It is a teacher's awareness of the various tools and resources that builds a bridge across educational achievement gaps. Becoming an expert on these models/strategies is concrete ways to ensure that all students have better chance to learn retain and perform better.

From the results of the study, Fast-Draw Model showed great promise in helping students to improve their algebraic word problems solving skills, increase performance and developed confidence in solving word problem. If the model proposed by this study is adopted in algebraic word problems solving teaching and learning it will boost the performance of students in skills acquisition, problem solving ability and developing of the right type of attitude and retention ability towards mathematics as a subject.

On the basis of these findings in this study the following conclusions were drawn:

1, Students taught through Fast-Draw Model performed better than those taught by the Conventional lecture method

2. Differences between the achievement levels were due to problem solving based strategy otherwise both groups have equal basic knowledge of algebraic word problems solving.

3. The study showed that using Fast-Draw Model which breaks a problem into steps/component were students could follow to solve problems, which may results in higher percentage of correct answers and therefore an increase in test scores.

4. Fast-Draw Model results in meaningful, social connection with the teacher, students, peers and groups in the classroom.

5. The use of the model (Fast-Draw) can enhanced the attitude of the students towards algebraic word problems solving positively more than Polya or the Conventional method of teaching.

6. The present study showed that Fast-Draw and Polya Models methods advocate social constructivist have enhanced the performance of students after exposure.

7. The use of Fast-Draw and Polya Models strategies in the teaching of algebraic word problems solving enhances academic performance, attitude and retention level towards algebraic word problems solving JSS 2 students.

5.4 Contribution to Knowledge

The ability to experience and explore the application of knowledge and skills provides valuable connections between what is known, what is learned and why it is important (Geary, 2004). The society is constantly in such of a magic, one size-fits-all situations. The need for better strategy that would address students' word problems solving and enhances attitude, retention ability and performance in teaching and learning of algebraic word problems solving led to the use of Fast-Draw and Polya Models strategies. The study has established the following as its contribution to knowledge;

1. The researcher tested the new model of instruction of algebraic word problems solving (Fast-Draw Model) and compared it with existing Polya Model of word problem solving on the Nigerian soil which has not been done before either in Kano State or Nigeria to the best of my knowledge, and from the literature known to the researcher.

2. Fast-Draw Model of instruction has further established to enable retention and attitude of JSS 2 students towards solving algebraic word problems.

3. It was established that both Fast-Draw and Polya Models improves the problem solving of students and thus, enhances their performance.

5. The study brings to limelight that Fast-Draw Model exist and can be used to teach more word problems topics at any level of our educational system more than Polya Model of instruction or the dominant Conventional teacher-center Method.

6. The teaching strategies adopted (Fast-Draw and Polya Models) improved students attitude, retention ability and academic performance during the study. This suggests that, combination of the two models can be used in teaching to improve academic performance in JSS or SSS classes.

7. The findings have contributed new knowledge to the existing literature.

5.5 Recommendations

This study investigated the effects of Fast-Draw and Polya Models on attitude, retention and performance in algebraic word problems solving on JSS 2 students in Kano State, Nigeria. The limiting parameters of this study dictated that a quasi-experimental design be utilized. The study was also isolated to four educational zones out of fourteen (14) zonal education offices in Kano State with a population of five thousand three hundred and seventy seven (5377) in which a sample of three hundred and fifty two (352) was drawn to participate. Based on the results of this study, several recommendations were made.

1. Further study can be carried out in related area such as linear and quadratic equation, to compare the efficacy of Fast-Draw Model, Polya Model and the Conventional Method of teaching word problems solving.
2. All the three instructional methodologies used have advantages. It is recommended that further

1. Researches into the advantages inherent in combining of these methods of instruction and the planning strategies can be carried out to enhance a variety of educational needs and situations.
2. Since this study utilized a population of JSS 2, it is recommended that the aforementioned study include multiple levels such as senior secondary one or two.

3. Teachers should use Fast-Draw Model in combination with other models in teaching other word problems solving. But just, they need to conceptualize their role as facilitators in the development of the students' mathematical construction rather than sole source of mathematics knowledge while employing Fast-Draw Model in the classroom.
4. Extensive training programs, seminars and workshops should be organize for mathematics
5. Teachers in the upper and lower basic classes to employ Fast-Draw Model in the classroom
6. The study provided that Fast-Draw Model is more effective method of instruction for teaching and learning of algebraic word problems solving as compared to Polya Model and the Conventional Method of teaching. Therefore, teachers of mathematics should use Fast-Draw Model to improve students' academic performance, develop more positive attitude and retain more knowledge in mathematics.
7. Teachers should be encouraged to adopt problem-based solving method in their teaching practices since these has been proved to be an effective method of handling word problems in mathematics.

5.6 Scope of the Study

Although the results of this study indicated greater promise for using Fast-Draw Model strategies in teaching algebraic word problems solving skills to students at JSS level, there are some limitations that should be acknowledged. Some of the limitations observed during the study were as follows:

1. Findings from this study were applicable to JSS 2 classes only. If the models of instruction had been applied to classroom for extended period of time, different results might have been produced this can be particularly true of the Fast-Draw Model of instruction.
2. This study was conducted only on the following topics proportion, rate, fractions, invers operation, sharing and JSS 2 students. Therefore, the findings of the study were generalized to this grade level and to these topics. Further studies can offer opportunities to handle teaching using Fast-Draw Model by focusing on different topics or subjects and class level

3. Grouping of students was not easy because of uniformity that was expected in each group, comparing of the height, low, medium, gender, abilities among others.
4. The study included a limited amount of response from the Attitudinal Questionnaire. The data gathered represent a small portion of the population on the impact of how effective Fast-Draw Model was in the classroom. Increasing the data size could add more validity and reliability to this study.
5. The length of the study period was limited which results in a shorter generalization (Ten weeks).

5.7 Suggestion for Further Studies

The study aimed at examining the effects of two word problems solving models on attitude, retention and performance among JSS 2 students in Kano State, Nigeria. The study suggested that further studies should be carried out as follow;

1. Further studies can offer opportunities to handle teaching other topics in mathematics using Fast-Draw Model on different levels.
2. Fast-Draw and Polya Models can be combined with other model notably demonstration method in the teaching of algebraic word problems solving to test for their efficacy in improving attitude retention and performance of students particularly at the lower or upper secondary schools.
3. Further studies can be redirected to cover other areas of mathematics since this study was restricted to algebraic word problems solving at JSS level only.
4. The study can be replicated in other areas within the state and other states in Nigeria and abroad to determine the efficacy and effectiveness of Fast-Draw and Polya Models as teaching strategies on student's attitude, retention and performance

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Table 1.1
Students Performance in Mathematics in BECE (2010—2018.)

Year	% A—C	% Below C
2010	32.7	67.3
2011	31.0	69
2012	28.7	71.3
2013	59.3	40.7
2014	33.2	66.8
2015	48.8	51.2
2016	56.7	43.3
2017	44.9	55.1
2018	39.3	60.7

Saucers: Kano Education Resource Department (KERD), Ministry of Education, Kano State (2018)

Table 3.3
Result of Pilot Test using Algebraic word Problems Solving Performance Test (AWPSPT)

1.	56	11.	27	21.	20	31	37		
2.	73	12.	47	22.	57	32.	43		
3.	30	13.	40	23.	20	33.	53		
4.	30	14.	67	24.	30	34.	23		
5.	50	15.	23	25.	40	35.	70		
6.	23	16.	27	26.	10	36.	27		
7.	43	17.	57	27.	53	37.	27		
8.	60	18.	33	28.	50	38.	37		
9.	23	19.	40	29.	27				
10.	37	20.	17	30.	33				

APPENDIX 1

Instructional Guide for the Experimental Group 1 (Fast-Draw Model)

Week one (1)

Topic: Sharing

Class: Junior secondary school two 2 (JSS 11)

Duration: 40 minutes

Rational: To enable students solve every day problems on sharing.

Objective: By the end of the lesson the students are expected to be able to solve problems involving sharing.

Learning resources: Pieces of stones/sticks, students' they, chart and markers bottle tops.

Grouping: There is going to be five groups and each group will contains a presenter, a facilitator, a time keeper and an encourager who will be encouraging and motivating the group members.

Procedure

Sample Lesson: Musa wants to distribute **24** oranges equally to **6** students. How many oranges should Musa give to each student?

1. ***Find what you are solving*.**

   In this step, the students were asked to look for and underline the question sentence. For example: *The students underline the sentence "*How many oranges should Musa give to each student?"

   - Musa wants to distribute **24** oranges equally to **6** students. How many oranges should Musa give to each student?

2. ***Ask yourself, "What information is given?"***

   In this step the students were asked to find and circle the number phrases in the problem. For example:

   - Musa wants to distribute **24** equally to **6** student How many oranges should Musa give to each student?

3. ***Set up the equation***

   In this step the students were asked to set up an equation using the numbers in the correct order

   For example:

   - **24** oranges----------**6** students =

2 ***Tie down the sign***

In this step, the students were asked to read the underline question sentence and explain which operation they would use. For example, a student explained that the sentence;

"How many oranges Musa give to each student?" means "division operation" and those 24 oranges would be divided into 6 students for Musa to be able to give each student an equal number of oranges.

- **24** oranges-- ÷ --**6** students =

5. Discover the sign

In this step the students were asked to discover the operation sign, circle it and state it. For example

- **24** oranges ÷ **6** students =

.6.Read the problem

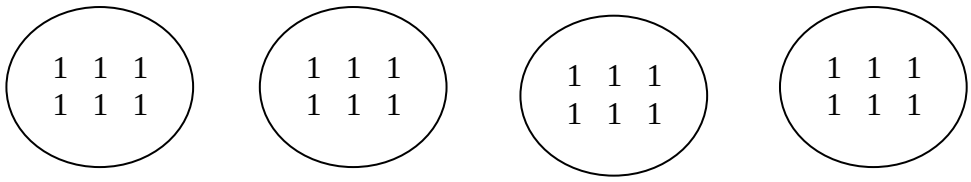
The students were asked to read aloud the newly formulated mathematical version of the problem. For example: "The problem I/we want to solve is to divide **24** by **6**."

7 Answer the problem or draw

In this step the students were asked to visualize the answer by drawing tallies and circles. For example:

24 oranges ÷ **6** students =

1. The students drew as much as tallies as the number of the dividend (24) 111111111111111111111111
2. The tallies were circled according to the value of the divisor (**6**)



3. The number of the circles that showed the quotient was counted. **24** ÷ **6** = **4**

8. ***Write the answer***

In this step the students were asked to write down their answers. For example, they wrote that the number of oranges that each student could get was **4**.

24 oranges ÷ **6** students = **4**

The teacher always guided the students while the above mentioned steps of fast draw model were being applied. He should try to encourage the students to think about the problem by posing different questions especially within the first applications where the students had problem. For example he may ask: "Which operation should we use in order Musa to distribute the oranges

equally to each student?" Further the teacher can helped the students visualize their answers. (*see Appendix B2 for another sample)*

Instructional Guide for the Experimental Group 1(fast-draw)

Week two (2)

Class: Junior Secondary School two 2 (JSS 11)

Duration: 40 minutes

Rational: Use proportion in everyday life.

Objective: By the end of the lesson the students are expected to apply proportion in solving word problems.

Learning Resources: Big ruler, cardboard paper, chart and markers.

Grouping: There is going to be five groups and each group will contains a presenter, a facilitator, a time keeper and an encourager who will be encouraging and motivating the group members.

Procedure

The teacher first asks the students to write down the problem in their notebooks in the study group. Then the teacher guides them into solving the given problem using the steps of fast draw model as follow;

Sample Lesson: Our school has **7** floors. There are **12** classrooms on each floor. How many classrooms are in our school?

1. ***Find what you are solving.***

In this problem, the students were asked to look for and underline the question sentence. For example: *The students underlined the sentence* "How many classrooms are in our school?"

Our school has **7** floors. There are **12** classrooms on each floor. How many classrooms are in our school?

*2.**Ask yourself, "What information is given?"***

In this step the students were asked to find and circle the number phrases in the problem. For example: Our school has (**7**floors). There are *(***12** classrooms) on each floor.

How many classrooms are in our school?

3.Set up the equation

In this step the students were asked to set up an equation using the numbers in the correct order.

- **7** floors---------- **12** classrooms =

4. ***Tie down the sign***

In this step, the students were asked to read the underlined question sentence and explain which operation they would use. For example, a student explained that the sentence “How many classrooms are in our school?” means “multiplication operation”

- **7** floors x **12** classrooms =

*5.**Discover the sign***

In this step the students were asked to discover the operation sign circle it and state it. For example:

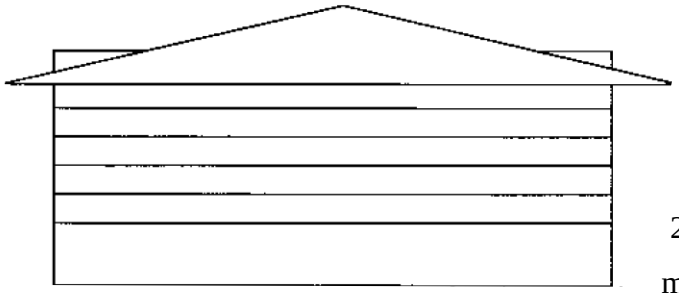
- **7** floors x **12**

6. ***Read the problem.***

The students were asked to read aloud the newly formulated mathematical version of problem. For example: "The problem I want to solve is to multiply **7** by **12**."

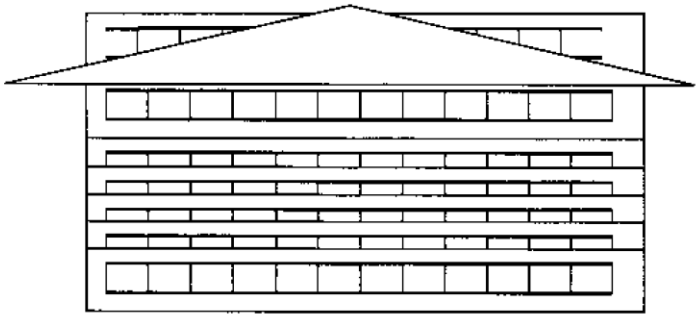
7. ***Answer the problem or draw***

In this step the students were asked to visualize the answer by drawing rectangles. For example;1. Draw rectangles for the number of groups



- **7** floors x **12** classrooms

2. Draw small rectangles to represent how many are in each group



3. Add the small rectangles in all rectangles and write the total **7** x **12** = **84** - "**7** groups of **12** equals eighty four"

8. ***Write the answer***.

In this step the students were asked to write down their answers. For example, they wrote that the number of classrooms was 84 in the school.

7 x **12** = 84

The teacher always guided the students while the above mentioned steps of fast draw model were being applied. He should try to encourage the students to think about the problem by posing different questions especially within the first applications where the students had problem. For example he may ask: “Which operation should we use in order Musa to distribute the oranges equally to each student?” Further the teacher can helped the students visualize their answers.

Week three (3)

Class: Junior Secondary School two 2 (JSS 11)

Duration: 40 minutes

Rational: Fractions, word problems

Objective: By the end of the lesson the students are expected to apply fractions in solving word problems.

Learning Resources: Big ruler, cardboard paper, chart and markers.

Grouping: There is going to be five groups and each group will contains a presenter, a facilitator, a time keeper and an encourager who will be encouraging and motivating the group members.

Procedure

The teacher first asks the students to write down the problem in their notebooks in the study group. Then the teacher guides them into solving the given problem using the steps of fast draw model as follow;

Sample Lesson: A woman shares 10 oranges among two of her children. The first child got 6/10 of all the oranges. How many oranges did the child get?

1. ***Find what you are solving.***

In this problem, the students were asked to look for and underline the question sentence. For example: The students underlined the sentence "How many oranges did the child get?"

A woman shares 10 oranges among two of her children. The first child got 6/10 of all the oranges. How many oranges did the child get?

2. ***Ask yourself***, "What information is given?"

In this step the students were asked to find and circle the number phrases in the problem. For example: There are 10 oranges and there are two children.

How many the first child get?

3. ***Set up the equation***

In this step the students were asked to set up an equation using the numbers in the correct order.

- 10 oranges---------- two children =

4. ***Tie down the sign***

In this step, the students were asked to read the underlined question sentence and explain which operation they would use. For example, a student explained that the sentence “How many oranges are there in all?” means “multiplication operation” multiply the fraction of the first child with the total oranges.

$\frac{6}{10}$ x 10 → $\frac{3}{5}$ x 10 =

5. ***Discover the sign***

In this step the students were asked to discover the operation sign circle it and state it. For example:

$\frac{6}{10}$ x 10

6***. Read the problem.***

The students were asked to read aloud the newly formulated mathematical version of problem. For example: "The problem I want to solve is to multiply 6/10 by 10."

7***. Answer the problem or draw***

In this step the students were asked to example;

10 oranges x $\frac{3}{5}$ of the first child

8***. Write the answer.***

In this step the students were asked to write down their answers. For example, they wrote that the number of oranges was 6 for the first child.

$\frac{3}{5}$ x 10 = 6

The teacher always guided the students while the above mentioned steps of fast draw model were being applied. He should try to encourage the students to think about the problem by posing different questions especially within the first applications where the students had problem. For example he may ask: “Which operation should we use in order Musa to distribute the oranges equally to each student?” Further the teacher can helped the students visualize their answers.

Week four

Class: Junior Secondary School two 2 (JSS 11)

Duration: 40 minutes

Rational: Rate.

Objective: By the end of the lesson the students are expected to apply Rate in solving word problems.

Learning Resources: Big ruler, cardboard paper, chart and markers.

Grouping: There is going to be five groups and each group will contains a presenter, a facilitator, a time keeper and an encourager who will be encouraging and motivating the group members.

Procedure

The teacher first asks the students to write down the problem in their notebooks in the study group. Then the teacher guides them into solving the given problem using the steps of fast draw model as follow;

Sample Lesson: A worker gets ₦2400 for 5 hours work. What is the rate of pay per hour?

1. ***Find what you are solving.***

In this problem, the students were asked to look for and underline the question sentence. For example: *The students underlined the sentence* "What is the rate of pay per hour?"

A worker gets ₦2400 for 5 hours work. "What is the rate of pay per hour?"

*2.**Ask yourself, "What information is given?"***

In this step the students were asked to find and circle the number phrases in the problem. For example: The amount is ₦2400.The work done is 5 hours.

What is the rate per hour?

*3.**Set up the equation***

In this step the students were asked to set up an equation using the numbers in the correct order.

- **In 5 hours the worker gets** = ₦2400

*4. **Tie down the sign***

In this step, the students were asked to read the underlined question sentence and explain which operation they would use. For example, a student explained that the sentence "what is the rate of pay per hour?" means "division operation"

- ₦2400 ÷ 5 hours =

*5.**Discover the sign***

In this step the students were asked to discover the operation sign circle it and state it. For example:

- ₦2400 ÷ 5 hours =

*6. **Read the problem.***

The students were asked to read aloud the newly formulated mathematical version of problem. For example: "The problem I want to solve is to divide ₦2400 by 5"

*7. **Answer the problem or draw***

2400 naira divided by 5 hours ⟶ ₦2400 ÷ 5 =

*8. **Write the answer.***

In this step the students were asked to write down their answers. For example, they wrote that 2400 naira divided by 5 hours is 480 naira.

₦2400 ÷ 5 = ₦480. So the hourly rate is 480 naira.

The teacher always guided the students while the above mentioned steps of fast draw model were being applied. He should try to encourage the students to think about the problem by posing different questions especially within the first applications where the students had problem. For example he may ask: “Which operation should we use in order Musa to distribute the oranges equally to each student?” Further the teacher can helped the students visualize their answers.

Week five (5)

Class: Junior Secondary School two 2 (JSS 11)

Duration: 40 minutes

Rational: Use of inverse operation in everyday life.

Objective: By the end of the lesson the students are expected to apply inverse in solving word problems.

Learning Resources: Big ruler, cardboard paper, chart and markers.

Grouping: There is going to be five groups and each group will contains a presenter, a facilitator, a time keeper and an encourager who will be encouraging and motivating the group members.

Procedure

The teacher first asks the students to write down the problem in their notebooks in the study group. Then the teacher guides them into solving the given problem using the steps of fast draw model as follow;

Sample Lesson: When Musa cycles at 16km/h, he takes 25 minutes to get to school. How long does he take when he cycles at 20 km/h?

1. ***Find what you are solving***.

In this problem, the students were asked to look for and underline the question sentence. For example: *The students underlined the sentence* "How long does he take when he cycles at 20km/h?"

When Musa cycles at 16km/h he takes 25 minutes to get to school. How long does he takes when he cycles at 20km/h?

*2.**Ask yourself, "What information is given?"***

In this step the students were asked to find and circle the number phrases in the problem. For example: He cycles at 16km/h and takes 25 minutes..

How long does he takes when he cycles at 20km/h?

*3.**Set up the equation***

In this step the students were asked to set up an equation using the numbers in the correct order. At 16km/h Musa takes 25 minutes

- **16km/h---------- 25 minute** =

*4. **Tie down the sign***

In this step, the students were asked to read the underlined question sentence and explain which operation they would use. For example, a student explained that the sentence "How long does he takes when he cycles at 20km/h?" means " it takes more longer time to cycle the same distance when he cycle 1km/h, so multiplication operation is use"

- **25 minutes** by 16

5. ***Discover the sign***

In this step the students were asked to discover the operation sign circle it and state it. For example: we divide the result by 20, because he has to take a shorter time to cover the same distance when he travels faster

- 25 x 16 ÷ 20

*6****. Read the problem***.

The students were asked to read aloud the newly formulated mathematical version of problem. For example: "The problem I want to solve is to multiply 25 by 16 and divide the result by 20" 25 x 16 ÷ 20

7. ***Answer the problem or draw***

- **25** x $\frac{16}{20}$**minutes**

*8****. Write the answer.***

In this step the students were asked to write down their answers. For example, they wrote that the number of minutes was 20.

25 x $\frac{16}{20}$ = 20 minutes

The teacher always guided the students while the above mentioned steps of fast draw model were being applied. He should try to encourage the students to think about the problem by posing different questions especially within the first applications where the students had problem. For example he may ask: “Which operation should we use in order Musa to distribute the oranges equally to each student?” Further the teacher can helped the students visualize their answers.

APPENDIX 11

Instructional Guide for the Experimental Group11 (Polya)

Week one (1)

Stage/Time	Teaching/Learning Activity	Learning Points
Step 1(introd) multiplicative 5 minute equations	Review of add and multiplicative inverse, simple equations	Addition and inverse and simple
Step 2 (Hands on Activity) 7 min	Students do the following; stand Up, sit down, Add 3 to 15 subtr 3 From the result, multiply 7 by 2 Divide the result by 2	inverse operation
Step 3 (Bridge) 15 minute	I think of a number, 14 is added to the number gives 29. What number Am I thinking of ? –understand the Problem, device a plan, carry out the Plan, look back.	
	My number add 14 → 29 Thus, 29 subtrc 14 → my number. My number = 29 – 14 = 15	

Week two (2)

2) When a sum of money is shared between nine people, each person gets ₦1500. What is the sum of money?

Understand the problem

Sum of money $\xrightarrow{\div 9}$ ₦1500

Devise a plan

Thus ₦1500 $\xrightarrow{X\ 9}$ sum of money

Carry out the plan

Sum of money = ₦1500 X 9 = ₦13500

Look back; 13500 ÷ 9 = 1500

Week three (3)

Objective; By the end of the lesson students should be able to use unitary method to solve problems involving inverse proportion

Daily activities; Fractions, converting fractions to percentage.

1) Seven workers dig a piece of ground in 10 days. How long would 5 workers take?

Understand the problem; we are to find time, so time comes last in every work.

Devise a plan; 7 workers take 10 days

1 worker takes 10 x 7 days = 70 days

Carry out the plan; 5 workers take 70 ÷ 5 = 14

Look back; $\frac{70}{5}$ = 14 days.

Week four (4)

2) Five people take 8 days to plant 1200 trees. How long will it take ten people ton plant the same number of trees?

Understand the problem; 5 people take 8 days to plant 1200 trees

Devise a plan; 1 person takes 8 x 5 days = 40 days

Carry out the plan; 10 people take 40 ÷ 10 = 4 days

Look back; you can see that the number of trees is not used. So when solving using a Unitary method always;

1) Write in sentences with the quantity to be found at the end.

2) Decide whether the problem is an example of direct or inverse proportion.

3) Find the rate for 1 unit before answering the problem.

Objective; the students should be able to at the end of the lesson solve problems involving rates that correct quantities of different kinds.

Daily practice; revisions on fractions, percentage, proportions, ratio and sharing.

Problem; a worker gets ₦2400 for 5 hours' work. What is the rate of pay per hour?

Understand the problem; in 5 hours the worker gets ₦2400.

Devise a plan; In 1 hour the worker gets ₦$\frac{2400}{5}$

Carry out the plan; ₦$\frac{2400}{5}$ = 480,

Look back; ₦$\frac{2400}{5}$ = ₦480. So the worker gets ₦480 per day.

Week five (5)

3) The price of an article is reduced from ₦400 to ₦360. Express the reduction as a rate of Kobo in the naira.

   Understand the problem; Reduction, ₦400 to ₦360 = ₦40

   Devise a plan; on ₦400 the reduction is ₦40

   Carry out the plan; on ₦ 1 the reduction is ₦$\frac{40}{400}$ = $\frac{1}{10}$ = 10k

   Look back; the reduction is at the rate of 10k in the naira (The equivalent to reduction of 10%).

   NB: in every example we solve above unitary method is used to find the rate.

Quiz questions

1) An athlete runs 90m in 10 second. Find this rate in meters per minute.
2) A football player scores 40 goals in 60 games. Find his rate of scoring in goals Per game.
3) A girl cycle at a rate of 16km/h for 2 $\frac{1}{2}$ hours. How far does she travel?
4) A car travels 126km in 1$\frac{1}{2}$ hours. Find its rate in km/h.

Proportion

1) A man gets ₦800 for 5 hours work. How much does he get for 14 hours?
2) A girl buys seven pens for ₦210. How much 10 would pens cost?
3) A bag of corn can feed 100 chickens for 12 days. How long would the same bag feed 80 chickens?

4) It takes twenty-one 9-litre buckets to fill a drum with water. How many 7-litre buckets would it take?

Inverse operation

A bottle is $\frac{3}{4}$ full and contains 723 ml. How much will the bottle hold when completely full?

1) 14 times a certain number gives −84. What is the number?
2) When a number is divided by $-\frac{1}{2}$ the result is$\frac{4}{7}$. What is the number?

3) A TV set is paid for in 12 equal installments. Each payment is ₦6000. How much does the TV set cost?

Sharing

Objective: By the end of the lesson students should be able at the end of the lesson solve problems involving sharing.

Daily practice: revision on proportion and ratio

Problem: Two students share mangoes in the ratio 2:3. How many mangoes do each Students get?

Understand the problem; Treat the parts of the ratio as share

Devise a plan; one student gets 2 shares, the other student get 3 share, this shows there are 5 shares altogether.

Carry out the plan; Number of mangoes in 5 shares = 35

Number of mangoes in 1 share = $\frac{35}{5}$ = 7

Number of mangoes in 2 shares = 2 x 7 = 14

Number of mangoes in 3 shares 3 x 7 = 21

Look back; one student gets 14 mangoes and the other student gets 21mangoes.

2) If 450g of jam costs ₦180, how much will $1\frac{1}{2}$kg cost?

Understand the problem; unit must be the same, i.e., working in grams.

Devise a plan; cost of 1500g: cost of 450g, 1500: 450 = 10: 3

Carry out the plan; cost of 450g = ₦180, cost of $1\frac{1}{2}$kg = $\frac{10}{3}$ x 180 = 10 x 60

Look back; 10 x 60 = 600, the cost is ₦600.

Quiz questions

1) *A shelf holds 21 books each 5cm thick. How many books each 7cm thick will the shelf hold?*
2) *To pay for a television set it takes 15 monthly payments of ₦1280. How long will it take at ₦800 per month?*
3) *A rope can be cut into 18 lengths of 17.5cm. How much length of 15.75cm can it be cut into?*

4) *A lorry can carry 820 bricks each of mass 1.68kg. How many 1.64 bricks can it carry?*

APPENDIX 111

Instructional Guide for the Control Group

Week one 1

Topic: Sharing

Class: Junior Secondary School two (JSS11)

Duration: 40 minutes

Objective: By the end of the lesson the students are expected to solve word problems on sharing.

Daily practice: s Revision on simple division of numbers

Introduction: The teacher asks the students to divide some given numbers like; *12 ÷ 3, 14 ÷ 7. 48 ÷ 6, 144 ÷ 12 etc.*

Presentation: The teacher starts by writing some word problems on the board. For example;

Oral practice; I have 8 naira I give my sister 2 naira and my brother 3. How much remains for me?

Step 1: The teacher explains the problem word by word to the students on the board.

Step 11: The teacher writes another example; three students were given 18 oranges to share. How many will each get? The teacher explain and solve it on the board, 18 oranges divided by 3, each will get 18 ÷ 3 = 6 oranges

Step 111: *Two women shares 60 eggs in the ratio 1 to 2.How many eggs does each receive?*

S0lution; total eggs 60, 2 women, ratio 1 to 2, total ratio 3, therefore,

One woman $\frac{1}{3}$ x 60 = 20 eggs, the other woman $\frac{2}{3}$ x 60 = 40 eggs

Conclusion: The teacher concludes the lesson by summarizing the important points to consider when solving sharing word problems.

Evaluation: The following questions were given to students to be answered as classwork or as an assignment to help extend learning.

1. *Amina is 12 years old and Musa is 8 years old .They share 15 bananas in the ratio of their Ages. How many does each gets?*
2. *A farmer divides 240 cattle among his three children in the ratio 5 : 4 : 3. How many cattle Does each get?*

Week two (2)

Topic: Proportion

Class: Junior Secondary School two (JSS 11)

Duration: 40 minutes

Objective: By the end of the lesson the students are expected to be able to solve word problems on proportions.

Daily practice: Revisions on simple division and sharing

Introduction: Students to answer questions on simple division and sharing. For example; share 35 mangoes in the ratio 2 to 3.

Presentation: The teacher writes two word problems on proportion on the board as follow;

1. *Seven workers dig a piece of ground 10 days. How long would 5 workers take? 2. A worker gets ₦900 for 10 hours of work. Find the amount for (a) 3 hours (b) 24hrs*

Step 1: The teacher explains the problem statement word by word and then solves them for the students to see on the board;

(a) We are to find time; time comes last in every line of working.

7 workers take 10 days

1 worker takes 10 x 7 days = 70 days

5 workers take 70 ÷ 5 days = 14 days. You can see that we assume that all the workers Work at the same rate.

(b) We are to find money. Money comes last in every line of working.

For 10 hours the worker gets ₦900

For 1 hour the worker gets ₦900 ÷ 10 = ₦90

(a) For 3 hours the worker gets 3 x ₦90 = ₦270

(b) For 24 hours the worker gets 24 x ₦90 = ₦2160.

Step 111: The teacher then asks the students whither they understand the lesson or not and if they have any question they should ask.

Conclusion: The teacher concludes the lesson by summarizing some of the important points in the lesson.

Evaluation: Students were to answer some questions to help them remember the information given to them.

(1) A woman is paid ₦750 for 5 hours. Find her pay for a) 2hours b) 22hours.

(2) A man gets ₦800 for 5 hours' work. How much does he get for 14 hours?

(3) A 14-year old boy runs 100m 1n 14 seconds. How long would it take a 6-year old boy?

Week three (3)

Topic: Inverse operation

Class: Junior Secondary School Two (JSS 11)

Duration: 40 minutes

Objective: By the end of the lesson the students are expected to be able to apply inverse operation to the solution of simple problems.

Daily practice: Revisions on Additive inverse and Multiplicative inverse.

Introduction: The teacher introduce the lesson through; find the inverse of the following; open the door, add 20, multiply by 5, divide by 0.03, etc.

Presentation: The teacher writes a sample problem on the board and asks students whether they can solve it.

I think of a number, 14 added to the number gives 29. What number am I thinking of?

Step 1: The teacher then explain the problem word by word to the students in the class and solve it.

my number → add 14 → 29

thus 29 → subtract 14 → my number

my number = 29 – 14 = 15

Step 11: The teacher after solving the problem for the students to see entertaining questions from them.

Step 111: The teacher then asks the students whether they understand the lesson or not after which he calls on a student to come to the board and solve the following.

(1) Find the number which, when 8 is subtracted from it, gives −3

Conclusion: The teacher concludes the lesson by summarizing some of the important points in the lesson.

Evaluation: Students will take some exercises to practice as classwork as well as assignment this with the aim of finding out students' level of understanding of the topic.

(1) A boy has some money. He spends ₦180. He is left with ₦320. How much money did he at first?

(2) I think of a number. 4subtracted from the number gives 12. What number am I thinking of?

(3) Find the number which, when 5 is subtracted from it, gives 7.

Week four (4)

Topic: Simple Fractions (Addition and Subtraction)

Class: Junior Secondary School Two 2 (JSS 11).

Duration: 40 minutes

Objective: By the end of the lesson the students are expected to be able to solve word problems involving addition and subtraction of fractions.

Learning resources: fraction board, flash card, square paper, chart and markers color chalk.

Daily practice: Revision on division of whole numbers and sharing.

Introduction: Answer simple questions on fractions, sharing of oranges and proportions. For example, *what is* $\frac{3}{4}$, $\frac{5}{8}$, $\frac{5}{7} - \frac{1}{3}$, $\frac{1}{5} + \frac{3}{15}$, *etc.*

Presentation: The teacher writes fraction word problems on the board and asks the students whether they have come across it before.

A student read $\frac{4}{7}$ *of a textbook before going to bed. What fraction was remaining?*

1: The teacher explains the problem word by word.

Step 11: The teacher solve the **Step** problem on the board for the students to see.

We say, since $\frac{4}{7}$ of the book has been read, $(1 - \frac{4}{7}) = \frac{7-4}{7} = \frac{3}{7}$ of the book remains.

2*) A family spent* $\frac{2}{7}$ *of her four-week monthly budget in the first week,* $\frac{1}{3}$ *in the second week and the remaining ₦520.00 in the last two weeks. How much was the family budgets?*

In the first two weeks, the family spent $(\frac{2}{7} + \frac{1}{3}) = \frac{6+7}{21} = \frac{13}{21}$ of the budget.

The proportion of the budget remaining for the last two weeks is therefore $(1 - \frac{13}{21})$ or $\frac{8}{21}$

8 twenty-first of the budget is ₦520.00

1 twenty-first of the budget is 520 ÷ 8

Therefore the whole budget is (₦520/8) x 21 = ₦1,365.00

Step 111: The teacher call on someone to come and solve the following problem on the board. He then asks whether they understand the lesson or not and if there is any question.

Suppose you spend $\frac{2}{5}$ *of your pocket money on transport and* $\frac{4}{7}$ *on novels. What fraction remains?*

Conclusion: The teacher concludes the lesson by summarizing some of the important points in the lesson.

Evaluation: Students are to answer questions to help them extend learning.

1) $\frac{3}{7}$ *of a class are boys. What fraction of the class consists of girls? If there are 28 girls, how many boys are there in the class?*
2) *After travelling 30 kilometers from your home, you discovered that you have covered* $\frac{2}{5}$ *of the journey to school. How far is your school from your home?*

3) *Bala ate $\frac{1}{4}$ of a banana in a bunch While Ado ate $\frac{1}{3}$ of the bunch what fraction of the bunch had been eaten?*

4) *There are 420 students in a school $\frac{1}{3}$ of the population is made up of girls. How many boys are there in the school?*

5) *Find three-quarter of the sum of one and one-third.*

Week five (5)

Topic: Rate

Class: Junior Secondary School Two 2 (JSS11)

Duration: 40 minutes

Objective: By the end of the lesson the students are expected to be able to solve word problems involving rates that connect quantities of different kinds.

Daily practice: Revisions on some different prices of commodities, proportions and sharing.

Introduction: Practical discussion on the application of rate in daily life. For example, *how many times did you come to school in a week, the cost of a book is ₦12.00 what is the cost of 3 books? Etc.*

Presentation: The teacher writes the following word problems on rate on the board.

1) *A worker gets₦2400 for 5 hours' work. What is the rate of pay per hour?*
2) *A car goes 160km in 2 hours. What is the rate in km/h*

Step1: The teacher then explains the problem word by word.

Step 11: The teacher then solve the problem for the students to see and observe.

1) In 5 hours the worker gets ₦2400

   Now we use the unitary method to solve

   In 1 hour the worker gets ₦2400/5 = ₦480

   The workers' rate of pay is ₦480.00/hour.

2) In two hours the car travels 160km

   Now we use the unitary method to solve

   In 1 hour the car travels 160/2km = 80km.

   The rate of the car is 80km/hour.

Step 111: The teacher asks one or two students to come and solve. Thereafter asks whether they have understood the lesson or not.

Conclusion: The teacher concludes the lesson by given a brief summary of the main important points in the lesson.

Evaluation: The following exercises are given as classwork as well as assignment to the student to measure their understanding as class activity or assignment to extend learning.

1) *A car travels 126km in $1\frac{1}{2}$ hours. Find its rate in km/h.*
2) *A girl cycles at a rate of 16km/h for $2\frac{1}{2}$ hours. How far does she travel?*
3) *A football player scores 40 goals in 60 games. Find his rate of scoring in goals per game.*

APPENDIX iv (a)

ALGEBRAIC WORD PROBLEMS SOLVING PERFORMANCE TEST (Pilot test)

Name ---------- **School** ----------

Sex ---------- **Age** ----------

Instruction: Answer all questions;

1. Adamu's father bought him a forty-four page-fairy tale book. Adamu read six pages a day. How many pages are there left at the end of the 5^{th} day?
   a.15 b.16 c.7 1/3 d. 14

2. How many meters do a tortoise which moves forward at sixty meters per hour precede at 5 hours?
   a. 250 b. 300 c. 600 d. 35

2. A pile of nuts can be shared equally between 8 boys, between 9 boys or between 10 boys. What is the least number of nuts in the pile?
   a. 180 b. 72 c. 720 d 18

3. There are twelve seats in a bus; nine people were sitting on each seat. Eight people got off the bus in the first bus-stop. How many passengers were there left in the bus?
   a. 105 b. 95 c. 100 d. 116

5. When Amina is nine years old, her mother is thirty-two years old. How old would Amina be when her mother is forty years old?
   a. 17 b. 19 c.25 d. 17

6. If a boy cycles to school, he travel 5km; if he goes by bus, the bus takes him 10km. Find the ratio of the cycle journey to the bus journey.
   a. 1:2 b. 2:1 c. 10:5 d. 15:10

7. A worker gets ₦900 for ten hours of work. Find the amount for three hours work.
   a. ₦90 b. ₦270 c.₦210 d. ₦240

8. A three-tone lorry makes ten journeys to move a pile of earth. How many journeys would a five-tone lorry make?
   a. 12 journeys b. 8 journeys c. 6 journeys d. 4 journeys

9. A pencil and a rubber together cost 15k. Find the cost 8pecls and 8 rubbers
   a. 120k b. 12k c. 64k d. 56k

10. A box of forty-five matches cost ₦25. A petty trader splits a box into bundles of six matches and sells them for ₦5 per bundle. Find the profit on two boxes of matches.
    a. ₦15 b.₦20 c. ₦30 d.₦25

11. One number is greater by 3 than a second number. Three times the larger is equal to four times the smaller. Find the larger number.
    A. 5 b. 6 c. 7 d. 9

12 I am getting round the circle of a playground whose peripheral length is one hundred and twenty four meters in four minutes. If so, how many meters do I proceed in 1 minute?
   a. 41 b. 31 c. 5 d. 120

13 The number of male passengers in a plane is one hundred and sixty two. The number of female passengers is fifty-seven less than the number of male passengers. How many passengers are there in the plane?

a. 219 b. 267 c. 225 d. 209

14 A student was given enough pocket money to last him ten weeks on the assumption that he spends ₦342.00 in three weeks. If he actually spends ₦285.00 in a week, how long will the money last?

a. 9 weeks b. 7 weeks c. 4 weeks d. 8 weeks

15 A man earns ₦20.00 for two hours, how much does he earn in six hours?

a. ₦40.00 b. ₦150.00 c. ₦80.00 d. ₦60.00

16 If seven men can build a wall in fifteen days, how long will it takes thirty-five men working at the same rate?

a. 5 days b. 3 days c. 6 days d. 7 days

17 A bag of corn can feed hundred chickens for twelve days. How long would the same bag feed eighty chickens?

a. 15 days b. 14 days c. 18 days d. 17 days

18 A car travels at sixty km/hour and takes five hours for a journey. How long would the car take if it travelled at ninety km/hour?

a. 2hr b. 30hr c. 3hr d. 3

19 To pay for a television set it takes fifteen monthly payment of ₦1280.00. How long will it take at ₦800.00 per month?

a. 12 month b. 20 month c. 18 month d. 24 month

20 81 carpets, each measuring $1m^2$, are required to cover the floor of a hall. How many $9m^2$ carpets are required to cover the same floor?

a. 6 carpets b. 9 carpets c. 18 carpets d.15 carpets

21 A car travels eleven kilometers per liter of petrol. Find how much petrol the car uses in going eight hundred and ninety one kilometers?

a. 81 liters b. 72 liters c. 64 liters d. 121 liters

22 A car factory made three hundred and seventy-five cars in five days. Find its production rate in cars per day

a. 55 cars b. 25 cars c. 75 cars d. 35 cars

23 In 2007 the population of Nigeria was one hundred and forty million. By 2017 the estimated population will be one hundred and forty-five million six hundred thousand. What is the estimated increase in Nigerian's population during these ten years?

a. 40.6 million b. 4.6 million c. 50.6 million d. 5.6 million

24 If 12 eggs cost ₦1.80, how many eggs can be bought for ₦6.30?

a. 15 b. 42 c. 53 d. 52(½)

25 2 people can stay at a hotel for a night for ₦84. Find the hotel bill for 5 people for a night at the same rate.

1 210 b. 42 c. 420 d. 168

26 A boy has some money. He spends ₦180.00. He is left with ₦320. How much money did he have at first?

a. ₦140.00 b. ₦500.00 c. ₦420.00 d. ₦600.00

27 To feed 400 boys for dinner each day costs ₦136. Find the cost of feeding 500 boys for one day. a. ₦108.8 b. ₦3.70 c. ₦2.90 d. ₦120.90

28 Three-quarter of a certain number is twelve. What is the number?

a. 16 b. 24 c. 32 d. 18

29 If 20 oranges cost 96k, how many oranges can be bought for ₦1.92 at the same rate

a. 25 b. 15 c. 30 d. 40

30 It cost ₦100 to feed 15 people for a week. How many people can be fed for a week on ₦80?
a. 12 b. 14 c. 13 d. 10

31 16 men complete a certain piece of work in 15 days. How many days will it take 24 men? A. 10 b. 9 c. 11 d. 8

32 When a sum of money is equally shared between nine people, each person gets ₦1500. What is the sum of the money?
a. ₦3000.00 b. ₦7500.00 c.₦13500.00 d. ₦15300.00

33 A bottle is 3/4 full and contains seven hundred and twenty-three milliliters. How much will the bottle hold when completely full?
a. 823 ml b. 923 ml c. 100 ml d. 964 ml

34 My car travels 6km on a liter of petrol. My friend's car travels 9km on a liter of petrol. How much petrol does he uses on a trip for which I use 9 liters?
a. 12 b. 13.5 c. 13 d. 14

35 If thirty buses can carry one thousand five people, how many people can five buses carry?
a. 200 b. 250 c. 500 d. 750

36 24 men complete a piece of work in 32 days. How long would it have taken 32 men working at the same rate? A. 24 b. 42 c. 46 d. 32

37 If a store of food is enough to last 32 men 24 days. How long would the store feed 42 men? A. 14 days b. 48 days' c. 40 days c.56 days.

38 The cost of a TV set is either ₦680 cash or 24 monthly installments of ₦35. Find the difference between the cash price and the hire purchase price.
a. ₦160 b.₦840 c. ₦520 d. ₦620

39 Ado has4/5 yard of fabric, Musa has 3/7 yard of fabric. How much more fabric does Ado have?
a. $1(3/35)$ yard b. $7(3/5)$ yard c. 1/2yard d. $1(3/5)$ yard

40 160 eggs are to be placed into boxes; no box can hold more than 8 eggs. How many boxes are needed? A. 18 b. 20 c. 40 d. 25

41 As she cooked, Fatima used $3(2/8)$ cups of milk, $2(4/16)$ cups of water and 1/2 cup of orange juice. What liquid did she use?
a. 6 cups b. $5(3/4)$ cups c. 5 cups d. $6(1/4)$ cups.

42 A Wheelbarrow can hold $52(1/2)$ kg. Five rocks that weigh $9(5/8)$ kg, $12(1/6)$ kg, $9(1/4)$ kg, $11(1/8)$kg, and $10(1/2)$ kg are to be loaded into the wheelbarrow. Can the wheelbarrow hold all the five rocks?
1 Yes b. No

43 When 5 is subtracted from two-third of a certain whole number, the result is greater than seven find the least possible value of the original number.
a. 13.5 b. 18 c. 15 d. 20

44 The route Umar usually takes to his school is $4(2/5)$ km. After having rains, when that road is flooded, he must take a different route that is $4(9/10)$ km. How much longer is Umar's alternative route?
a. $1(3/8)$ km b. 1/2km c. $9(3/8$)km d. 8(1/2) km

45 When the length of wood is cut into eighteen equal lengths, each piece is 12.2 cm long. How long was the wood before it was cut?
a. 30.2 cm b. 1.48 cm c. 219.6 cm d. 216 cm

46 Which of the following is the inverse operation of add eight?
a. Subtract -8 b. add -1/8 c. subtract -8 d. subtract 8

47 I choose a number multiply it by 3, then added 7. The result is 67. What was the number I first chose? A. 21 b. 20 c. 60 d. 42

48 A car dealer sold 24 cars for a total of ₦13632000. What was the average price of the car? A. ₦13064 b.₦14200 c. 568 d. 592

49 A JSS one student scored 6/7in an English test and 5/9 in mathematics test. Determine his better score in the two tests? A. 6/7 b. 5/9

50 A carpenter requires short planks each of length 2(5/8) M to make benches. How many such planks can he get from 2 planks each of length 15(3/4) M?
a. 12 b. 10 c. 8 d. 14S

Marking Scheme for Algebraic Word Problems Performance Test (Pilot Test)

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

APPENDIX IV (b)
ALGEBRAIC WORD PROBLEMS SOLVING PERFORMANCE TEST (Pre-test)

Zone ---------- **Male/ Fame ----------**

Instruction: Answer all questions;

1. Adamu's father bought him a forty-four page-fairy tale book. Adamu read six pages a day. How many pages are there left at the end of the 5^{th} day?
   a.15 b.16 c.$7\frac{1}{3}$ d. 14
2. How many meters do a tortoise which moves forward at sixty meters per hour precede at 5 hours?
   b. 250 b. 300 c. 600 d. 350
3. There are twelve seats in a bus; nine people were sitting on each seat. Eight people got off the bus in the first bus-stop. How many passengers were there left in the bus?
   b. 105 b. 95 c. 100 d. 116
4. When Amina is nine years old, her mother is thirty-two years old. How old would Amina be when her mother is forty years old?
   b. 11.3 b. 19 c.25 d. 17
5. A worker gets ₦900 for ten hours of work. Find the amount for three hours work.
   b. ₦90 b. ₦270 c.₦210 d. ₦240
6. A three-tone lorry makes ten journeys to move a pile of earth. How many journeys would a five-tone lorry make?
   b. 12 journeys b. 8 journeys c. 6 journeys d. 4 journeys
7. A box of forty-five matches cost ₦25. A petty trader splits a box into bundles of six matches and sells them for ₦5 per bundle. Find the profit on two boxes of matches.
   b. ₦15 b.₦20 c. ₦30 d.₦25
8. I am getting round the circle of a playground whose peripheral length is one hundred and twenty four meters in four minutes. If so, how many meters do I proceed in 1 minute?
   b. 41 b. 31 c. 5 d. 120
9. The number of male passengers in a plane is one hundred and sixty two. The number of female passengers is fifty-seven less than the number of male passengers. How many passengers are there in the plane?
   b. 219 b. 267 c. 225 d. 209
10. A student was given enough pocket money to last him ten weeks on the assumption that he spends ₦342.00 in three weeks. If he actually spends ₦285.00 in a week, how long will the money last?
    b. 9 weeks b. 7 weeks c. 4 weeks d. 8 weeks
11. A man earns ₦20.00 for two hours, how much does he earn in six hours?
    b. ₦40.00 b. ₦150.00 c. ₦80.00 d. ₦60.00
12. If seven men can build a wall in fifteen days, how long will it takes thirty-five men working at the same rate?
    b. 5 days b. 3 days c. 6 days d. 7 days
13. A bag of corn can feed hundred chickens for twelve days. How long would the same bag feed eighty chickens?
    b. 15 days b. 14 days c. 18 days d. 17 days

14. A car travels at sixty km/hour and takes five hours for a journey. How long would the car take if it travelled at ninety km/hour?
    b. 2hr b. 30hr c. 3hr d. $3\frac{1}{3}$
15. To pay for a television set it takes fifteen monthly payment of ₦1280.00. How long will it take at ₦800.00 per month?
    b. 12 month b. 20 month c. 18 month d. 24 month
16. 81 carpets, each measuring $1m^2$, are required to cover the floor of a hall. How many $9m^2$ carpets are required to cover the same floor?
    b. 6 carpets b. 9 carpets c. 18 carpets d.15 carpets
17. A car travels eleven kilometers per liter of petrol. Find how much petrol the car uses in going eight hundred and ninety one kilometers?
    b. 81 liters b. 72 liters c. 64 liters d. 121 liters
18. A car factory made three hundred and seventy-five cars in five days. Find its production rate in cars per day
    b. 55 cars b. 25 cars c. 75 cars d. 35 cars
19. In 2007 the population of Nigeria was one hundred and forty million. By 2017 the estimated population will be one hundred and forty-five million six hundred thousand. What is the estimated increase in Nigerian's population during these ten years?
    b. 40.6 million b. 4.6 million c. 50.6 million d. 5.6 million
20. A boy has some money. He spends ₦180.00. He is left with ₦320. How much money did he have at first?
    b. ₦140.00 b. ₦500.00 c. ₦420.00 d. ₦600.00
21. Three-quarter of a certain number is twelve. What is the number?
    b. 16 b. 24 c. 32 d. 18
22. When a sum of money is equally shared between nine people, each person gets ₦1500. What is the sum of the money?
    b. ₦3000.00 b. ₦7500.00 c.₦13500.00 d. ₦15300.00
23. A bottle is $\frac{3}{4}$ full and contains seven hundred and twenty-three milliliters. How much will the bottle hold when completely full?
    b. 823 ml b. 923 ml c. 100 ml d. 964 ml
24. If thirty buses can carry one thousand five people, how many people can five buses carry?
    b. 200 b. 250 c. 500 d. 750
25. Ado has $\frac{4}{5}$ yard of fabric, Musa has $\frac{3}{7}$ yard of fabric. How much more fabric does Ado have?
    b. $\frac{13}{35}$yard b. $7\frac{3}{5}$ yard c. $\frac{1}{2}$ yard d. $1\frac{3}{5}$ yard
26. As she cooked, Fatima used $3\frac{2}{8}$ cups of milk, $2\frac{4}{16}$ cups of water and $\frac{1}{2}$ cup of orange juice. What liquid did she use?
    b. 6 cups b. $5\frac{3}{4}$ cups c. 5 cups d. $6\frac{1}{4}$ cups.
27. A Wheelbarrow can hold $52\frac{1}{2}$ kg. Five rocks that weigh $9\frac{5}{8}$ kg, $12\frac{1}{6}$ kg, $9\frac{1}{4}$ kg, $11\frac{1}{8}$kg, and $10\frac{1}{2}$ kg are to be loaded into the wheelbarrow. Can the wheelbarrow hold all the five rocks?
    2 Yes b. No

28. The route Umar usually takes to his school is $4\frac{2}{5}$ km. After having rains, when that road is flooded, he must take a different route that is $4\frac{9}{10}$ km. How much longer is Umar's alternative route?

    b. $1\frac{3}{8}$ km b. $\frac{1}{2}$ km c. $9\frac{3}{8}$ km d. 8. $\frac{1}{2}$ km

29. When the length of wood is cut into eighteen equal lengths, each piece is 12.2 cm long. How long was the wood before it was cut?

    b. 30.2 cm b. 1.48 cm c. 219.6 cm d. 216 cm

30. Which of the following is the inverse operation of add eight?

    b. Subtract -8 b. add -1/8 c. subtract -8 d. subtract 8

Marking Scheme for Algebraic Word Problems Solving Performance Test (AWPSPT)

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

APPENDIX V
ALGEBRAIC WORD PROBLEMS SOLVING RETENTION TEST (Post post-test)

Zone---------- **Male / Female ----------**

Instruction: Answer all questions;

1. To pay for a television set it takes fifteen monthly payment of ₦1280.00. How long will it take at ₦800.00 per month?

a. 12 month b. 20 month c. 18 month d. 24 month

2. How many meters do a tortoise which moves forward at sixty meters per hour precede at five hours?

a. 250 b. 300 c. 600 d. 350

3. A bottle is $\frac{3}{4}$ full and contains seven hundred and twenty-three ml. How much will the bottle hold when completely full?

a. 823 ml b. 923 ml c. 100 ml d. 964 ml

4. There are twelve seats in a bus. Nine people were sitting on each seat. Eight people got off the bus in the first bus-stop. How many passengers were there left in the bus?

a.105 b. 95 c. 100 d. 116

5. A Wheelbarrow can hold $52\frac{1}{2}$ kg. Five rocks that weigh $9\frac{5}{8}$ kg, $12\frac{1}{6}$ kg, $9\frac{1}{4}$ kg, $11\frac{1}{8}$ kg, and $10\frac{1}{2}$kg are to be loaded into the wheelbarrow. Can the wheelbarrow hold all the five rocks?

a. Yes b. No

6. A worker gets ₦900 for ten hours of work. Find the amount for three hours work.

a. ₦90 b. ₦270 c.₦210 d. ₦240

7. A three-tone lorry makes ten journeys to move a pile of earth. How many journeys would a five-tone lorry make?

a. 12 journeys b. 8 journeys c. 6 journeys d. 4 journeys

8. When Amina is nine years old, her mother is thirty-two years old. How old would Amina be when her mother is forty years old?

a.11.3 b. 19 c.25 d. 17

9. A box of forty five matches cost ₦25. A petty trader splits a box into bundles of six matches and sells them for ₦5 per bundle. Find the profit on two boxes of matches.

a. ₦15 b.₦20 c. ₦30 d.₦25

10. I am getting round the circle of a playground whose peripheral length is one hundred and twenty-four meters in four minutes. If so, how many meters do I proceed in 1 minute?

a. 41 b. 31 c. 5 d. 120

11. As she cooked, Fatima used $3\frac{2}{8}$ cups of milk, $2\frac{4}{16}$ cups of water and $\frac{1}{2}$ cup of orange juice. What liquid did she use?

a. 6 cups b. $5\frac{3}{4}$ cups c. 5 cups d. $6\frac{1}{4}$ cups.

12. A student was given enough pocket money to last him ten weeks on the assumption that he spends ₦342.00 in three weeks. If he actually spends ₦285.00 in a week, how long will the money last?

a. 9 weeks b. 7 weeks c. 4 weeks d. 8 weeks

13. Adamu's father bought him a forty-four-page-fairy tale book. Adamu read six pages a day. How many pages are there left at the end of the 5^{th} day?

a. 15 b. 16 c. $7\frac{1}{3}$ d. 14

14. A man earns ₦20.00 for two hours, how much does he earn in six hours?
    a. ₦40.00 b. ₦150.00 c. ₦80.00 d. ₦60.00
15. If 7 men can build a wall in fifteen days, how long will it takes thirty-five men working at the same rate?
    a. 5 days b. 3 days c. 6 days d. 7 days
16. A car travels eleven kilometers km per liter of petrol. Find how much petrol the car uses in going eight hundred and ninety-one km?
    a. 81 liters b. 72 liters c. 64 liters d. 121 liters
17. which of the following is the inverse operation of add eight?
    a. Subtract -8 b. add $-\frac{1}{8}$ c. subtract -8 d. subtract 8
18. In 2007 the population of Nigeria was one hundred and forty million. By 2017 the estimated population will be one hundred and forty-five million six hundred thousand. What is the estimated increase in Nigerian's population during these ten years?
    a. 40.6 million b. 4.6 million c. 50.6 million d. 5.6 million
19. A car factory made three hundred and seventy-five cars in five days. Find its production rate in cars per day.
    a. 55 cars b. 25 cars c. 75 cars d. 35 cars

20. A car travels at sixty km/hour and takes five hours for a journey. How long would the car take if it travelled at ninety km/hour?
    a. 2hr b. 30hr c. 3hr d. $3\frac{1}{3}$

21. A boy has some money. He spends ₦180.00. He is left with ₦320. How much money did he have at first?
    a. ₦140.00 b. ₦500.00 c. ₦420.00 d. ₦600.00
22. Three-quarter of a certain number is twelve. What is the number?
    a. 16 b. 24 c. 32 d. 18
23. A bag of corn can feed one chickens for twelve days. How long would the same bag feed eighty chickens?
    a. 15 days b. 14 days c. 18 days d. 17 days
24. If thirty buses can carry one thousand five hundred people, how many people can five buses carry?
    a. 200 b. 250 c. 500 d. 750
25. eighty-one carpets, each measuring $1m^2$, are required to cover the floor of a hall. How many $9m^2$ carpets are required to cover the same floor?
    a. 6 carpets b. 9 carpets c. 18 carpets d.15 carpets
26. Ado has $\frac{4}{5}$ yard of fabric, Musa has $\frac{3}{7}$ yard of fabric. How much more fabric does Ado have?
    a. $\frac{13}{35}$ yard b. $\frac{7}{35}$ yard c. $\frac{1}{2}$ yard d. $\frac{1}{35}$ yard
27. The route Umar usually takes to his school is $4\frac{2}{5}$ km. After having rains, when that road is flooded, he must take a different route that is 4 km. How much longer is Umar's alternative route?
    a. $1\frac{3}{8}$ km b. $\frac{1}{2}$ km c. $9\frac{3}{8}$ km d. $8\frac{1}{2}$ km
28. The number of male passengers in a plane is one hundred and sixty-two. The number of female passengers is fifty-seven less than the number of male passengers. How many passengers are there in the plane?
    a. 219 b. 267 c. 225 d. 209

29. When the length of wood is cut into eighteen equal lengths, each piece is 12.2 cm long. How long was the wood before it was cut?
a. 30.2 cm b. 1.48 cm c. 219.6 cm d. 216 cm

30. When a sum of money is equally shared between nine people, each person gets ₦1500. What is the sum of the money?
a. ₦3000.00 b. ₦7500.00 c.₦13500.00 d ₦15300.00

Marking Scheme for Algebraic Word Problems Solving Retention Test (post-post Test)

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

APPENDIX VI
Algebraic Word Problems Solving Attitudinal Questionnaire

Zone ---------- **Gender: Male---------Female--------**

Below are some statements about mathematics and mathematics teaching and learning. Read each item carefully and tick in the column that best agree with your options/choice. The points are Strongly Agree **(SA) 5,** Agree **(A) 4,** Undecided (UD) 3, Disagree (DA) 2 and Strongly Disagree (SD) 1.

STATEMENT	**A**	**SA**	**UD**	**D**	**SD**
I study mathematics word problems solving because:					
It help me become good problems solver					
My parent advises me to study word problem solving very well.					
All my friends try hard in word problems solving.					
It tells me more about myself and my environment.					
It helps me understand many science topics.					
I want to be recognized in the society as good mathematician.					
My brother is good mathematics word problem solver.					
I want to pursue a career that requires additional knowledge of mathematics word problems solving.					
I would like to be identify with the same students in the school who are good mathematics problems solvers.					
Universities/Colleges requires good background in word problems solving.					
It relates with real life situations.					
The approach the teacher uses in teaching concepts has:					
Increase my interest in word problems solving.					
It helped me to be more active in the class activities.					
. It made word problem concepts more difficult to understand					
Given me the opportunity to apply in my day to day experience to learning more mathematics word problem concepts.					
Helped me to see the logical concepts not as difficult as I thought they were to understand.					
The approach the teacher use is prepared to other approaches and should continue in solving more word problems					
Makes me to like more word problems and gives me a sense of greater achievement and capability.					
Allows the sharing of ideas which has helped me to Appreciate the significant of word problems to my existence.					
Help to change my view of the word problem concepts taught.					

Source: Fenneman-Sharman (1976)

Appendix V11

```
T-TEST GROUPS=treatment(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=tattitude
  /CRITERIA=CI(.95).
```

T-Test

[DataSet1] C:\Users\Documents\Maitama Null One.sav

Group Statistics

	Treatment	N	Mean	Std. Deviation	Std. Error Mean
total attitude scores	1 Fast Draw and Polya	215	77.27	4.474	.305
	2 Lecture method	111	60.49	3.700	.351

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
total attitude scores	Equal variances assumed	11.374	.001	33.969	324	.000	16.783	.494	15.811	17.755
	Equal variances not assumed			36.075	262.041	.000	16.783	.465	15.867	17.699

APPENDIX VIII

```
GET
  FILE='C:\Users\Documents\Maitama Null Two.sav'.
DATASET NAME DataSet2 WINDOW=FRONT.
T-TEST GROUPS=treatment(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=retscores
  /CRITERIA=CI(.95).
```

T-Test

[DataSet2] C:\Users\Documents\Maitama Null Two.sav

Group Statistics

	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Retscores	1 Fast Draw and Polya	215	60.61	10.411	.710
	2 Lecture method	111	25.62	6.944	.659

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
retscores	Equal variances assumed	20.688	.000	31.923	324	.000	34.992	1.096	32.836	37.149
	Equal variances not assumed			36.120	303.413	.000	34.992	.969	33.086	36.899

APPENDIX IX

```
GET
  FILE='C:\Users\Documents\Maitama Null Three.sav'.
DATASET NAME DataSet3 WINDOW=FRONT.
T-TEST GROUPS=treatment(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=perfscores
  /CRITERIA=CI(.95).
```

T-Test

[DataSet3] C:\Users\Documents\Maitama Null Three.sav

Group Statistics

	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Perfscores	1 Fast Draw	106	61.59	9.584	.931
	2 Lecture method	111	24.48	7.357	.698

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
perfscores	Equal variances assumed	2.229	.137	32.087	215	.000	37.117	1.157	34.837	39.397
	Equal variances not assumed			31.895	196.897	.000	37.117	1.164	34.822	39.412

Appendix X

```
DATASET ACTIVATE DataSet2.
GET
  FILE='C:\Users\Documents\Maitama Null Four.sav'.
DATASET NAME DataSet4 WINDOW=FRONT.
T-TEST GROUPS=treatment(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=perfscores
  /CRITERIA=CI(.95).
```

T-Test

[DataSet4] C:\Users\Documents\Maitama Null Four.sav

Group Statistics

	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Perfscores	1 Polya	109	54.37	12.462	1.194
	2 Lecture method	110	24.31	7.173	.684

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
perfscores	Equal variances assumed	34.141	.000	21.901	217	.000	30.058	1.372	27.353	32.763
	Equal variances not assumed			21.850	172.162	.000	30.058	1.376	27.343	32.773

Appendix XI

```
DATASET ACTIVATE DataSet2.
GET
  FILE='C:\Users\Documents\Maitama Null Five.sav'.
DATASET NAME DataSet5 WINDOW=FRONT.
T-TEST GROUPS=treatment(1 2)
  /MISSING=ANALYSIS
  /VARIABLES=perfscores
  /CRITERIA=CI(.95).
```

T-Test

[DataSet5] C:\Users\Documents\Maitama Null Five.sav

Group Statistics

	Treatment	N	Mean	Std. Deviation	Std. Error Mean
Perfscores	1 Fast Draw	106	61.59	9.584	.931
	2 Polya	110	54.26	12.452	1.187

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
perfscores	Equal variances assumed	13.092	.000	4.836	214	.000	7.331	1.516	4.343	10.319
	Equal variances not assumed			4.859	204.134	.000	7.331	1.509	4.356	10.305

Appendix XII

```
DATASET ACTIVATE DataSet2.
GET
  FILE='C:\Users\Documents\Maitama Null Six.sav'.
DATASET NAME DataSet6 WINDOW=FRONT.
UNIANOVA perfscores BY sex treatment
  /RANDOM=treatment
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /EMMEANS=TABLES(sex)
  /EMMEANS=TABLES(treatment)
  /EMMEANS=TABLES(sex*treatment)
  /PRINT=DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=sex treatment sex*treatment.
```

Univariate Analysis of Variance

[DataSet6] C:\Users\Documents\Maitama Null Six.sav

Between-Subjects Factors

		Value Label	N
Sex	1	Male	167
	2	Female	161
Treatment	1	Fast Draw and Polya	218
	2	Lecture method	110

Descriptive Statistics

Dependent Variable:perfscores

Sex	Treatment	Mean	Std. Deviation	N
1 male	1 Fast Draw and Polya	52.46	8.790	110
	2 Lecture method	26.14	7.252	57
	Total	43.48	15.006	167
2 female	1 Fast Draw and Polya	55.40	8.099	108
	2 Lecture method	22.34	6.601	53
	Total	44.52	17.345	161

Total	1 Fast Draw and Polya	53.92	8.562	218
	2 Lecture method	24.31	7.173	110
	Total	43.99	16.180	328

Tests of Between-Subjects Effects

Dependent Variable:perfscores

Source		Type III Sum of Squares	Df	Mean Square	F	Sig.
Intercept	Hypothesis	446345.394	1	446345.394	6.932	.231
	Error	64391.413	1	64391.413[a]		
Sex	Hypothesis	13.702	1	13.702	.017	.919
	Error	828.375	1	828.375[b]		
Treatment	Hypothesis	64391.413	1	64391.413	77.732	.072
	Error	828.375	1	828.375[b]		
sex * treatment	Hypothesis	828.375	1	828.375	12.997	.000
	Error	20649.998	324	63.735[c]		

a. MS(treatment)
b. MS(sex * treatment)
c. MS(Error)

Expected Mean Squares[a,b]

Source	Variance Component			
	Var(treatment)	Var(sex * treatment)	Var(Error)	Quadratic Term
Intercept	146.087	73.043	1.000	Intercept, sex
Sex	.000	73.043	1.000	Sex
Treatment	146.087	73.043	1.000	
sex * treatment	.000	73.043	1.000	
Error	.000	.000	1.000	

a. For each source, the expected mean square equals the sum of the coefficients in the cells times the variance components, plus a quadratic term involving effects in the Quadratic Term cell.
b. Expected Mean Squares are based on the Type III Sums of Squares.

Estimated Marginal Means

1. sex

Dependent Variable:perfscores

sex	Mean	Std.	95% Confidence Interval

		Error	Lower Bound	Upper Bound
1 male	39.302	.651	38.020	40.584
2 female	38.869	.669	37.552	40.186

2. treatment

Dependent Variable:perfscores

			95% Confidence Interval	
Treatment	Mean	Std. Error	Lower Bound	Upper Bound
1 Fast Draw and Polya	53.931	.541	52.867	54.995
2 Lecture method	24.240	.762	22.742	25.738

3. sex * treatment

Dependent Variable:perfscores

				95% Confidence Interval	
sex	Treatment	Mean	Std. Error	Lower Bound	Upper Bound
1 male	1 Fast Draw and Polya	52.464	.761	50.966	53.961
	2 Lecture method	26.140	1.057	24.060	28.221
2 female	1 Fast Draw and Polya	55.398	.768	53.887	56.909
	2 Lecture method	22.340	1.097	20.182	24.497