THE EFFECT OF PRACTICAL APPROACH OF TEACHING GEOMETRY ON ATTITUDE AND PERFORMANCE OF JUNIOR SECONDARY SCHOOL STUDENTS KATSINA STATE, NIGERIA.

BY

BintaTafashiya HAMISU

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

APRIL,2017

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BintaTafashiya HAMISU
B.Ed (Maths)(A.B.U.)(1998)
M.ED/P13EDSC8016

A THESIS SUBMITTED TO THE SCHOOL OF POSTGRADUATE STUDIES, AHMADU BELLO UNIVERSITY, ZARIA
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF MASTER DEGREE IN MATHEMATICS EDUCATION.

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

APRIL, 2017

DECLARATION

I Binta Tafashiya HAMISU M.ED/P13EDSC8016 hereby declare that the work in the Thesis entitled "The Effect of Practical Approach Of Teaching Geometry On Attitude And Performance Of Junior Secondary School Students Katsina State, Nigeria", has been written by me in the Science Education Department (Mathematics Education Section).The information derived from various literatures has been acknowledge in the text and a list of References provided. It has not been used in any previous work for higher degree at any university.

_____ _____

Binta Tafashiya HAMISU Date

CERTIFICATION

This Thesis entitled "The Effect Of Practical Approach Of Teaching Geometry On Attitude And Performance Of Junior Secondary School Students Katsina State, Nigeria ", by Binta Hamisu Tafashiya meets the requirement governing the Award of the Degree of Masters in Mathematics Education in Ahmadu Bello University, Zaria and is Approved for its Contributions to Knowledge and Literary Presentation.

_____	_____
Prof. C. Bolaji .	Date
Chairman Supervisory Committee	
_____	_____
Prof. Mamman Musa	Date
Member Supervisory Committee	
_____	_____
Prof.Mamman Musa	Date
Head, Science Education Department	
_____	_____
Prof. S. Z. Abubakar	Date
Dean, School of Postgraduate Studies	

DEDICATION

This research work is dedicated to my Parents, Husband, Children, Brothers and Sisters for the Financial and Moral Support given to me during the research work.

ACKNOWLEDGEMENTS

Praise be to Allah, the Beneficent the Most Merciful. I wish to express my profound gratitude to Allah (S.W.T) who provided me with the opportunity, health, knowledge and materials to do the research work efficiently and successfully through his mercy.

I must register my appreciation to my Supervisors Prof. Bolaji C. and Prof. Mamman Musa for having time to go through my work to give constructive criticism, suggestions and corrections throughout the course of this study. May Allah reward them in one way or the other. I must acknowledge the support of my lecturers in the Department Prof. Y.K Kajuru, Dr. M.O. Ibrahim and Mallam I. H. Usman for their tireless efforts and advices which led to successful completion of my course. My gratitude also goes to the Post Graduate Co-coordinator of the Department of Science Education A.B.U Zaria in person of Dr. M.O. Ibrahim and Dr. S.S Bichi Coordinator Science Education Section. My special thanks also go to Aminu EL-Ladan Hassan Usman Katsina Polytechnic, Mathematics and Statistics Department, all the four Principals and the Teachers in the sampled schools, Fatima Ibrahim Gwanda Government Girls' College Katsina, Mohammad Family Support Program Secondary School Katsina, Ahmad Olorukooba Adebare of Suncais Junior Secondary School Katsina and Ibrahim of Government Day Junior Secondary School K\Sauri Katsina for their numerous contributions during the field work. I am indebted to my Parents who deserved most sincere gratitude and thankfulness for their Parental Care, Moral and Financial Support accorded me right from my infancy. May Allah have Mercy on them, Amin. I am thankful to my Husband Alh. Hamisu Tafashiya (MadawakinGona), who played an important role in the undertaking and completion of the course, may Allah bless and reward him abundantly. Finally acknowledge the support of my Children for their Patience, Endurance throughout my study. May the blessing of Allah be with them all Amin.

LIST OF TABLES

Table:

3.1: Distribution of Schools and Students in Katsina State 46

3.2: Distribution of Population According to School Gender 47

3.3: Distribution of Samples Study Schools and Sex 48

4.1: Summary of Mean and Standard Deviation of Expe and Control 54

4.2: Summary of the Mean and Standard Deviation on Gender 54

4.3: Summary of Mean and Standard Deviation on Experimental Gender 55

4.4: Summary of Mann Whitney U-test on Experimental Vs Control 56

4.5 Pre-test of Experimental and Control groups 56

4.6 Summary of t-test Analysis 57

4.7 Summary of t-test Analysis 58

4.8 Analysis of GPT on Gender Experimental Group 59

4.9 Summary of Mann Whitney U Test on Experimental vs Control 60

LIST OF FIGURES

Figure:

I: Literature Review: Various Model of Three Dimensional Figures 25

II: Literature Review: Method of teaching geometry of flat shapes 26

III: Literature Review: Model methods of teaching sum of a triangle 27

IV: Literature Review: Models of teaching Segment, Square and Volume 28

V: Literature Review: Model of teaching special or Quadrantal angles 29

VII: Literature Review: Models of Height and Diameter 31

LIST OF APPENDICES

Appendix:

A.	Experimental and Control Group Lesson Plan	73
B	Pre- Test Instruments	100
C	Post- Test Instruments `	104
D	Post- Test (Attitudinal test)	107
E	Summary of Mann Whitney U-test	109

ABBREVIATIONS AND SYMBOLS

The abbreviated words used and their corresponding details are as follows:-

GPT : Geometry Performance Test

GAQ : Geometry Attitudinal Test

EG : Experimental Group

CG : Control Group

OPERATIONAL DEFINITION OF TERMS

Practical Approach: Application of mathematical methods and creativity to Stimulate thought or intellectual curiosity.

Geometry: Is the study of points, lines, and shapes in relation to mathematics.

Attitude: Believes about mathematics interest and enjoyment in Learning mathematics and perseverance in solving problems.

Performance: Geometrical performance measures the geometrical literacy to formulate, employ and interpret geometry in a variety of context to describe, predict and explain a phenomena.

TABLE OF CONTENTS

Title page	i
Declaration	ii
Certification	iii
Dedication	iv
Acknowledgements	v
List of Table	vi
List of Figures	vii
List of Appendices	viii
Abbreviations and symbols	ix
Operational Definition of terms	x
Table of Contents	xi
Abstract	xiv

CHAPTER ONE; THE PROBLEM

1.1 **I**ntroduction to the Study	1
1.2 Statement of the Problem	3
1.3 Objectives of the Study	5
1.4 Research Questions	5
1.5 Null Hypotheses	6
1.6 Significance of the Study	6
1.7 Basic Assumption /Delimitation of the Study	7
1.8 Scope of the Study	8

CHAPTER TWO; REVIEW OF RELATED LITERATURE

2.1 Introduction	9
2.2 Historical Perspectives of Geometry with shapes and concepts	10
2.3 Teaching Geometry in Junior Secondary School	15
2.4 Mathematics Teaching Methods	16
2.5 Practical Approach to Teaching Geometry	18
2.5.1 Experimental Method of Teaching	19
2.5.2 Laboratory Method of Teaching	20
2.5.3 Mathematics Teaching Model (Kits)	24
2.5.4 Method of Teaching Symmetry of Flat Shapes	26
2.5.5 Models of Teaching Segment, Square and Volume	28
2.5.6 Model of Teaching Special or Quadrantal Angles	29
2.6 Conventional Approach Methods	31
2.7 Definition of Attitude	32
2.7.1 Attitude towards Geometry and Academic Achievement in JSS.	33
2.8 Gender Difference and Achievement in Geometry	37
2.9 Overview of Empirical Studies	38
2.10 Implications to the Reviewed Literature on the Present Study	43

CHAPTER THREE; RESEARCH METHODOLOGY

3.1 Introduction ……	45
3.2 Research Design ……	45

3.3 Population of the Study 46
3.4 Sample and Sampling Technique 48
3.5 Instrumentation 49
3.5.1 Geometry Performance Test (GPT) 49
3.5.2 Geometry Attitudinal Questionnaire (GAQ) 49
3.6 Validity of the Instruments 49
3.7 Pilot testing 50
3.8 Reliability of the Instruments 50
3.9 Items Analysis 51
3.10 Administration of Instruments 51
3.11 Data Collection procedure 51
3.12 Data Analysis 52

CHAPTER FOUR; RESULT, ANALYSES AND DISCUSSION
4.1 Introduction 53
4.2 Data Presentation, Analysis and Result 53
4.3 Summary of the Findings 60
4.4 Discussions of the findings 61

CHAPTER FIVE; SUMMARY, CONCLUSION & RECOMMENDATION
5.1 Introduction 64
5.2 Summary 64
5.3 Conclusions 65
5.4 Recommendations 66
5.5 Contribution to Knowledge in geometry and mathematics 67
5.6 Limitation of the Study 68
5.7 Suggestion for further studies 68
References 69
Appendices 73

ABSTRACT

This study investigated the effects of practical approach on teaching geometric concepts, students' attitudes and performance among junior secondary school II students in Katsina metropolis, Katsina state, Nigeria. The population consisted of 31,937 JS II students comprising of 17,271 male and 14,666 female. The research was carried out on Students from which four schools were selected with 160 students using simple random sampling techniques. The design used is pre-test, post-test with control and experimental groups' designs. From the four schools randomly selected, two were randomly selected as experimental groups and two as control groups. Experimental group comprises two intact classes of 40 students each as well as the control group. The Geometry Performance Test (GPT) and Geometry Attitudinal Questionnaire (GAQ) were the main instruments used for data collection with reliability coefficient of r=0.84 and r=0.82 respectively. The statistic used was t-test for testing the hypotheses at 0.05 level of significant. There was a significant difference between the mean achievements of students taught geometric concepts using practical approach and those taught using Conventional Approach. Similarly, using Practical Approach in experimental group males and females differ significantly, males perform better than females. There is positive attitudinal change with Experimental group students while students of Control group with negative attitude.

The findings indicated that practical approach plays vital role in the teaching learning process of geometry. It was recommended that there should be adequate and constant supervision of Teachers to ensure Practical Approach Method for effective teaching and learning process. It is also recommended that effective instructional strategy and materials should be used.

THE PROBLEM

1.1 Introduction

Over the years, mathematics teaching and learning at junior secondary schools has not been impressive and leads to failures in WASC, SSCE and JAMB mathematics examination as a result of the poor performance right from junior secondary school which has more to do with the methods of teaching than the content of curricular of the school mathematics.(WAEC report) Studies on the factors responsible for the failure and consistent poor performance have identified poor teaching methods and non usage of instructional materials among others (Badmus, 2002).

Walfram (2004) defined mathematics more broadly as the process of translating a problem to a mathematical form, deciding what result is required mathematically, doing the computation, moving from the mathematical beginning point to the mathematical endpoint and interpreting the result. This problem is more with Geometry in particular. The development of a highly skilled scientifically- and technologically based manpower requires a strong grounding in mathematics. Mathematics is "the classification and study of all possible patterns". An area of Mathematics that is often used to produce patterns in artistic works is geometry. Geometric is the branch of Mathematics which deals with the relationship of lines, angles and surfaces. Mathematics is also a subject of enjoyment and excitement, which offers students opportunities for creative work and moments of enlightenment and joy. When ideas are discovered and insights gained, students are spurred to pursue mathematics beyond the classroom walls since practical approach is being used as teaching method.

Evidences from research findings revealed that many young learners performed very poorly in the subject due to one factor or the other, thereby limiting their career prospects to areas that demand

little or no Mathematics (Ado, 2004 & Gana, 2006). For most children, practical work provides the most effective means by which understanding of mathematics can develop. It enables them to think out the mathematical ideas which are contained within the various activities they undertake at the same time as they are carrying out these activities; and so to progress within each topic from the handling of actual objects to a stage in which pictures or diagrams can be used to represent these objects and then to a final stage at which symbols are used which can be manipulated in abstract ways.

The teaching and learning of geometry has been the subject of considerable international interest, with many questions remaining about appropriate teaching methods and curriculum design, with a view to informing the development of better pedagogical models and instructional strategies in teaching geometry. Geometry conception has been considered as a base for learning mathematics. Nevertheless geometry as a branch of mathematics is perceived as difficult by most of the students (Iji & Harbor-Peter, 2005). The researchers suggested that an essential teaching strategy used by mathematics teachers at this Junior Secondary School level is an approach that aims mutually to reinforce Practical Approaches in order to develop students' thinking, particularly in the transition to Geometric Shapes. They should be given the opportunity to learn about these shapes. This research, therefore intends to consider the teaching of geometry in schools at Junior Secondary level. Certain definitions will be made, some geometrical concepts will be considered in terms of teaching strategies for effective learning. The use of manipulative (concrete materials), practical work, and use of technological aids should be part of the learning experiences of the students.

Geometry starts from what you can see, touch or feel. For any strategy of teaching geometry to be effective and meaningful at the formative stage, the strategy must have those features that will

expose the learner to those learning opportunities that geometry as a subject is naturally endowed with. Without this, the teacher will be teaching himself as the common practice in school today.

Every Nation, in the world over, depends on what education can do for its development. Nigeria national objectives, for instance, are geared towards self-realization; individual and national efficiency, economic, scientific and technological progress, among other (National Policy on Education, 2004 reviewed). Despite the importance of mathematics in our educational system, its teaching and learning process is in situation that requires urgent attention if better performance is expected. Many students cannot defend their score grade in many institution of higher learning. For this reason, only few students continue with Mathematics in higher level

(Bature & Bature(2006), argued that mathematics is poorly learned because it is poorly taught in both primary and secondary schools. No wonder our science/mathematics departments in higher institution are becoming empty. Secondary school mathematics has brought a lot of sorrow to students, teacher's parents and guardians because of poor achievements. Poor achievements of students in mathematics and points out that introduction of suitable instructional materials and methods are likely solutions (salau 2000). Past researches such as Cech showed that males performed better than females. According to Cech (2012), mentioned that girls find mathematics subject much more difficult than boys. Cech continues that although girls achieve at equal levels to boys in middle and high school, many girls stop taking mathematics as soon as they can.

1.2 Statement of the Problem

Mathematics has been one of the most important subjects in educational system, for it is the grass root of all sciences and technology. Mathematics was made a core subject of Science Curricular,

yet students performance in the subject continue to be worse as years go by (Segun, 2001 & Hussaini, 2003).

Geometry as a branch of Mathematics is also related to everyday experience; therefore, need effective teaching of elementary geometry. The problem confronting the research is the persistent mass failure in geometry at JSS level. Geometry a branch of mathematics is also related to everyday experience. Children through games have idea for turning, moving up or down and going round in their clockwise or anti-clockwise directions. These serve as a starting point for the teaching of elementary geometry. The teaching /learning of geometry in our school had suffered tremendously in the last decades as pointed out in the WAEC Chief Examiner' reports of 2000 and 2004. The poor performance of students in mathematics and geometry in particular has been a thing of concern to the researcher due to the poor performance in Geometry at JSS level. Students express difficulty in understanding geometric shapes and concepts being taught to them by their teachers. The poor foundations resulted in poor answering of questions in geometry which may be compulsory or often seem on the first sight thereby giving rise to cumulative mass failures of students' (Bature & Bature, 2006) How well can practical approach strategy influence students' ability in retaining geometrical concept being taught in Junior Secondary Schools?. Research conducted by Bolaji (2000), Bature and Bature (2006) have uncovered poor instructional techniques as one of the cause for poor performance among Secondary School Students in the subject.

Students learn better when concrete objects are used. Student should be exposed to as much practical work that will open a clear understanding of concepts and relations as well as being a powerful means of motivation. It is very true that the main focus of this study is on geometry.

The problem of this study is therefore, to access and investigate the: The Effects of Practical Approach of Teaching Geometry on attitude and performance of Junior Secondary School Katsina State Nigeria.

1.3 Objective of the study

The objective of the study was to determine the efficacy of practical approach on attitude and performance in geometry among junior secondary school students in Katsina state, Nigeria, specifically the study:

1. investigated practical approach on the academic performance in geometrical concepts.
2. investigated the effect of Practical approach on Gender performance among secondary school students in geometry using practical approach.
3. find out whether there is any difference in the performance of males and females in the geometrical concepts using conventional approach.
4. determine the relative effectiveness of the practical approach and lecture method on JSS 2 student attitude towards the learning of geometric concepts.

1.4 Research Questions

The study sought to provide answers to the following research questions

1. What is the difference between the mean scores of those that are taught geometrical concept using practical approach and those taught using conventional Approach ?
2. What is the effect of practical approach on gender performance among junior secondary school students in geometry using practical Approach?
3. Do male and female students differ in their performance of geometrical concept after teaching using conventional approach?

4. Is there any difference in attitude change towards learning of geometric concepts on JSS II Students using practical approach and lecture method?

1.5 Null Hypothesis

To answer the research questions of the study, the following null hypotheses were formulated and tested at a 0.05 level of significance.

HO_1: There is no significant difference between the mean scores of students taught geometrical concept using practical approach and those taught using lecture method.

HO_2: There is no significant difference between the mean scores on gender performance among junior secondary school students in geometrical concept using practical approach.

$H0_3$: There is no significant difference between male and female performance on geometrical concepts using conventional approach.

$H0_4$; There is no significant difference in attitude change towards learning of geometric concepts on JSS II Students using practical approach and lecture method.

1.6 Significance of the Study:

The Significance of the Study depends on the research findings of Effects of Practical Approach on teaching Geometric Concepts, which when put in use will ease teachers work in the class and on the part of the students makes learning permanent and interesting to them by using instructional materials.

The importance of this research is therefore to provide information from the findings which will be practiced by students, teachers, zonal offices, State MIP Offices States Ministry of Education, Federal Ministry of Education as well as in further researches. Similarly teacher become

acquainted with variety of effective teaching approaches to teach geometric concepts like Experimental Method, Discovery Method, Student Centered Method, Laboratory Method and Model kit Method which reduce difficulties in learning geometry at junior secondary school level which extends to senior secondary school and tertiary level geometry.

It is hoped that curriculum developers, Mathematics Text books writers will make use of the findings to improve the performance of students in geometry and makes them develop positive attitudes in geometry.

Hence, this work focuses on strategies for effective teaching and learning of Geometry at the Junior Secondary School level with a view to providing the desired foundation for building other geometry concepts. Professional bodies and associations like MAN, STAN e.t.c. and fellow researchers, the findings could be significant and useful to them, for it provide them new channels of imparting geometric knowledge to the learners to upraised their performance and academic achievement as well motivate them to develop positive attitude in geometry and mathematics as a whole.

1.7 Basic Assumptions of the study

The basic assumptions of the study are as follows:

Teachers that are included in the research were sensitized with practical approach method of teaching in which students touch, see and feel, this leads to easy and permanent learning if compared with conventional approach. Teachers in the research schools will develop habit of instructional materials improvisation which serves as the core centre of practical approach teaching method. This improvisation makes learning to be student centered, allows students to discover things by themselves and finally to solve problems at hand under the guidance of their teachers.

Teachers can improvise instructional materials by the use of local materials found at their disposals.

Practical approach equipped students with ample knowledge and skills to solve Geometric problems in the class, surroundings and the world in general. This will surely improved students' achievement in Geometry and Mathematics as well as developing positive attitude.

1.8 Scope of the study

Knowledge of mathematics is very wide from which Geometry is part of it. Therefore, it is not humanly possible to investigate all aspect of geometry in Junior Secondary Schools curriculum. However, the current study intended to use some selected topics designed in the junior secondary school geometry, from mathematics curriculum. Topics to be taught were selected across the Geometry syllabus: Pythagoras theorem, Bearings, Quadrilaterals, Plane and Solid Shapes, Angle of Elevation and Depression, Angles at a point add up to 360, parallel lines cut by a transversal, types of triangles and angles for they serve as basic foundation for learning geometry in senior secondary school and A level.

The study was limited to JSS II Students of 2013/2014 Session because descriptive geometry as provided for in the junior secondary schools mathematics curriculum requires live problems which are commensurate to the students level of understanding. Therefore at that age level thirteen years and above, students can think, reasons and analyzed beyond the reality of concrete experiences. JSS II Students were considered due to the fact that JSS I are new and JSS III are busy for their JSCE Examination. Four Schools were randomly selected with forty students of intact class in each school. The study was design to cover only the effect of practical approach of teaching geometry on attitude and performance of junior secondary school II students, Katsina state, Nigeria. Six weeks was used, to teach the students' the above geometric concepts. Later assessment and evaluation were made to determine the effectiveness of the strategy through the students' performance in the selected junior secondary schools of Katsina metropolis. Instruments used were

Geometry Performance Test (GPT) to test students' performance in geometry and Geometry Attitude Questionnaire (GAQ) to test if there is any attitudinal change of students using practical approach. Objective test and rating scale were used respectively.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter discussed the previous review of literature related to Effect of Practical Approach on Teaching Geometric Concepts and Students' Attitudes and Performance among JSS II Students. In review of literature, the researcher has to identify, select, read, evaluate and document all sources of information in order to be able to analyze and interpret his result and draw valid conclusions. The review was done under the following sub-headings:

Theoretical Framework

2.2 Historical Perspectives of Geometry with Shapes and Concepts.

2.3 Teaching Geometry in Junior Secondary School

2.4 Mathematics Teaching Method

2.5 Practical Approach to Teaching Geometry

2.6 Conventional Approach Method

2.7 Definition of Attitude

2.7.1 Attitude Towards Geometry and Academic Achievement in Junior Schools.

2.8 Gender Difference and Achievement in Geometry

2.9 Overview of Empirical Studies

2.10 Implications of the Reviewed Literature on the Present Study

2.2 Theoretical framework

The current study described three theoretical framework on practical approach. The findings of Tarte and Fannema (2000) showed that male students were claimed to be better in geometry than their female counterparts. Various adopted models (model kits) as part of practical approach by Adetola, 2006 and Ale, 2007. Experimental method of teaching by Polya, (1954) for discovery purpose and activity based learning method.

Altun, 2005 in his studies used student-based experimental method in which students are active and which aims at learning through drill and practice, proving and induction in geometry on student success compared to teacher centered traditional teaching method where student are passive..

2.2 Historical Perspectives of Geometry with Shapes and Concepts

Geometry is derived from the Greek "ge" meaning earth and 'metria' meaning measure; hence the original meaning of geometry was "land measurement". It is believed that land measurement was first developed in Egypt where periodical flooding of the Nile obliterated existing landmarks. Land surveyors had to premeasure after each flood using rope with 12 knots equally spaced out. These surveyors were called "Harpedonaptae" meaning rope-stretchers. A study of the ancient pyramids of Egypt strengthens this view. The builders were seen to have remarkable knowledge of practical geometry. They were able to observe compass bearings without a magnetic compass; they constructed square corners with minimal errors of measurement of lengths and angles.

Earliest attempt to systematize the geometrical scheme came from Euclid, who laid down certain entities out of which more complex groupings could emerge. He presented these as a logical necessary sequence for establishing his propositions, namely: 'points', 'lines' 'angles', 'polygons' and the 'circles'. Euclid however, organized existing knowledge of geometry into a logical system

in his ‘Elements’ (a 13-volume series). Other contributors to the development of geometry were Thales credited with the introduction of Theoretical geometry. His particular interest was in measuring inaccessible height; Pythagoras (507-582 B.C) was a pupil of Thales whose legacy of Pythagoras’ Theorem is still very useful in solving problems of right angled-triangles.

Plato (347-427 B.C.) was a student of Socrates for 8 years before he became associated with a set of Pythagoreans in Athens. He then formed his own school of philosophy. On his gate he had the following inscription: “Let no one destitute of geometry enter my doors”. He is known to be one of the greatest philosophers of the antiquity; Alexander the Great founded Alexandria on the Nile Delta in the fourth century B.C Ptolmey (85-165 A.D) made Alexandria a center for literary and scientific study which gave birth to the world’s greatest ancient university. Her library totaled 600,000 scrolls within her 40 years of existence. This university flourished for nearly 1000 years but was destroyed in 642 A.D during Arab invasion of North Africa. The university had numerous professors of geometry who helped to lay the foundation for modern geometry.

Archimedes (212-287 B.C) came to Alexandria from Sicily. He was a practical man who invented irrigation systems and war machines. He is best remembered for his study of articles, spheres parabolas, spirals and cylinders. Apollonius (Ca 225 B.C) known by his contemporaries as a great geometer, wrote eight books on geometry concentrating on conic sections merely through intellectual interest Kepier discovered 18 years later, the amazing practical applications of his knowledge in the laws relating to the orbits of planets as they revolve around the sun. (Maclean, Mumford, Bock, Hazell and Kaye, 1964).

The earliest recorded beginnings of geometry can be traced to ancient Mesopotamia, Egypt, and the Indus Valley from around 3000 BC. Early geometry was a collection of empirically discovered principles concerning lengths, angles, areas, and volumes, which were developed to meet some

practical need in surveying, construction, astronomy, and various crafts. The earliest known texts on geometry are the Egyptian *Rhind Papyrus* and *Moscow Papyrus*, Babylonian clay tablets, and the Indian *Shulba Sutras*, while the Chinese had the work of Mozi, Zhang Heng, and the *Nine Chapters on the Mathematical Art*, edited by Liu Hui. South of Egypt the ancient Nubians established a system of geometry including early versions of sun clocks.

Until relatively recently (i.e. the last 200 years), the teaching and development of geometry in Europe and the Islamic world was based on Greek geometry Euclid's *Elements* (c. 300 BCE) was one of the most important early texts on geometry, in which he presented geometry in an ideal axiomatic form, which came to be known as Euclidean geometry. The treatise is not, as is sometimes thought, a compendium of all that Hellenistic mathematicians knew about geometry at that time; rather, it is an elementary introduction to it; Euclid himself wrote eight more advanced books on geometry. We know from other references that Euclid's was not the first elementary geometry textbook, but the others fell into disuse and were lost.

In the Middle Ages, mathematics in medieval Islam contributed to the development of geometry, especially algebraic geometry and geometric algebra. Al-Mahani conceived the idea of reducing geometrical problems such as duplicating the cube to problems in algebra. Thābit ibn Qurra (known as Thebit in Latin) (836–901) dealt with arithmetic operations applied to ratios of Geometrical quantities, and contributed to the development of analytic geometry. Omar Khayyám (1048–1131) found geometric solutions to cubic equations, and his extensive studies of the parallel postulate contributed to the development of non-Euclidean geometry. The theorems of Ibn al-Haytham (Alhazen), Omar Khayyam and Nasir al-Din al-Tusi on quadrilaterals, including the Lambert quadrilateral and Saccheri quadrilateral, were the first theorems on elliptical geometry and hyperbolic geometry, and along with their alternative postulates, such as Playfair's axiom,

these works had a considerable influence on the development of non-Euclidean geometry among later European geometers, including Witelo, Levi ben Gerson, Alfonso, John Wallis, and Giovanni Girolamo Saccheri. In the early 17th century, there were two important developments in geometry. The first, and most important was the creation of analytic geometry, or geometry with coordinates and equations, by René Descartes (1596–1650) and Pierre de Fermat (1601–1665). This was a necessary precursor to the development of calculus and a precise quantitative science of physics. The second geometric development of this period was the systematic study of projective geometry by Girard Desargues (1591–1661). Projective geometry is the study of geometry without measurement, just the study of how points align with each other.

Two developments in geometry in the 19th century changed the way it had been studied previously. These were the discovery of non-Euclidean geometries by Lobachevsky, Bolyai and Gauss and of the formulation of symmetry as the central consideration in the Erlangen Programme of Felix Klein (which generalized the Euclidean and non-Euclidean geometries). Two of the master geometers of the time were Bernhard Riemann, working primarily with tools from mathematical analysis, and introducing the Riemann surface, and Henri Poincaré, the founder of algebraic topology and the geometric theory of dynamical systems. As a consequence of these major changes in the conception of geometry, the concept of "space" became something rich and varied, and the natural background for theories as different as complex analysis and .

All around us in the physical world, we have objects of various shapes, sizes and forms. Each object has its particular shape, size and form by which it can be identified. No matter what similarities exist between some objects, there are differences that distinguish one object from another. Children are part of this physical world where they come in contact with a variety of objects of different shapes, form and size. They should be given the opportunity to learn about

these shapes. To do this, we need Geometry. Hogon (2000), on her assessment of the importance of geometry rightly pointed out that even the houses we are living in are constructed with the knowledge of geometry in mind. The word construction is completely, indispensable in the technological world. Practically every serious shape is constructed and construction at higher technology is not devoid of the construction started at the elementary mathematics level. It implies that Geometry helps in the development of psychomotor skills such as sewing, metal works, blacksmithing, goldsmithing, shoemaking, barbing, shooting of gun by hunters, which is a simple projectile involving both practical and descriptive geometry. Geometry is an aspect of mathematics which deals with the study of different shapes. These shapes may be plane or solid. A plane shape is a geometrical form such that the straight line that joins any two points on it wholly lies on the surface. A solid shape on the other hand is bounded by surfaces which may not wholly be represented on a plane surface. Plane shapes are shapes with only two dimensions (length and breadth) e.g. quadrilateral (Square, Rectangle, Kite, Rhombus, Parallelogram and Trapezium which are all four sided figures). Also included are Triangle of different types and Circle in which area and perimeter are calculated. Solid shapes are three dimensional figures (length, breath and height) e.g. Cuboids, Cube, Cylinder, Sphere, Cone, Pyramid etc. Total surface area and volume are normally found here.

2.3 Teaching Geometry in Junior Secondary School

Geometry is a vital branch of the mathematics curriculum. Junior secondary level reviews the basic geometrical concepts introduced informally at primary level and expand on them for a deeper knowledge of their properties. Constructions of solid shapes from nets; copying of figures (angles and triangles) using protractor and ruler only; an in-depth study of triangles; (classification by

angles and by sides) and symmetrical plane figures are concept directly concerned with geometry content. Other curricular contents have application and computational values e.g. areas, perimeters and volumes of geometrical shapes (plane or solid), calculation of missing angles, circular faces, sectors, segments, etc. (Linking geometry with algebra). A host of practical activities is needed in the teaching and learning of geometry. Students should be encouraged to participate in a practical work. Use of students' work-book should be encouraged more.

According to the Principles and Standards for School Mathematics (National Council Of Teachers Of Mathematics, 2000), grade 6–8 students (age 13-15 years) should come to the study of geometry with informal knowledge about points, lines, planes and a variety of two-and three dimensional shapes with geometric relationships. Similarly, the Turkish elementary and middle school mathematics curriculum includes the study of definitions of plane, identifying plane and solid figures, and learning about their properties.

According to Ukwu (2000), posited that Geometry happens to be the main post of call if the mind of man is appropriately developed. The reason is that, at birth man finds himself surrounded with shapes, pattern and forms. He immediately becomes aware of these things which are really the major constituents of his environment and in no time, willingly or instructively becomes curious and inquisitive or begin to demand for explanation with regard to where about of the patterns, shapes and forms around him. It has been observed that students have not been demonstrating strong conceptual knowledge of this subject.

Many students develop misconceptions and others fail to go beyond simple visualization of geometric figures (Mistretta, 2000). Although laboratory instruction is used in many disciplines such as physics, chemistry and biology education, it is usually not used in mathematics education.

In the mathematics teaching often, after theorems and their proofs have been carefully presented, students are just given exercises.

Therefore, with good teaching methods in geometry (Practical Approach) and ample use of instructional materials, students will have a good start of geometric concepts, which as a result of the world will be technologically advanced. Similarly, students can manipulate and make geometric objects of different shapes and design for textile industries and other places.

2.4 Mathematics Teaching Methods

Different methods of teaching mathematics have been proposed by different educators and the knowledge of these methods may help in working out a better teaching strategy. It is not appropriate for a teacher to commit to one particular method. A teacher should adopt a teaching approach after considering the nature of the children, their interests and maturity and the resources available. Every method has certain merits and few demerits and it is the work of a teacher to decide which method is best for the students. Therefore, teachers of mathematics should start thinking of the various ways on how to improve their teaching methods. According to Penick (2006) teaching methods are changing as we renew our focus on students and meaningful learning in a broad set of intellectual domains. The new concern of teachers for students is how they can learn and develop knowledge and ideas while at the same time we are setting our sights on expanded or additional goals for them.

Teachers do not use instructional materials in teaching neither can they improvise. Teachers do not consider the psychology of the learner. For example they may not use concrete materials and motivation where necessary, which makes mathematics teaching, not related to real life situation. Aubrey, (1997) in Odugwu 2001 says, teaching skills will lead invariably to effective learning

closely related to content and teaching methods is teaching competences. It's ability to integrate the content and methods to achieve optimal results. Therefore, a good teacher should possess both the subject matter and methodology with concrete objects being practilised, for effective teaching learning process to take place.

It has been observed that (ugwuanyi,2002) an effective teaching and learning is a situation in which both the teacher and his pupils have warm understanding, organized, business like, stimulating, and imaginative rather than being cold, aloof, unplanned, slipshod, dull and routine like. Also theory appeared to be taught as absolute knowledge and teaching methods that encourages student – centered activities for developing reasoning skills and processes, through scientific approach, are conspicuously lacking.

Strategies in the sense are the things the teacher must to do to encourage and sustain students' interest, motivation and achievement in their study of mathematics. That is to say some teachers use inappropriate methods while others use sterile and uninspiring methods of instruction that is abstract and usually not related to the students' environment. Discovery method views teaching as thinking, probing, searching, discovery, gathering information, sifting information, analyzing and drawing conclusion for them.

In order to ensure that appropriate methods are used, tertiary institutions should design several courses in methodology in order to expose student teachers to a variety of methods. For serving teachers, seminars and workshops should be organized for them from time to time in order to familiarize them with better methods and techniques of teaching mathematics.

2.5 Practical Approach To Teaching Geometry

Mathematics is essential school subject needed for science and technology development. Mathematics as a subject is used in all aspects of life arranging from counting numbers and figures to manipulating them for meaningful decision taking. Due to the importance of Mathematics to man and the society at large, the teaching of Mathematics was made compulsory from primary level up to secondary school level in Nigeria (National Policy On Education, 2004 reviewed).

In traditional teaching method, most students graduate with memorized information as they are not given chances of problem solving, using information, that is, reforming the knowledge and they are not provided with activities that help them use their thinking skills and that are directed to research skills (Açikgöz, 2002). The National Policy on Education (FRN,2004) stipulates that education at all levels "shall be structured to develop the practice of self-learning" and as result "teaching shall be by practical, exploratory and experimental methods" Specifically, the policy (FRN,2004)posits that at the primary level, "the medium of instruction shall be language of the environment for the first three years…" and "…from the fourth year, English shall progressively be used as a medium of instruction …" That is to say, with this they will have a sound background in mathematics right from primary school which make them to perform better in their junior secondary school mathematics.

(Adetula 2001) many students welcome mathematics classes in appreciation of the power of certain mathematical methods and creativity, especially discovery method. A lesson designed to provide routine drill or mere memorization of mathematical facts may be less interesting than a lesson whose goals is to stimulate thought or intellectual curiosity.

Having seen different practical approach methods above, this work will focus on some of the methods like Experimental method, Laboratory method and model method of teaching mathematics as practical approach in comparism with lecture method which is part of traditional

teaching method. Most of the researchers agree that traditional teaching methods are not sufficient in mathematics teaching and other science disciplines (Tando, 2006;).

2.5.1 Experimental Method of Teaching

As the world is ever changing, lecture method is no more effective method of teaching; as such we need student centered method to suite with the changing world. Polya (1954) also very strongly emphasizes the importance of experimental methods, exploration in the discovery or invention of new mathematics and is quoted as one of the most productive mathematicians of all time. There have been some changes in the curriculum of Primary School Mathematics Education applied in 2005-2006 educational year. It is, in principle, adopted in the new program that activity-based learning methods used in mathematics education to make students more active in learning. One of these teaching methods is the experimental teaching method. By experimental teaching, we can attain a generalization as can be seen in discovery learning. The method used is actually discovery learning method but sometimes there is a need to use some experiment material to be able to make some discoveries by the students.

(Altun, 2005). The aim of this study is to determine the effect of student-based experimental method in which students are active and which aims at learning through drill and practice, proving and induction in geometry on students' success compared to teacher centered traditional teaching method where students are passive. We can summarize the advantages and disadvantages of Experimental teaching method.

Advantages

The first and most important of all, since students find the theories and rules that are discovered by using mathematics knowledge in high level on their own by trial and error process, it makes

learning more enjoyable, easier and increases their success. Second, because students produce knowledge by themselves, they become more involved in lessons which create a continuous activity and liveliness. Finally, this method can be utilized in teaching of not only volume of pyramid, cone and sphere but also in teaching of other geometry concepts.

Disadvantages

As for disadvantages, activities have to be prepared by teacher beforehand. There appears to be some problems in obtaining the materials to be used in activities and it takes more time to carry out experimental activities in comparison with traditional teaching method. It makes learning more over boring, due to the long time taken.

2.5.2 Laboratory Method of Teaching

According to Rabiu 2004, laboratory is generally understood to be a special room where scientific investigations are carried out through laboratory activities, student discover new ideas for themselves. Therefore, the introduction of mathematics laboratories in our schools to run side by side with the existing laboratories in Biology, Chemistry, Physics, and Home Economics cannot be overemphasized.

Igbokwe (2000) Mathematics laboratory is a place where students can learn and explore various Mathematical concepts and verify different Mathematical facts and theories using varieties of activities and materials.

Mathematics laboratory is a specially equipped room in a building where Mathematics lessons or activities hold on regular basis or a corner of the regular classroom with tables containing collection of teaching aids. Odili (2006) posited that Mathematics is a subject which has to be learnt by doing rather than by reading. The doing of Mathematics gives rise to the need of a suitable

method and suitable place. Laboratory method and Mathematical laboratory are the proper answer to it.

How Mathematics laboratory should be in our Schools

It should be a focal point for all Mathematical work in the school. Much of the apparatus to be stored there should be made movable and could be utilized in ordinary classroom. The Mathematics laboratory should be the calculating center of the school. In addition to slide rules there should be a collection of desk calculators. These would have a most stimulating effect in the teaching of Mathematics and for some students are never ending sources of fascination.

Work in the mathematics laboratory will throw into a more practical light on what is being done in ordinary class work. This will help the students who are slow in understanding abstract when the truth of these abstractions is shown in a concrete manner, they are more readily appreciated. This in turn will lead to far greater understanding of Mathematics than could ever be obtained by chalk and talk methods.

A Well Equipped Mathematics laboratory is described as Follows

The size of the laboratory should be as large as other science laboratories in the school or even larger. The windows and doors should be on the sides of the room not at the ends. At the teaching end, there should be a large chalkboard well-spaced to enable the teachers refer back to previous work. Apart from the large chalkboard in front of the laboratory, there should also be a roller chalkboard with two or three plain surfaces and one ruled graph surface. It may be made detachable such that it may simply be hanged on the fixture with the long side horizontal or vertical as required. Another attractive chalkboard, which should be magnetic in nature, is required in Mathematics laboratory with number symbols on it and figures made out of plastic with

magnetized portions that adhere to the surface of the board. On the sidewall of the room, low cupboards with working surface should be installed as standard type furniture. These are precisely to keep useful teaching equipment, chalkboard instruments, demonstration models, exhibition, materials and visual aids. On the opposite sides of the chalkboard could be placed a fairly large notice board where the result of experiments or statistical investigations are to be displayed. The upper part of the walls should have a display and pegboard on which further materials could be fastened such as Mathematical materials from newspapers and periodicals, historical dates relating to Mathematics, sketches of most of the elementary functions and instructional charts. The teacher's desk should be large enough and should have an ample supply of drawers. It might also be useful to have a light girder above the teacher's desk from which he could suspend demonstration models of the pulley type. There should be electric power points on each wall and also at the front and back of the laboratory. This is to effectively use overhead projectors or electric desk calculators without requiring on extension wire. A store should be provided for the stock of Mathematical books, experimental equipment, computers, and other materials that may not be conveniently placed in cupboards might then be kept in the storeroom. (Rabi'u 2007).

Suggested list of apparatus to be kept in the Mathematics Laboratory

According to Rabiu 2007, large Geometrical instruments for use on chalkboard, Mathematical reference books particularly computing books. Specialized Mathematical stationeries e.g. computer coding sheets, logarithmic and semi-logarithmic graph papers etc. Set of slide-rules with a file of instruction cards in a programmed learning systems. A collection of Mathematical kits or solids made with rods, plastics, cardboard papers. A collection of Mathematical models, made by the students. Weighing and measuring instruments e.g. rulers, weight scales, spring balance etc. Constructional equipment e.g. compass, protractors, dividers etc. Dice, cards, sampling bottles,

coins etc. for statistics and probability. Drawing boards, T-squares, circular protractors etc. Coloured wool and needles for curve stitching. Collection of sample tools like pliers, small hammers, saws, screwdrivers, cello-tape etc. Mathematical game facilities and wall charts among many other. The function of the Mathematics laboratory is to give opportunities for the practical work within the framework of the school time-table. In locating lessons to the Mathematics laboratory we must consider the size of the school. Practical work is best done in double periods because of the time involve in giving out and collecting materials. There is the need for every class in the school to be allocated at least a double period once a week. For a considerably large school, more than one Mathematics laboratory becomes a necessity. For the good students, their understanding of Mathematics is sharpened by practical work. For those who are weak the laboratory approach would show them many fields of real life where Mathematics is of importance and from their concrete experience, they might develop some insight into the abstract nature of the subject. The main feature of the work in a Mathematics laboratory is that it should be a basis for the study of Mathematical concepts in their practical aspects. Ideas about probability from experiments with dice, playing cards and small bags containing different quantities of coloured counters for practical random sampling should be provided. Practical works are best done individually in the Mathematics laboratory or in pairs so that every member of the class is actively participating.

Advantages of Laboratory techniques in the teaching and learning of Mathematics

It stimulates and maintains the interest of the students in Mathematics. It encourages Mathematical exploration and manipulation by the students. It keeps the students alive and thinking and helps them to realize the application of Mathematics. It can be used to illustrate basic concepts, laws or rules of Mathematics and development of such concepts, law or rules. It provides the opportunity

for students to learn how to use cutters, turners, drill bits Mathematical set, paint, brush, models of solids and charts and other kinds of laboratory equipment in Mathematics laboratory.

2.5.3 Mathematics Teaching Model (Kits)

Mathematical modeling is an act of relating mathematics to real life problems. Mathematical models, in the past were used to eradicate smallpox. Mathematical modeling is a way of using mathematics to tackle real life problems; the idea of mathematicalization is usually the idea of mathematical model. Teachers need to build-up students' perception in the twilight zone between mathematics and the real world to get the students to 'see' underlying patterns in the jagged outlines of experience, and also to get them to 'see' the meaning of mathematical solutions when these are translated back into physical terms. Relying on this, the National Mathematical Centre embarked on a project on Mathematics Kits (model) for Primary and Secondary Schools. For the fact that the kits were provided with the shapes readymade, this study tried to fill or bridge the gap by activity method, where students use cardboard papers to cut the shapes themselves, also the teachers guide through improvisation, which resulted in good learning out-come.

(Adetula, 2006; Ale, 2007). The impact of these models on selected schools was a resounding success. In its elementary form, that is meaningful to Primary and Secondary school levels, the word model is often used to refer to concrete representation or mental constructs of ideas. That is, a model is a physical replica of a concept. For instance for common solids, the name of some objects representing mathematical concepts are listed below:

Name of subject	**Concept**
Cube of Sugar	Cube
Tin of Nido	Cylinder

Packet of Omo	Cuboids
Ball	Sphere
Roof of circular building	Cone

Quite often, teachers tell students that mathematics exists, useful and purposive without really showing how. In mathematical modeling, these things are what they will be seeing and doing as will be exemplified in the different model methods of teaching various Mathematics concepts.

Various Models Methods

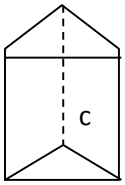
Model Method of Teaching the Characteristic of Solid Shapes

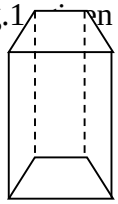
Explore the characteristics of these solid shapes in Fig.1 above in that

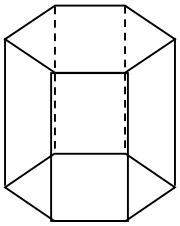
Number of vertices (**V**)

Number of edges (E)

Number of faces (F)

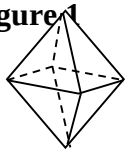


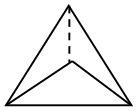


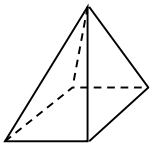


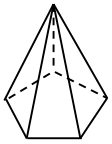
Triangular prism Quadrilateral prism Hexagonal prism

Figure 1









Regular Octahedron Triangular pyramid Square pyramid Pentagonal pyramid

Any relationship? Yes F+V-E=2, Table 2.1

Name	V	F	E	V + F - E

Tetrahedron or				
Triangular Pyramid	4	4	6	2
Square Pyramid	5	5	8	2
Pentagonal Pyramid	6	6	10	2
Regular Octahedron	6	8	12	2
Triangular Prism	6	5	9	2
Hexagonal Prism	12	8	18	2

Therefore, model can be used to help students discover relationship.

Roles of model

The roles of models in the teaching and learning of Mathematics include:

- To provide a setting for discovery of concept as indicated above
- To provide a means for making independent investigation

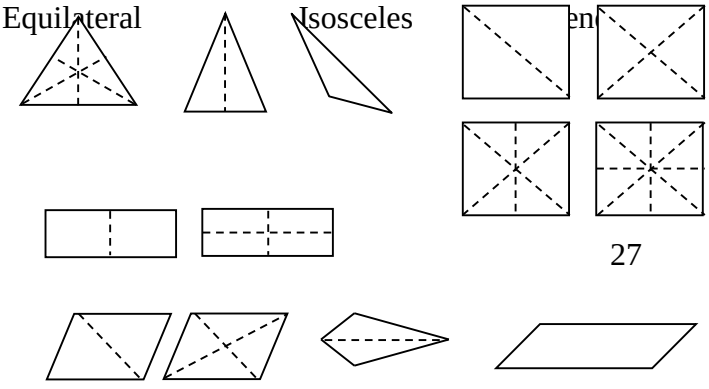
  To generate interest in a new topic

- To provide retention

2.5.4 Method of Teaching Symmetry of Flat Shapes

Cardboard cuts of rectangles, squares, parallelogram, trapezium, circles, triangles.

Equilateral Isosceles



Rectangle Square

Rhombus Kite Parallelogram

Circle

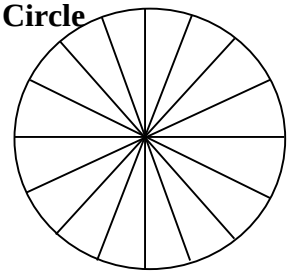


Figure 3

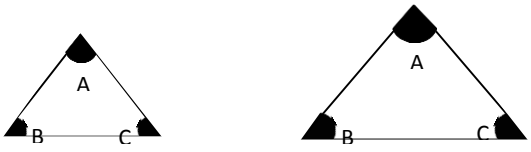
Shapes	No of Symmetry
Triangle	
Scalene	0
Isosceles	1
Equilateral	3
Quadrilateral	
Rectangle	2
Rhombus	2
Square	4
Parallelogram	0
Kite	1

Trying to fold each shape into two equal halves, if the two halves fully overlap then the line of folding is the line of symmetry.

Circle	Infinite

Model Method of Teaching Sum of Angles of a Triangle

By drawing a triangle on a separate sheet of paper, cut out the three shaded portions of the triangles as shown below:

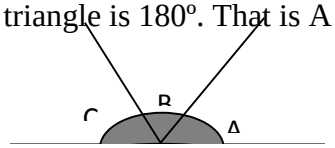


(a) **(b)**

Fig 3

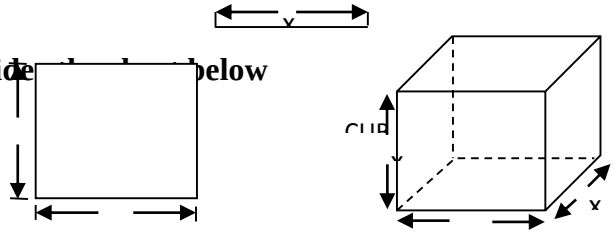
Bring the three shaded portions to form angles on a straight line as shown below:

Since students know those angles on a straight line adds up to 180º, students will then conclude that the sum of angles of a triangle is 180º. That is A + B + C = 180º.



Model Method of Teaching Segment, Square and Volume

Consider the shapes below



SEGMENT

Figure 4

Teachers lead students and ask pertinent questions such as

- What does x represent in each figure?
- What expression can be used to represent the area of the square?
- What expression can be used to represent the volume of the cube?
- How many dimensions does a line segment have? A square? A cube?
- How many dimensions are suggested by each of the following algebraic expressions: X, X^2, and X^3? Teacher now uses chart to help students focus attention on how to relate the measures listed below on the left with the algebraic expressions listed on the right.

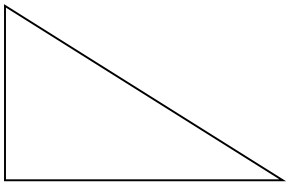
Length of a segment	x
Area of a square	x^2
Volume of a square	x^3

Note that a segment, a square and a cube are familiar figures. Now, how many dimensions does the algebraic expression x4, suggest? To keep the imaginations of students in orbit, teacher lead the students to some very mathematics abstract idea of n-dimension space. The purpose of model when mathematics teachers used it effectively is:

- To motivate learning.
- To awaken student interest.

- To help students discover concept.
- To help clarify idea.
- To speed up communication.
- To help students solve a problem.
- To help the students to practice a skill
- To help the students grasp a special relationship

2.5.6 Model method of teaching special or quadrantal angles (0º, 90º, 180º, 270º) of trigonometrically functions



In a right angle Δ ABC

Cos θ = c/b **sec θ** = c/b

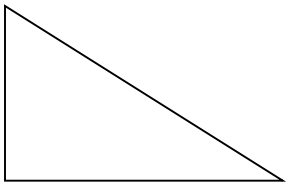
Sin θ = a/c **cosecθ** = c/a

Tan θ = a/b **cot θ** = b/a

Figure 5

Will we still have a right angle Δ ABC if θ = 0º?

Or θ = 90º?



In the right angle triangle ABC, consider

What happens when θ started decreasing?

First point B moves to point B´

Then to point B″,…, and finally, as point B

Tends to point C, i.e., as $\theta \rightarrow 0^{o}$.

=>$a \rightarrow 0$ and $c \rightarrow b$. Hence, **Figure 6**

Sin 0^{o} = 0/b = 0 **Cosec 0^{o}** = b/0 = ∞

Cos 0^{o} = b/b = 1 **Sec 0^{o}** = b/b = 1

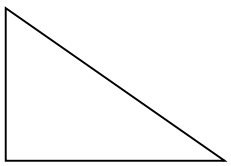
Tan 0^{o} = 0/b = 0 **Cot 0^{o}** = b/o = ∞

In the right – angled Δ ABC, consider what happens

when θ started increasing. First point C moves to

C′ as B moves to B′ then to C″ as B′ moves to B″.

Finally, as C tends to point A, $b \rightarrow 0$, $\theta \rightarrow 90^{o}$ and $a \rightarrow c$, Hence,



Sin 90^{o} = c/c = 1 **Cosec 90^{o}** = c/c = 1

Cos 90^{o} = o/c = 0 **Sec 90^{o}** = c/o = ∞

Tan 90^{o} = c/o = ∞ **Cot 90^{o}** = o/c = 0 Figure 7

Strictly speaking, angles 0^{o} and 90^{o} cannot appear in a right angled triangle as acute angles, but in an extended view of trigonometric functions, we just have to consider their values. The symbol ∞ (infinity) indicates that the absolute value of the quantity increases without bound. Note that ∞ (infinity) is not a number. Model Method of Teaching the Relationships between Volumes of a Cylinder, a Cone and a Sphere. Consider these three models indicated below: The models are so designed in such a way that the height H equals the diameter D. that is H = D.

- Fill the cylinder with water;
- Discover that the water in this cylinder will fill the cone three times;
- Also discover that the water in this cylinder will fill exactly the Cone and the sphere;
- Is it reasonable to say that the volume of the sphere is twice that of the cone
- Use this result to derive a formula for the volume of a sphere expressed in terms of the radius.

That is,

$V = \pi \{D/2\}^2 H - 1/3 \pi \{D/2\}^2 H$

$= 2/3 \pi \{D/2\}^2 H$

$= 2/3 \pi \{2/3\}^2 . 2r$

$= 4/3 \pi r^3$.

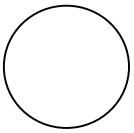


Figure 8

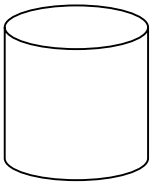


Figure 9

2.6 Conventional Approach Teaching Method

The Conventional method revolves around the teacher and is more of group –oriented and teacher centered. The approaches or strategies to teaching Geometry among primary and secondary schools are virtually the same. The Conventional Approach as an instructional strategy which demands that only one person can speak at a time and here shy or slow learning students may always be reluctant to speak at all, but it is still the most commonly used method. The approach encourages rote memorization of Mathematics concepts which leads to easy for getting the concepts learnts (Uyoata.2006) .

2.7 Definition of Attitude

Bature (2005) observes that major determining factors for attitude formation are the individual wants, information on group affiliation and personality. Attitude has to do with the way one perceives, the opinion one holds as well as what one beliefs about things, people, activities, institutions, polices, administrations and phenomena in general.

Attitudes refer to the affective aspects of mathematics learning such as:

• Beliefs about mathematics and its usefulness

• Interest and enjoyment in learning mathematics

• Appreciation of the beauty and power of mathematics

• Confidence in using mathematics

• Perseverance in solving a problem

Sambo (2008) argues that the measurement of attitude is a complex matter and cannot be observed directly but can be inferred from the way individual student reacts to a particular stimulus or situation. In education, attitude is one of the important elements which determine students' success.

According to Effandi and Normah (2009), students' attitudes towards mathematics are very much related to their attitude towards problem solving in general. They add that negative attitudes need to be overcome, so that later in life, students will not suffer from poor problem-solving skills. It is important to master problem solving skills as these skills are essential for dealing competently with our everyday life. Their claim is supported by O'Connell (2000) who points out that students must have positive attitude towards problem solving if they are to succeed. He proposes that solving problems requires patience, persistence, perseverance and willingness to accept risks. This

concurs with Papanastasiou (2000) claims that students with positive attitude towards mathematics will generally excel at it.

Students' attitudes towards mathematics are shaped by their learning experiences. Making the learning of mathematics fun, meaningful and relevant goes a long way to inculcating positive attitudes towards the subject. Care and attention should be given to the design of the learning activities, to build confidence in and develop appreciation for the subject.

2.7.1 Attitude Towards Geometry and Academic Achievement in JSS

It is generally believed and commonly accepted that mathematics is a subject and that only exceptionally good ones can learn it successfully. Such belief has gone a long way to affect the attitude of students towards the subject and Geometry in particular. The kind of attitude a child brings to the classroom is very important.

According to Cetingöz and Özkal (2009) attitudes affect the students' interaction with their friends, families, school and lessons. Therefore, students' attitude towards the course will add to their success. Attitudes are fundamental to the dynamics of behaviors and they are the determining factor of what the students learn. If a student has a positive attitude towards mathematics, he will not only enjoy studying it but would derive satisfaction from the knowledge of mathematics ideas he gains. But it is unfortunate that many students hate most Geometry in mathematics. This apathy towards mathematics can be traced among other things to the instructional process and perhaps to the influence of the society and peers in the schools. Unlike intelligence which is a mental ability, attitudes are learnt and they are emotionally toned predisposition to reaction in a consistent way towards a person, object or idea. This reaction could be positive or negative. The student learns this attitude in school, at home and from his peers.

In the school situation, the teacher is an important factor which determines the attitude of a student. He could make or mar studentș interest in mathematics. Teachers represent a rather wide range of competence both as far as subject matter training and pedagogy is concerned.

The way the teacher translates the curriculum in to knowledge for assimilation by students is very important. Teachers have always, according to the syllabus, taught mathematics as a body of isolated groups of information without any relationship with one another and with the realm of reality. Students are thus confined to operate within a realm of a closed system of sets of techniques without integrating what they are learning with other parts of their knowledge. Hardly do teachers make their students realize the importance of mathematics. And worst still the techniques the teachers employed in the teaching Geometry are as such that the subject is never brought to bear on the immediate environment of the student.

Therefore, the welding of mathematical techniques pure and simple does not crystallize any practical experience of life beyond that of having learnt the techniques and hence is totally void of creative synthesis of life experience. What is needed is a way of ensuring deeper mathematical insight, in such a way that the Geometry can be learnt as one blended whole are relating Geometric Concepts to the environment. Although, mathematics is not native to any society, the blended content of mathematics could be related to the Nigerian environment and so is the teaching of Geometry.

The justification for the teaching of geometry is supposed to assist student to:

Clarify and enlarge student’s store of geometrical concepts. Aids in the mastering of simple use of geometrical instrument and techniques of geometric drawing, measurement and constructions. Acquaint students with good geometrical notation, application of set language to geometrical

experience and concept and the procedures involved in deductive proofs of geometrical theorems. Develop insight into analogous properties and relations of geometry in 2-dimensional and 3-dimensional objects. Many students turn out to be very miserable and inattentive in a mathematics class after being taught a topic and discover they could not memorize or recall such a concept with ease. The reason for this difficulty may vary but this could sometimes be related to the teaching method being used to explain such topics.

Aprebo, (2002) says that exhibition of poor knowledge of mathematics contents, lack of accurate use of instructional materials, pedagogical approaches and evaluation strategies by many teachers and undue emphasis on examination syllabuses coverage at the expense of meaningful learning of mathematics concepts by many school administrators contribute immensely to the persistent and consistent poor performances of students in mathematics at both the internal and external examination.

Harbor-Peters (2001) asserted that the issue of poor performance in mathematics examinations was due to problem of teaching methods. There has also been an increasing awareness by those concerned with mathematics education that the conventional methods of teaching mathematics, has not been very successful. For effective teaching to take place, the skillful mathematics teacher needs to use many different methods and techniques at his disposal.

A carefully designed teaching method can make teaching and learning effective (Chianson in Kurumeh & Opala, 2008).

This research examines the core topics in geometry where the problems of teaching and learning occurs most in mathematics. Topics such as plane and solid shapes, measurement of plane and solid shapes, polygons, Geometrical ratio, geometrical transformation, latitude and longitude etc.

Statistics have shown difficulty in teaching and learning of mathematics, generally identified to be difficult by both students and teachers. Geometry in particular, has resulted in mass failure in examinations. The mass failure in mathematics examinations is real and the trend of student's performance has been on the decline. A cluster of variables has been implicated as responsible for the dismal performance of students. These include, government related variables, curriculum related variables, examination body related, teacher, student, home and text-book related variables. Teaching of clarity, understanding, application and retention concrete and tangible retention have been the focus of Geometry and mathematics educators for decades, in order to motivate students to perform effectively in Geometry. The continuous evolution and revolution in the theories of science education over the years have been to speed up the pace of delivery of good quality science instructions including mathematics which involve fruitful method of instructional delivery. The poor performance of students in mathematics and geometry in particular has been a thing of concern to mathematics educators, parents and government. The chief examiner's annual reports in mathematics in the Senior School Certificate Examinations (SSCE) conducted by the West African Examinations Council (WAEC) and National Examinations Council (NECO) are good testimonies of those facts. Mathematics educators have put in effort aimed at identifying the major problems associated with secondary school mathematics. Despite all these noble efforts, the problem of poor achievement in mathematics has continued to rear its head. It is based on this fact that this research identified geometry as a core difficult area where student's performance has always been low. Falayajo et.al, (1997), is indicating that learners perform poorly on items dealing with Geometry and measurement. Measurement and construction are treated under the broad headings of measurements and practical/ descriptive geometry for the primary level, and mensuration and geometry for the secondary level. Measurement and construction topic include

further treatment of problems on area, volumes, length of both similar and un similar shapes, using scale factor method and formulae, and construction of special angles, right-angled triangle, freehand and accurate scale drawing of planes, views and the whole objects using a pair of compasses, dividers, set square and ruler. Adequate coverage is giving to calculating area of parallelograms, rhombuses, trapeziums and circles and the use of calculations of lengths area and volume of figures.

Conclusively the study wants find out if positive attitude towards geometry leads to good achievement of students'.

2.8 Gender Difference and Achievement in Geometry

The main goal of instruction is to bring about desirable changes in knowledge, skills and attitude of students. Teaching of Geometry therefore, should adopt methods that encourage the manifestation of the desired attributes, irrespective of the individual and the gender differences that exist. The issue of gender differences has attracted attention from educators and researchers. Ewhrudjakpor (2006), Gender refers to culturally patterned behaviors either actual or normative which are attached to sexes. It involves masculinity or femininity. Student's sex has been a prominent factor in Mathematics and Geometry learning. The extend of knowledge of students serves as a potential basis for effective learning. It is common assumption that knowledge of Mathematics and Geometry between male and female students differ significantly. The phenomenon is reported to be worldwide. In most cases, the male students are claimed to be better in Mathematics. According to Aiyegbusi,(2005), one major obstacle to women's involvement in Science, Technology and Engineering is the relative poor performance of female students in Mathematics. Since a good knowledge of Mathematics is a fundamental pre-requisite in pursuing careers in the field.

Research finding by (Abdullahi, 1998 and Kolawale, 2007) revealed that the method adopted by some mathematics teachers in the manipulation of numbers and subsequent interpretation for decision making especially at the primary level had made many to hate the subject. Beside the inconsistencies in the application of abstract terms and symbols had worsened the situation, thereby leading to under achievement in the subject. Various studies were carried out to find weather gender differences exist in academic achievement of students, in which this research intended to find out boys or girls perform better.

2.9 Overview Empirical Studies

Many researchers have been carried out on the understanding of effect of practical approach in teaching geometric concepts and students attitudes in Junior Secondary School, those available to the researcher are reviewed in this section.

In their study on improving Nigerian Secondary Students' Achievement in Geometry Bature and Bature (2006) examined the effect of gender and school type on S.S.C.E mathematics achievement in Bauchi Metropolis. Four hypotheses were formulated and tested. Data were collected from SSCE results of 1995, 1996 and 1997,a total of 5260 candidates results were used, t- test was used to test the hypotheses at 0.05 levels of significant. The result shows that there were no significant differences between the achievement of boys and girls; and single sex schools \mixed sex schools. The implication of this study is that achievement in Mathematics does not depend on gender or school type.

Ahmed (2001) investigated students' relationship between visual perception of geometric shapes and achievement of students in junior secondary schools in Minna metropolis. A sample of 370 made up of boys 186 and girls 184 from eleven purposively sampled schools was used to determine

the relationship between visual perception of geometric shapes and achievement. The pearson product moment correlation coefficient was used to test the hypotheses while T and F- test where also used. The result revealed that significant relationship exist between visual perception of geometric shapes and achievement. Also, significant differences in the mean scores of males and females in the test of geometric achievement were found. While test of visual perception of geometric shapes was found not significant at ὰ = 0.05. similarly, significant difference erxist between visual perception of geometric shapes and test of Geometric achievement by school types at ὰ = 0.05. in addition, scheffis test reveal that the mean scores of girls school differ significantly compared to the mean scores of boys or mixed schools. The findings of the study confirmed that visual perception of geometric shapes is related to students' geometric learning.

Achor, Imoko and Jimin (2012) on their study improving some Nigeria secondary student's achievement in geometry used a non equivalent pre-test, post-test control group quasi experimental design, on intact classes assign to the experimental and control groups. The population consisted of 7184 SS1students out of which a sample of 288 students was selected from four secondary schools. Two of the selected schools were assigned as experimental group while the other two were the control group Geometry 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,B,C, & D) ANCOVA was use to analyze data' that there was a significant difference between the mean achievement of the group taught geometry using team approach and the group that interacted with their class teachers using problem solving approach only. (F1, 287 = 117.96 P < 0.05). However male and female students taught did not differ in their mean achievement significantly (F1, 287 9.690, P > 0.05). There was a significant interaction effect of gender and method on students' achievement in geometry (F1, 287 = 6.551,P < 0.05) it is recommended among others that adequate

teaching and learning materials be made available for teachers who were encouraged to use team teaching along with problem solving strategy. .

Lawal and Samson (2010), in their studies in model method of teaching mathematics concluded that generally, a mathematical model is a mathematical idealization in the form of a system, proposition, formula, or equation of a physical, biological or social phenomena. However, this is restricted to the elementarized form of presenting model as a physical replica of a mathematical concept with the view of eliciting meaning and gaining more understanding in the concept. This now becomes a strong foundation for the mathematics teachers (trained at the university) that will be teaching these mathematics concepts at the secondary school level. Students express difficulty in understanding and retaining concepts being taught to them by their teachers. Researchers identified that how well students retain taught mathematics concept can be traced back to the teaching approach used. How well can cooperative learning strategy influence students' ability in retaining mathematics concept being taught in secondary schools? In teaching of abstract Concepts in Junior Secondary Education, there is a need for activities that will help students learn theoretical information by trying and proving and for the use of concrete materials in which students are actively involved.

Rabiu (2007) concluded that with laboratory teaching, student discover many ideas for themselves without being told. Therefore, the establishment of Mathematics laboratories is essential in our schools. Once a school has developed a mathematics laboratory, it will be in a stronger position to promote interest and effective understanding for mathematics for all categories of student. Finally, for school that may not be able to possess well equipped laboratories immediately, it is suggested that modest beginning of the mathematics laboratory be initiated with the few resources available. This can successfully be done by improvisation.

An investigation on a sample of 120 junior secondary III students in secondary schools in Kano State, the result revealed that, in geometry, students performed better in basic geometric concepts 59% than in knowledge of basic properties 51% or knowledge of relationship among geometric objects 46%. Adetula′s (2000) study is pertinent to the current study because junior secondary III student were involved and the findings will serve as a guide on the areas of geometry that need further investigation. Experimental teaching method that has been utilized for years in science education, in which laboratory activities are used and that has been proved to be more effective in comparison with traditional teaching method was used to calculate the volumes of pyramid, cone and sphere. According to the test results, it was seen that experimental teaching method in which laboratory activities are used was more effective than traditional teaching method. In general success, it was found out that in knowledge and comprehension level questions students in experiment group who were taught by experimental method of teaching were more successful than those were taught by traditional teaching method. This result is parallel with what Confucius articulated thousands of years ago "I hear, I forget; I see, I remember; I do, I understand" and with many researchers' findings such as Nakhleh Tsai and Telli et al. (2004).

However, the education to develop human resources needed is not given much attention. In particular, low quality education in Science and Mathematics is an urgent issue to be addressed. In response to the request of the government of Kenya, the government of Japan began the project for Strengthening Mathematics and Sciences in Secondary Education (SMASSE) in 1998 which provides assistance to Science and Mathematics education through in–service training of teachers. In line with the Kenyan government policy on education, the SMASSE project was launched to enhance Mathematics and Science education in secondary schools in the country with the assistance of Japan International Cooperation Agency (JICA). The project is also tasked with the

provision of teaching/learning materials and training of teachers on how to improvise these materials where necessary through Activity, Student, Experiment and Improvisation (ASEI) and Plan, Do, See and Improve (PDSI). ASEI (Activity, Students, Experiments, Improvisation) movement emphasizes student's participation from the start to the end of the lesson. The teaching activity should be student centered, based on experiments and improvisation if necessary. For instance, the teaching/learning of Longitudes and Latitudes in mathematics can be accompanied by improvising a metallic or plastic globe and using it in locating the position of an object along the equator. For the students to participate in the lesson, the teacher must plan the lesson well. Similarly, the teacher must also evaluate every aspect of the lesson during teaching.

PDSI (Plan, Do, See, Improve) approach stresses on the need for the learners to carry out a well-planned learning activity that involves seeing for them and improving the activity even further for effective learning to take place. This is based on the findings of Yadar (2007) and UNESCO (2008) which postulate that an object well-handled practically impresses itself more firmly in the mind than the object merely seen from a distance or in an illustration.

In this study the researcher intended to find the efficacy of practical approach on teaching geometric concepts using pretest and posttest for both experimental and control groups using achievement test. Also Attitude Questionnaire to test students' attitude before and after the treatment. With this, the research is different from the past researches.

2.10 Implications of the Reviewed Literature on the Present Study

Among the problems that generated this research is poor academic achievement as it relates to Geometry as a school subject which has severally been attributed to poor teaching methods among the Nigerian school population. This study has indicated that practical approach is a superior

approach to teaching using lecture method, as it relates to achievement in Geometry. It is therefore, necessary for Teachers of mathematics to review their approaches and methods of teaching geometry in the school, in the light of present findings. The findings of this study suggest that students taught using practical approach to teaching Geometry gain scores than students taught using lecture method.

This study has an influence on the initiation of using mathematics laboratory in teaching of mathematics at secondary level. As the need for good strategy for teaching mathematics so as to improve the result and performance of student in board examination, the study has thrown a light on the use appropriate strategy that is the integration of three methods of teaching namely Expository, Experimental and problem solving method coupled with modeling in laboratory atmosphere. As per this study, use of strategy evolved for teaching mathematics is a mathematics laboratory as described there are some schools where mathematics laboratory is not an integral part of curriculum framework. So this study signifies that, mathematics laboratory could be made an integral part of curriculum framework and create mandatory use of lab for teaching mathematics. The ultimate result of study revealed that; practical approach was more effective instructional method for teaching mathematics as compared to traditional methods of teaching. Furthermore; mathematics laboratory appeared to be a befitting platform for creating positive interdependence as compared to classroom.

Students should develop and explore the mathematics ideas in depth, and see that mathematics is an integrated whole, not merely isolated pieces of knowledge. They should be given a variety of learning experiences to help them develop a deep understanding of mathematical concepts, and to make sense of various mathematical ideas, as well as their connections and applications, in order to participate actively in learning mathematics and to become more confident in exploring and

applying mathematics. The use of manipulative (concrete materials), practical work, and use of technological aids should be part of the learning experiences of the students. It is observed that the above techniques used in Geometry learning effectively increase the academic success in addition to the social and intellectual abilities of the students. Various research have shown at secondary school level this technique is effective in the learning process of the theoretical subjects, in the development of critical thinking process of the students and increase active participation in the educational process. Past literatures conducted their studies on gender achievement, visual perception of geometric shapes while this study uses Models Kits (Adetula,2006; Ale, 2004), Laboratory Method (Rabiu 2004) to find out the efficacy in students Academic Achievement and students' Attitude in relation to geometric shapes.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The purpose of this study is to find strategies for effective way of teaching and learning at the junior secondary school level for the sake of building other geometric concepts. This chapter discussed about the design of the study; the population of the study, and sampling technique, instrumentation, validity and reliability of the instrument, Pilot study, method of data collection and data analysis.

3.2 Research design

The study adopted a pre-test and post-test Experimental-Control group design. The sample were divided into two groups, group A was Experimental group that used Practical Approach and group B was the Control group that used Conventional Method. The two groups were pre-tested to determine their entry level. Post-test was administered on both groups and the results were analyzed after six weeks of class instruction on selected geometric topics.

EG $\rightarrow O_1^{(AC, AT)} \rightarrow x_1 \rightarrow 0_2^{(AC, AT)}$

CG $\rightarrow O_1^{(AC, AT)} \rightarrow x_1 \rightarrow 0_2^{(AC, AT)}$

Group A Experimental Group

Group B Control Group

0_1 Pre-test

X Treatment (practical approach)

0_2 Post-test.

AC Academic Achievement

AT Attitude

X_O No Treatment

3.3 Population of the Study

Table 3.1 Distribution of Schools and Students with Gender in Katsina State.

S/N	ZONE	NO.OF SCHOOLS	MALE	FEMALE	TOTAL ENROLMENT
1.	DAURA	31	11,206	4,699	15,905
2.	DUTSINMA	32	9,750	5,975	15,725
3.	FUNTUA	37	23,163	8,498	31,651
4.	MALUMFASHI	23	14,291	7,393	21,684
5.	MANI	25	7,829	2,458	10,287
6.	KANKIA	30	8,132	4,068	12,200
7.	KATSINA	37	20,618	16,988	37,606

TOTAL	215	94,989	50,079	145,058

Source: MOE, KATSINA (2012/2013)

The population of this study was made up of all students in junior secondary school in Katsina state as shown above. The target population is the junior secondary schools in Katsina metropolis. There are a total of 13 schools. Thus, the total number of students was thirty one thousand nine hundred and thirty seven (31,937), comprising seventeen thousand two hundred and seventy one (17,271) males and fourteen thousand six hundred and sixty six (14,666) females, out of which only JSS II Students were considered. The distribution of these schools in Katsina.

TABLE 3.2: Distribution of Population According to School Gender.

S/N	Schools	Type of School	Male	Female	Total
1.	GGJSS Katsina	Single Female	-	608	608
2.	GJSS Kambarawa	Mixed	1,102	309	1,411
3.	GJSS Kofar Sauri	Mixed	1,569	487	2,056
4.	GJSS Natsinta	Mixed	1,058	874	1,932
5.	GRBSS Batagarawa	Male	306	-	306
6.	GJC Katsina	Mixed	2,047	2,047	4,094
7.	KCK (Jnr) Katsina	Mixed	1,380	1,255	2,635
8.	GGJSS K/ynadaka	Single Female	-	6,151	6,151
9.	SUNCAIS (Jnr)	Male	120	-	120

10.	GSAB Katsina	Mixed	4,631	326	4,957
11.	GJSS D/Safe	Mixed	4,259	2,026	6,285
12.	GJSS Yandaki	Mixed	722	454	1,176
13.	FSPSS Katsina	Mixed	137	69	206
	Total		**17,271**	**14,666**	**31,937**

Source: MOE, Katsina (2012/2013).

3.4 Sample and Sampling Technique

Four junior secondary schools were selected using the stratified sampling technique, after identifying different random by considering population characteristics of male and females. Each of the four schools has four arms A, B, C and D. Intact class was used in each of the selected schools (Compbell and Stanley, 1996), allows for naturally collectives that are intact class. Four intact classes of forty students each were selected from the two experimental groups and another two Control groups. A total of about one hundred and sixty (160) junior secondary school students were used as sample size.

The research was conducted with the participation of 160 second year of Junior Secondary School Students (JSS II) of Katsina State, being divided in to control and experimental groups giving pre-test and post-test with treatment for the experimental group only. One of these group was identified as experimental group (n=80), 40 from boys' school (Suncais Katsina) and 40 from girls' school (GGC(Jnr) Katsina) using practical approach methods and the other control group (n=80), 40 from boys' school (GJSS K/Sauri Katsina) and 40 from girls' school (Family Support Katsina) using the Conventional method for them. The summary of the sample selected is shown below in table 3.2. The researcher uses Morgan's table.

Table 3.3 Distribution of Sample Study Schools and Sex

Groups	Schools Names	Male	Female	Total
Experimental	SUNCAIS(Jnr),Katsina	40	-	40
	GGC (Jnr), Katsina	-	40	40
Control	GJSS K/Sauri, Katsina	40	-	40
	FSPSS, Katsina	-	40	40
	Total			**160**

3.5 Instrumentation

The following instruments were used for data collection.

i. Geometry performance test (GPT) ; and

ii. Geometry attitudinal questionnaire (GAQ)

3.5.1 Geometry Performance Test (GPT)

There are fifteen questions which were all objective questions and fill in the blank with fifteen solutions. The GPT is shown on the Appendix C.

3.5.2 Geometry Attitudinal Questionnaire (GAQ)

There are fifteen questions were feeling and attitude towards geometry and its learning are tested in each statement. Rating scale were used indicating five points strongly agreed (SA), Agreed (A), undecided (U), disagreed (D), strongly disagreed (SD). The GAQ is shown on Appendix D.

3.6 Validity of the Instruments

The pre-test (O) is to stabilized the students to be up to standard and post-test (O) to see the effect of practical approach if compared with traditional method ,that is to find the solutions to research questions in chapter one(1.4), to see how much ,had been learnt with the application of the

treatment (X). For this study the instruments used were: geometry performance test (GPT) and geometry attitudinal questionnaire (GAQ). The pre-test and post-test were different and related questions in geometry.

Validity is a check of test, efficiency and stability to major what is expected to measure in order to minimize errors and mis-interpretations. Validity is of two types that is content and face validity. For content validity to ensure good coverage of the course content, each research instrument, pre and post-test was given to four experts, two mathematics educators from Ummaru Musa Yar'adua University, Katsina, one from Government Girls` College Katsina and one from Government College Junior Katsina. The two mathematics educators validated the content to avoid ambiguity and all the corrections were implemented. According to Gay (1998), content validity is determined by experts' judgment. Finally the two Mathematics teachers looked at the face validity and validated it by Lecturer Ummaru Musa Yar'adua.

3.7 Pilot Testing

For the fact that the closest school to the randomly selected schools was Kofar Kaura Day Secondary School was selected the pilot study. The purpose for the pilot study were to find out:

Appropriateness of the instruments. The difficulties which the students might encounter in the process of answering the test questions and time taken. Appropriate statistical techniques to be used for the data analysis. The results of pilot study were used to modify final instruction of the content coverage. Two classes were treated using practical approach called experimental classes while the other two classes were taught using conventional approach for two weeks with no treatment. The GPT and GAQ were used to estimate the instrument reliability coefficient.

Therefore, both groups were assumed to be equivalent at the beginning in terms of geometric knowledge. They are homogeneous.

3.8 Reliability of the Instruments

Reliability is concerned with the stability of the test score. A test is reliable for the fact that the instrument is tested several times. According to Maduabum (2004), any reliability Coefficient of 0.5 and above is reliable. Thus, a reliable instrument minimizes the error to some acceptable bounds. To test the reliability of the instruments, the items were administered to the students used in the pilot study. This was done by the researcher with the assistance of one other mathematics teacher. The test/Retest and Kuder-Richardson`s reliability test were used to measure the pre and post tests given reliability co-efficient of 0.76 which indicates inter item consistency and heterogeneity of the knowledge domain sampled. The Split-Half Reliability test used for the attitudinal scale instrument has reliability co-efficient of 0.82 indicating a high consistency of measurement. It showed a fair grouping of the items as the items were divided into two halves as with Split-Half Reliability. One class was taught using practical approach while the other one using conventional method in two weeks. Using same students, the test was re-administered and the scores were correlated using Pearson Product Moment Correlation Coefficient, where r = 0.76, which is reliable.

3.09 Items Analysis

There were 45 items, 5 items for the analysis. 15 items for the pilot study, another 15 items for the pre-test and the last 15 items for the post test given to both experimental and control groups, the results were recorded as the data which was analyzed using statistical method.

3.10 Administration of Instruments

The experimental group of the study was taught geometry through practical approach while the control group was taught the same topic using conventional approach by the researcher with the help of four trained assistants in different schools. The teaching lasted for 6 weeks using students of 2012/2013 session of the academic calendar. The topics taught were types of triangles and angles, angle at a point, Pythagoras theorem, angle of elevation and depression, bearings and plane and solid geometry. A comprehensive lesson plan on practical approach and conventional approach were provided to ensure the control of extraneous variables see appendix A.

3.11 Data collection procedure

The research instruments were administered to the sampled students of Junior Secondary School two (JSS II) of 2012/2013 session in third term. Both the control and experimental groups were given pre-test; their mean score of each group was calculated and compared to determine the initial students' performance. Post test was also given and the result was compared.

3.12 Procedure for Data Analysis

The data collected from the study through pre-test, post test, Geometry performance test (GPT) and Geometry Attitudinal Questionnaire (GAQ), the scores were calculated and recorded for the purpose of hypothesis testing. The data collected was used to test the null hypothesis by using statistical packages. The hypothesis is used to find the significant difference between the mean score and the effect of treatment by the used of t-test to determine whether the means of two given samples differ significantly and also test the following hypothesis:-

HO_1: There is no significant difference between the mean scores of students taught geometrical concept using practical approach and those taught using lecture method. This hypothesis was tested using t-test statistic.

HO_2: There is no significant difference between the mean scores of female and male student taught in geometrical concept using practical approach and those taught using lecture method. This hypothesis was tested using t-test statistic.

$H0_3$: There is no significant difference between male and female students in their performance of geometrical concepts after teaching using practical approach. This hypothesis was tested using t-test statistic.

$H0_4$; There is no significant difference in attitude change between males and females at the end of teaching geometric concept using practical approach and lecture method. This hypothesis was tested using t-test statistic.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.1 Introduction

In this chapter, the result obtained from the analysis of the data collected and the discussion of the results is presented. The data collected was analyzed using standard statistical package. The chapter is presented in the following sub-headings.

- Data analysis and result
- Summary of the main findings
- Discussions

  The major objective of the study was to taste the efficacy of practical approach on attitude and performance in geometry Among Junior Secondary School Students in Katsina State, Nigeria.

4.2 Data Presentation Analysis and Result

The presentation of data, analysis and interpretations are organized around the research questions and null hypotheses of the study. The description statistics are as follows:

Research Question One: What is the difference between the mean scores of those who are taught geometrical concept using practical approach and those taught using lecture method?

Mean difference between practical approach and lecture method.

Table 4.1. Summary of the Mean and Standard Deviation of Students Academic Performance Scores in Geometrical Concept using Practical Approach and Lecture Method

The results in Table 4.1. Showed that the students exposed to experimental group had a mean score of 56.59 while the control group scored 32.30. The mean difference was 24.29. These showed that the experimental group had higher performance than those with the lecture method.

Groups	N	Mean	SD	Mean Difference
Exp.	80	56.59	7.72	
				24.29
Cont.	80	32.30	8.67	

Research Question Two: What is the effect of practical approach on the academic performance on gender when taught geometrical concepts and those taught using lecture method?

Data on gender related difference in geometry between practical approach and lecture method.

Table 4.2 Summary of the Mean and Standard Deviations of Student Score on Gender Difference, using Practical Approach and Lecture Method

The results in Table 4.2 Showed that the students exposed to experimental group of male had a mean score of 58.30 while the control group of male scored 31.95. The mean difference was 26.35.

These showed that the male experimental group had higher performance than those with the lecture method.

Groups	N	Mean	SD	Mean difference
Exp.(M)	40	58.30	7.63	
				26.35
Cont. (M)	40	31.95	9.11	

Table 4.2 Summary of the Mean and Standard Deviations of Student Score on Gender Difference, using Practical Approach and Lecture Method

The results in Table 4.2 Showed that the female students exposed to experimental group had a mean score of 54.87 while the control group of female scored 32.65. The mean difference was 22.22. These showed that the experimental group of female had higher performance than those with the lecture method.

Groups	N	Mean	SD	Mean difference
Exp. (F)	40	54.87	7.51	
				22.22
Cont.(F)	40	32.65	8.30	

Research Question Three: Do male and female students differ in their performance of geometrical concept after teaching using practical approach?

Table 4.3 Summary of the Mean and Standard Deviations of Student Score on Gender Difference, using Practical Approach

The results in Table 4.3 Showed that the male students exposed to experimental group had a mean score of 58.30 while the experimental female group scored 54.87. The mean difference was 3.43. These showed that the male experimental group had higher performance than the female experimental.

Groups	N	Mean	SD	Mean difference
Exp. (M)	40	58.30	7.63	
				3.43
Exp.(F)	40	54.87	7.51	

Research Question Four: Is there any difference in attitude change between males and females at the end of teaching geometric concepts using practical approach h and lecture method?

Table 4.4: Summary of Mann-Whitney U test on Experimental Vs Control

Based on the available data, the computer output for the test indicated a p-value of 0.000 which is less than $\propto$ = 0.05 (level of significance), thus, the null hypothesis was rejected, then there is significant difference. Conclude that the medians of the two groups are not equal. In fact we can conclude that Experimental group has a higher median indicating a more positive attitude.

Group	N	Median	W	P
CONTROL	80	41.000	4128.5	0.000

EXPERIMENTAL 80 48.000

4.5 Hypotheses Testing

In this section, the hypotheses were tested using inferential statistics.

From the Table 4.5 t-calculated was 1.03 and t-critical was 1.975, tcal < tcrit therefore, not rejected. There is no significant difference between the experimental and control groups in their pre-test scores.

Table 4.5; Pre-test of Experimental and Control Groups

VARIABLE	N	$\bar{X}$	SD	Df	t-cal	t-crit	P-value	Remarks
Exp. (pre-test)	80	25.73	8.61					
				158	1.03	1.97	0.30	**
Control (pre-test)	80	27.30	10.70					

** not significant at 0.05 level.

HO_1: There is no significant difference between the mean scores of students taught geometrical concept using practical approach and those taught using lecture method.

To taste this hypothesis, the mean scores of students exposed to practical approach and those exposed to lecture method were subjected to t- test statistic. Summary of the analysis are shown in table 4.6 .

The result in table 4.6 indicate that that the the calculated t- value is 24.29. This value is greater than the t- critical of 1.99 at alpha = 0.05 with the degree of freedom (df) = 158. This means that there is significant difference between mean scores of the experimental group and the control group in favour of the experimental group. Therefore, the null hypothesis one(**HO_1**) is rejected. This implies that the experimental group taught geometrical concept using practical approach significantly performed higher than the control group taught using lecture method.

Table 4.6 Summary Of t-test Analysis.

Group	N	$\bar{X}$	SD	df	t-cal	t-crit	p-value	Remark
Exp.	80	56.59	7.72					
				158	24.29	1.99	0.001	*
Cont .	80	32.30	8.67					

*= significant @0.005

HO_2: There is no significant difference between the mean scores of female and male student taught in geometrical concept using practical approach and those taught using lecture method, t-test statistic was used to analyse it.

Table 4.7 Summary Of t-test Analysis

The result in table 4.7 indicates that that the calculated t- value is 14.02. This value is greater than the t- critical of 1.99 at alpha = 0.05 with the degree of freedom (df) = 158. This means that there is significant difference between mean scores of the male experimental group and the male control group in favour of the male experimental group, t-cal > t-crit. Therefore, the null hypothesis one (**HO_2**) is rejected. This implies that the male experimental group taught geometrical concept using practical approach significantly performed higher than the male control group taught using lecture method.

Groups	**N**	**Mean**	**SD**	**df**	**t-cal**	**t-crit**	**p-value**	**Remark**
Exp.(M)	40	58.30	7.63					
				78	14.02	1.99	0.001	*
Cont. (M)	40	31.95	9.11					

*= significant @0.005

Table 4.7a Analysis of Geometry Performance Test (GPT) of Post-test for Female Experimental and Female Control Groups

The result in table 4.7a indicates that the calculated t- value is 12.56. This value is greater than the t- critical of 1.99 at alpha = 0.05 with the degree of freedom (df) = 158. This means that there is significant difference between mean scores of the female experimental group and the female control group in favour of the female experimental group, t-cal > t-crit. Therefore, the null hypothesis two(**HO_2**) is rejected. This implies that the female experimental group taught

geometrical concept using practical approach significantly performed higher than the female control group taught using lecture method.

Groups	N	Mean	SD	df	t-cal	t-crit	p-value	Remark
Exp. (F)	40	54.87	7.51					*
				78	12.56	1.99	0.001	
Cont.(F)	40	32.65	8.30					

*= significant @0.005

$H0_3$: There is no significant difference between male and female students in their performance of geometrical concepts after teaching using practical approach, t-test statistic was used to analyse it.

Table 4.8: Analysis of Geometry Performance Test (GPT) of Post-test for Male Experimental and Female Experimental Groups

The result in table 4.8 indicates t that the calculated t- value is 2.02. This value is greater than the t- critical of 1.99 at alpha = 0.05 with the degree of freedom (df) = 158. This means that there is significant difference between mean scores of the male experimental group and the female experimental group in favour of the male experimental group t-cal > t-crit. Therefore, the null hypothesis three (**HO_3**) is rejected. This implies that the male experimental group taught geometrical concept using practical approach significantly performed higher than the female experimental group taught using experimental method.

VARIABLE	N	$\bar{X}$	SD	df	t-cal	t-crit	P-value	Remark
Exp. Group(M)	40	58.30	7.63					

	78	2.02	1.99	0.046	*
Exp. Group(F)	40	54.87	7.51		

*= significant @0.005

H0$_4$; There is no significant difference in attitude change between males and females at the end of teaching geometric concept using practical approach and lecture method, t-test statistic was used to analyse it.

Table 4.9: Summary of Mann-Whitney U test on Experimental Vs Control

Based on the available data, the computer output for the test indicated a p-value of 0.000 which is less than $\propto = 0.05$ (level of significance), we therefore reject $H0_4$ and conclude that the medians of the two groups are not equal. In fact we can conclude that Experimental group has a higher median indicating a more positive attitude.

Group	**N**	**Median**	**W**	**P**
CONTROL	80	41.000	4128.5	0.000
EXPERIMENTAL	80	48.000		

4.3 Summary of the Findings

The result of GPT and GAQ were analyzed using the t-test statistic. The mean scores of each group were computed in relation to each hypothesis has shown in table 4.6, 4.7, 4.7a, 4.8 and 4.9. All the four hypothesis were rejected. The basis for hypotheses finding are as explained below.

The pre-test showed that no significant difference between Experimental Group and Control Group. Therefore, both groups were found to be equivalent before treatment. The analysis of the data showed that there is significant difference in the performance of the students in the Experimental and Control Groups. The results showed that Practical Approach leads to meaningful and effective learning and thus, higher performance. This can be justified by comparing the mean scores of Experimental Group as 56.59 and 32.30 for Control Group, due to the treatment given to Experimental Group. The result showed that there was significant difference in the performance of males and females taught using Practical Approach Method. The males performed better than females using above method. There was significant difference in the performance of males taught using Practical Approach and males taught using Conventional Method. Also females of Practical Approach perform better than those in Control Group. The results showed that there was significant difference in the students' performance using Practical Approach and Conventional Approach; the Experimental Group developed a more favorable attitude towards Geometry. In conclusion, favorable attitude plays a vital role in teaching learning process performance. Thus practical Approach leads to effective Geometry learning.

4.4 Discussion of the Findings

The main objective of the research was to find out if there is effect on Practical Approach teaching method when compared with Lecture Method on Junior Secondary II Students learning achievement.

The pre-test showed that no significant difference between Experimental Group and Control Group. Therefore, both groups were found to be equivalent before treatment. The analysis of the data showed that there is significant difference in the performance of the students in the Experimental and Control Groups. The results showed that Practical Approach leads to meaningful and effective learning and thus, higher performance. This can be justified by comparing the mean scores of Experimental Group as 56.59 and 32.30 for Control Group, due to the treatment given to Experimental Group. The result showed that there was significant difference in the performance of males and females taught using Practical Approach Method. The males performed better than females using above method. The findings of Tarte and Fennema (2000) showed that male students were claimed to be better in Mathematics than their female counterparts. Also this research found out that there is significant difference between mean scores of the male experimental group and the female experimental group in favour of the male experimental group t-cal > t-crit. This implies that the male experimental group taught geometrical concept using practical approach significantly performed higher than the female experimental group taught using experimental method.

There was significant difference in the performance of males taught using Practical Approach and males taught using Conventional Method. Also females of Practical Approach perform better than those in Control Group. The results showed that there was significant difference in the students' performance using Practical Approach and Conventional Approach; the Experimental Group developed a more favorable attitude towards Geometry. In conclusion, favorable attitude plays a vital role in teaching learning process performance. Thus practical Approach leads to effective Geometry learning.

The result of this study showed efficacy of practical approach in teaching geometric concepts by using concrete objects and visual perception of geometric shapes from the immediate environment

relates and influences students' achievement in geometry. The study also aimed at determining the extent to which practical approach is influenced by gender. Therefore, there is need for mathematics teachers to pay adequate and appropriate attention to the skill of exposing students to learning geometry from the natural and immediate environment. This will help the students to obtain base- line information needed in learning subsequent geometry from practical perspective. This enhances their understanding of geometry. The result showed that the experimental group with treatment have a better performance in junior secondary school geometry. mathematical solutions when these are translated back into physical terms.

(Adetula, 2006; Ale, 2007). The impact of these models on selected schools was a resounding success. In its elementary form, that is meaningful to Primary and Secondary school levels, the word model is often used to refer to concrete representation or mental constructs of ideas. That is, a model is a physical replica of a concept. Relying on this, the National Mathematical Centre embarked on a project on Mathematics Kits (model) for Primary and Secondary Schools. For the fact that the kits were provided with the shapes readymade, this study tried to fill or bridge the gap by activity method, where students use cardboard papers to cut the shapes themselves, also the teachers guide through improvisation, which resulted in good learning out-come.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter discussed the summary of the findings of the research, draws conclusion and recommendations from the result of the investigation. The recommendations will serve as corrective measures and as baseline to future research. Also discussed is the contribution to knowledge. This chapter summarizes the entire study and is presented in the following sub-headings:

- Summary
- Conclusion
- Recommendations
- Contributions to knowledge in geometry and Mathematics
- Limitation

- Suggestion for further studies

5.2 Summary

The study was designed to find out the problems of teaching and learning geometry in secondary schools in Katsina State with a view to making recommendations towards improvement. This becomes necessary in view of the poor performance observed in geometry in mathematics at both internal and external school examinations.

As teaching and learning of geometry was not impressive e and leads to failures in WAEC, NECO and JAMB as a result of poor performance, right from Junior Secondary School, this prompted the researcher to carry out the research. The problem of this study is therefore, to access and investigate the effects of practical approach of teaching geometry on attitude and performance of Junior Secondary School Students, Katsina State, Nigeria. There were four objectives, four research questions and four null hypotheses.

Past researchers were reviewed pertaining the research topic. Altun, (2005) in his studies used student-based experimental method in which students were active and learned through drill and practice, proving an induction in geometry on students' success compared to teacher centered were students are passive. Aprebo, (2002) says that exhibition of poor knowledge of mathematics (including geometry) contents, lack of accurate use of instructional materials, pedagogical approaches and evaluation strategies by many teachers. Aiygbusi (2005) one major obstacle to women involvement in science, technology and engineering is the relative poor performance of female students in mathematics and geometry.

The research design used was pre-test and post-test experimental –control group design. Experimental with treatment (X). The population of the study was 145,058 JSS students in Katsina

State while target population is 31,937 in Katsina Metropolis. The instruments used were Geometry Performance Test (GPT) and Geometry Attitudinal Questionnaire (GAQ), t-test statistic was used to analyse the data collected and the hypotheses were tested. Data presentation, analysis and discussions were done. Finally, summary, conclusion and recommendations were written.

5.3 Conclusion

The following conclusions were drawn from the findings and interpretations of the study;

1. Practical Approach was more effective than conventional Approach for there was significant difference between the achievement of Experimental and Control groups. Experimental group performed better due to ample use of instructional materials in addition to good methods of teaching such as laboratory, model and Experimental Method of teaching Geometric Concepts.

2. There was significant difference in Geometry Achievement Test between male of Experimental and Control also female of Experimental and Control.

3. In enhancing performance in Junior Secondary School, there was significant difference between male and female achievement in the same Experimental Group. Males performed better than females.

4. Practical Approach significantly motivates students to positive attitude in Geometry than those taught by Conventional method.

Conclusively, Practical Approach made students to develop positive attitude towards learning of geometry.

5.4 Recommendations

Considering the above findings of students taught by Practical Approach performs better and than those taught by Conventional Method. The following recommendations are made;-

1. For effective teaching and learning in Geometry at Junior Secondary School level both teachers and students should be familiar with Practical Approach Method through sensitization workshops.

2. National conferences, workshops, seminars should be organized for teachers to acquaint them with teaching methods such as experimental method, discovery method, student centered method, laboratory method and model kid method for better and easier understanding of geometric concepts.

3. Teachers should try as much as possible to relate their lesson to real life situation in order to reduce abstract nature of the subject.

4 The appropriate bodies responsible for the monitoring of teachers and students should be made to leave up to expectations.

5. It is recommended that effective instructional strategies and materials should be used to reduced abstract nature of geometry and improve students' performance generally.

5.5 Contributions to knowledge in geometry and Mathematics

1. The research was able to establish that practical approach enhance learning of geometry. Students were moved forward to teaching of geometry unlike conventional method. It was found that students learn geometry in playful way when using practical approach and learning become

permanent as concrete objects were used. Students express difficulty in understanding geometric shapes and concepts being taught to them by their teachers. Students learn better when concrete objects are used.

The research highlights effective methods of instruction such as Laboratory Method, Experimental Method, Model Kit Method and also improvisation of instructional materials by the teacher, for combination of knowledge and good method yields better and effective learning of Geometric Concepts and Mathematics in general. Applications and modeling play a vital role in the development of mathematical understanding and competencies. It is important that students apply mathematical problem-solving skills and reasoning skills to tackle a variety of Problems, including real-world problems. It was found that mathematical modeling is the process of formulating and improving a mathematical model to represent and solve real-world problems. Through mathematical modeling, students learn to use a variety of representations of data, and to select and apply appropriate mathematical methods and tools in solving real-world problems. The opportunity to deal with empirical data and use mathematical tools for data analysis should be part of the learning at all levels. Making the learning of mathematics fun, meaningful and relevant goes a long way to inculcating positive attitudes towards the subject. Care and attention should be given to the design of the learning activities, to build confidence in and develop appreciation for the subject.

2. Positive attitude was developed as a result of geometric teaching using practical approach method. The research found out that Practical Approach makes teaching and learning of geometry more effective by developing instructional materials and teaching strategies for better achievement and positive attitude towards geometry by students of junior secondary school.

3. The study found out, sgender difference can be wiped-out, if practical approach can be applied to simplify geometry teaching for easy assimilation to female students of junior secondary schools which leads to good WAEC and NECO results in general.

5.6 Limitations of the study

. The time for the geometric teaching, nature of the selected topics, teachers and students conditions were also some of the limitations. The entire Katsina state junior secondary schools cannot be covered due to financial and time constrains.

5.7 Suggestions for Further Studies

Based on the findings of this research work, further studies may be suggested in areas of efficacy of practical approach on attitude and performance in geometry among junior secondary school students in Katsina state, Nigeria. Effects of teachers' qualification on student performance in geometry.

The effects of practical approach on the female students could further be investigated with the aim of improving their performance in geometry. Other factors apart from sex could be responsible for better performance with the use of practical approach. Investigations can be carried out on the effects of practical approach on other geometry topics left out in this study. Students and teachers fallings on the use of practical approach could be investigated. Access topics in which males or females perform better.

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APPENDIX A

LESSON PLAN FOR EXPERIMENTAL GROUP

LESSON 1

Name: Binta Hamisu Tafashiya

School: Hassan Usman Katsina, Polytechnic.

Class: JS 2A and 2B

Subject: Geometry

Topic: Types of Triangles and Angles

Average age: 14 years

Sex: Mixed (Boys and Girls).

No in Class: 40

Duration: 1:20 min

Instructional Materials: Pencils, ruler, cardboard paper.

Behavioral objectives: By the end of the lesson, the students should be able to:

i Define Triangle and An angle.

ii Explain types of Triangle. .

iii Explain types of Angles. .

iv Solve problems on Triangles and Angles.

Intr**oduction:** The teacher introduces her lesson by asking students to explain the shape of their class room.

Presentation:

Step I: A triangles is a three sided figure with three angles. An angle is a measure of rotation**.**

Step II: Types of triangles.

.i Equilateral Triangle

ii Isosceles Triangle

iii Scalene Triangle

iv Right angled triangle

Step III: Types of angles

i Acute $0° < \omega° < 90°$.

ii Obtuse $9o° < \omega° < 180°$

iii Reflex $180° < \omega° < 360°$

iv Right angle = one side exactly 90°

v Complementary angle if $\hat{a} + \hat{b} = 90°$ e.g 30° + 50° = 90°

vi supplementary if $\hat{a} + \hat{b} = 180°$ e.g. 105° + 75° = 180°.

Types of Triangle

i equilateral triangle

ii isosceles

iii Scalene triangle

iv right angle triangle

Evaluation: The teacher evaluates his lesson by asking the students to explain the properties of equilateral and isosceles triangles.

LESSON 2

Name: Binta Hamisu Tafashiya

School: Hassan Usman Katsina, Polytechnic.

Class: JS 2A and 2B

Subject: Geometry

Topic: Angle at a point.

Average age: 14 years

Sex: Mixed (Boys and Girls).

No in Class: 40

Duration: 1:20 min

Instructional Materials: Pencils, Ruler, Cardboard paper.

Behavioral objectives: By the end of the lesson, the students should be able to

i define angles at a point add up to 360.

ii solve problems on angles at a point

iii solve problems on parallel lines cut by a transversal

Introduction: The teacher introduces her lesson by asking the students to explain what an angle is.

Presentation:

Step I:

The sum of angles at a point is equal to 360° e.g.

$x + 71° + 63° + 54° + 103° = 360°$

$x + 291° = 360°$

$x = 360° – 201°$

$x = 66°$

Step II

$49° + x + 38° + 52° = 180°$

$X + 139° = 180°$

$X = 180° – 139°$

$X = 41°$

$X + 53° + 90° = 180$

$X + 143° = 180°$

$X = 180° – 143°$

$X = 37°$

Step III

If two parallel lines are cut by a transversal, then

1. Vertically opposite angles are equal
2. Alternate angles are equal
3. Corresponding angles are equal
4. Adjacent angles are equal or sum of angles on a straight line = 180°

Evaluation: The teacher evaluate his lesson by asking the students to solve the problem

$x + 41° + 101° + 59° + 90° = 360°$

$x + 291° = 360°$

$x = 360° – 291°$

$x = 69°$

LESSON 3

Name: Binta Hamisu Tafashiya

School: Hassan Usman Katsina, Polytechnic.

Class: JS 2A and 2B

Subject: Geometry

Topic: Pythagoras's Theorem.

average age: 14 years

Sex: Mixed (Boys and Girls).

No in Class: 40

Duration: 1:20 min

Instructional Materials: Pencils, ruler, cardboard paper.

Behavioral objectives: By the end of the lesson, the students should be able to :

i state the theorem

ii prove the theorem .

iii deduce the 3 trigonometric rations

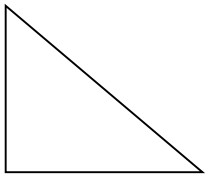
Introduction: The teacher introduces her lesson by asking students to explain the types of triangle they were taught.

Presentation:

Step I: According to Pythagora's in any right angled triangle, the square of the hypotenuse is equal to the sum of the squares of the other two sides

$Hyp^2 = opp^2 + adj^2$

$Ac^2 = AB^2 + BC^2$



A

Step II:

$AC^2 = AB^2 + BC^2$

$5^2 = 4^2 + BC^2$

$25 - 16 = BC^2$

$Bc^2 = 9$

$BC = \sqrt{9}$

BC = 3cm

Step III:

SOHCAHTOA

5:4:3 is called Pythagorean triple.

$\sin \Theta = {}^{4}/_{5}$, $\cos \Theta = {}^{3}/_{5}$, $\tan \Theta = {}^{4}/_{3}$

Evaluation: The teacher evaluates his lesson by asking the students to solve this problem.

Solution

$Ac^2 = AB^2 + BC^2$

$5^{2 =} AB^2 + 3^2$

$25 – 9 = AB^2$

$AB^2 = 16$

$AB = \sqrt{16}$

$AB = 4cm$

LESSON 4

Name: Binta Hamisu Tafashiya

School: Hassan Usman Katsina, Polytechnic.

Class: JS 2A and 2B

Subject: Geometry

Topic: Angle of Elevation and Depression

Average age: 14 years

Sex: Mixed (Boys and Girls).

No in Class: 40

Duration: 1:20 min

Instructional Materials: Pencils, Ruler, cardboard paper.

Behavioral objectives: By the end of the lesson, the students should be able to

i define angles of Elevation and Depression

ii solve problems on angles of Elevation and Depression

Introduction: The teacher introduces her lesson by asking them when do we use Pythagora's theorem?

Presentation:

Step I:

Angle of Elevation:- This is the angle between the horizontal and the line that joins the point of observation of the object up above the horizontal line.

Angle of Depression:- Angle of Depression is the angle between the horizontal and the line that joins the point of the observation of the object when observed below the horizontal line.

Step II: Example

A man observes that angle of Elevation of the top of a building is 68°. If the man is 10m away from the building, how high is the building. Solution:

$\text{Tan } 68° = \frac{h}{10}$

$h = 10\tan 68°$

10×2.4751

= 24.75m

Example 2

A ladder 2m long rests against a wall, the bottom of the ladder is on the ground and at a distance of 0.5m from the base of the wall. Calculate the angle made by the ladder with the wall.

Solution

Sin θ = $\frac{0.5}{2}$ = 0.25

θ = $\sin^{-1} 0.25$

θ = 14.4775°

θ = 14° (nearest degree)

Evaluation: The teacher evaluates the lesson by asking the students to solve the problems.

An Aeroplane leaves an airport and begins climbing at an angle of 30°. What is the approximate height above the level ground when it has moved 500m along the path?

Solution

Sin 30° = $\frac{opp}{hyp}$ = sin 30° = $\frac{x}{500}$

X = 500sin 30°

X = 500× 0.5

= 250m.

LESSON 5

Name: Binta Hamisu Tafashiya

School: Hassan Usman Katsina, Polytechnic.

Class: JS 2A and 2B

Subject: Geometry

Topic: Bearings

Average age: 14 years

Sex: Mixed (Boys and Girls).

No in Class: 40

Duration: 1:20 min

Instructional Materials: Compass points, pencils, ruler, cardboard paper.

Behavioral objectives: By the end of the lesson, the students should be able to

i Define bearings

ii Explain the language of the problem

iii Draw the cardinal axes as many as possible.

Introduction: The teacher introduces her lesson by asking students to explain the four cardinal points.

Presentation:

Step I: The teacher will define what bearing is for the students. Bearings directions are given as angles Or Bearings is the horizontal angle between a line and a reference direction, often measured clockwise direction from north.

Step II:

Two types of bearings are:-

i Compass bearing that is old conversion starting point is from North and south only e.g. N10E, S30W

ii True bearings that is new conversions which is in three digits e.g. 010,001,030 and 110.

Step III: language of the problem e.g. A is on a bearing of 030 from B a distance of 11m . Q is on a bearing of S40E from P a distance of 15km

Evaluation: The teacher evaluate his lesson by asking the students to solve the followings:-

I If G is on a bearing N10W from H a distance of 5m, draw it.

Exercise:

Define what bearing is and give examples of true and compass bearings.

Solution:

Directions are given as angles using references directions measured clockwise direction from north.

Examples of True bearing: 090,025,001,060,

Compass bearing: N50E, S70E, N40W, and S30W.

Conclusions: The teacher concludes his lesson by giving the student chance to ask questions in the areas of difficulties.

LESSON 6

Name: Binta Hamisu Tafashiya

School: Hassan Usman Katsina, Polytechnic.

Class: JS 2A and 2B

Subject: Geometry

Topic: Plane and solid shapes

Average age: 14 years

Sex: Mixed (Boys and Girls).

No in Class: 40

Duration: 1:20 min

Instructional Materials: pencils, ruler, cardboard paper.

Behavioral objectives: By the end of the lesson, the students should be able to

i deduce Areas and Perimeters of plane shapes.

ii deduce Areas and Volumes of Solid Shapes

iii use the deductions to calculate height, areas, perimeters and volumes of the above shapes.

Introduction: The teacher introduces her lesson by asking the students what type of shape is this class.

Presentation:

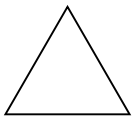
Step I:

Plane figures:-is a 2 dimensional surface. Its surface is smooth enough, not rough and it doesn't has transversal thickness. It deals with only areas and perimeters i.e. a plane figure is a 2 dimensional surface having no thickness.

Solid figure:- is a 3 dimensional figure having thickness.

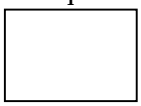
Step II

Formulae for plane and solid shapes

SHAPES	AREA	PERIMETER
1. Triangle 	$\frac{1}{2}$ ab sin ɷ OR $\frac{1}{2}$ bh OR	_____

	Brahma Gupta Hero's Formula		
Base = b	$\sqrt{S\,(s-a)(s-b)(s-c)}$		Where s= $\frac{1}{2}$ of per of angle. S = $\frac{a+b+c}{2}$.

2. Square



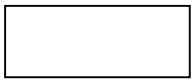
s

s

S^2

4s

3. Rectangle

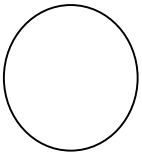


b

Lb

2 (Lb)

4. Circle



rrr

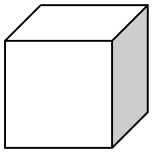
π r^2

2 πr^2 (circumference)

Solid shapes	Total surface area	Volume

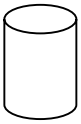
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1. Cube



$SXS = S^2 X\ 6 = 6S^2$ $SXSXS = S^3$

2. Cylinder

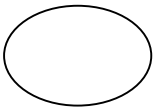


Curved surface = $2\ \pi\ r\ h$ $\pi\ r^2\ h$

Total surface area = $2\ \pi r\ h + 2\ \pi\ r^2 = 2\ \pi\ r\ (h + r)$.

One end close = $2\ \pi\ r\ h + \pi\ r^2$.

3. Sphere



$4\ \pi\ r^2$ $\frac{4}{3}\ \pi\ r^2$

APPENDIX B

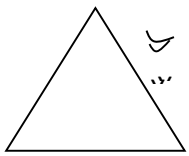
PRETEST GEOMETRY ITEMS

TIME: 30 MINUTES

NAME……..……. CLASS:……. GROUP:……...

SCHOOL:……SEX……Time: 30minutes

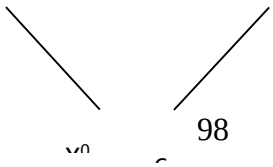
INSTRUCTIONS: Circle the correct options from A-E.

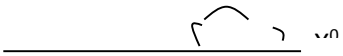


1. Find what is ‘a’ in the figure below?

A.80 B.-90 C.90 D. 180 E.360

2. Find x from the diagram below



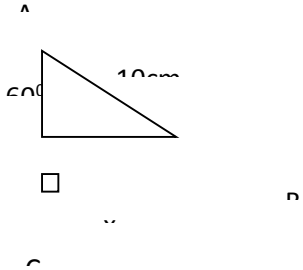


A. 122^0 B. 118^0 C. 292^0 D. 028^0 E. 056^0

3. A quadrilateral having all sides and angles equal is called

A. Kite B. Rhombus C. Rectangle D. Parallelogram E. Square

4. Find x in the figure below



A. 5cm B. 10cm C. 20cm D. 30cm E. 15cm

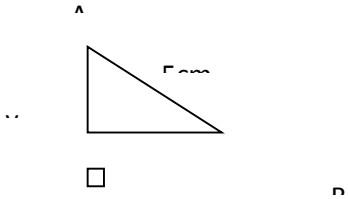
5. The triangle ABC has < A = < C = 62^0. Find <B

A.124 B.118 C. 62 D. 59 E. 56

6. Two angles of a triangle are 50 and 80. Such a triangle is called:

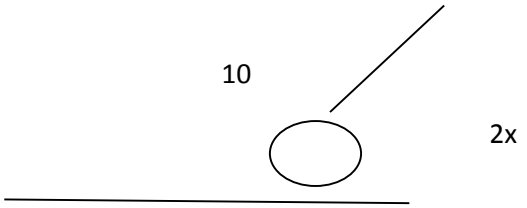
A. quadrilateral B. isosceles C. right-angled D. obtuse-angled E. scalene

7. From the figure below, find y



A.1 B. 2 C. 3 D. 4 E. 5

8. Find the Value of x in the diagram below:



A. 180^0 B. 156^0 C. 102^0 D. 78^0 E. 39^0

9. Three of the angles of a hexagon are each x. The others are each 3x.

A. 30 B. 40 C. 60 D. 80 E. 120

10. 11. How many vertices has a cube?

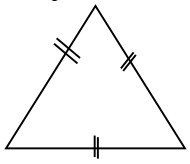
A. 4 B. 6 C. 8 D. 12 E. 16

11. How many quadrilaterals are in the diagram below:



A. 5 B. 4 C. 3 D. 2 E.

12. How many lines of symmetry are there in the figure below?



A.1 B. 2 C.3 D. 4 E.6

13. The amount of liquid a container can hold is called the capacity and the

Amount of space it occupies is called its

A. area. B. breadth C. space D. length E. volume.

14. Find the perimeter of a circle whose diameter is 11.2cm.

A. 11.2cm B. 17.6cm C. 23.4cm D. 35.2cm E.70.4cm

15. Find the volume of a cone of base radius 3 1/3cm and height 42cm

A. 77cm3 B. 147cm3 C. 154cm3 D. 539cm3 E. 1617cm3

Solution:

PRE – TEST ITEM

1.	A	2.	C
3.	E	4.	C
5.	E	6.	E
7.	A	8.	C

9.	E	10.	E
11.	B	12.	D
13.	D	14.	D
15.	E		

APPENDIX C

POST – TEST GEOMETRY ITEMS

TIME: 30 MINUTES

NAME:…….. CLASS:……. GROUP:……

SCHOOL:…… SEX:……

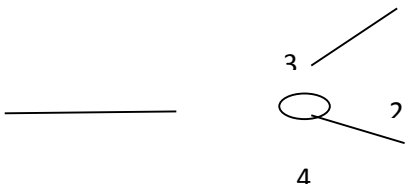
INSTRUCTION: CIRCLE THE CORRECTOPTIONS FROM A-E.

ANSWER ALL QUESTIONS

1. If the bearing of P from Q is 064^0. What is the bearing of Q from P?

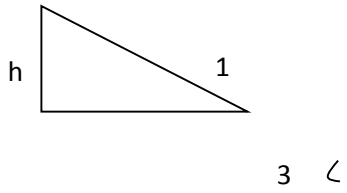
A.064^0 B. 116^0 C. 154^0 D. 144^0 E. 128^0

2. Find the value of x in the figure below:



A.40^0 B. 30^0 C.20^0 D. 10^0 E.5^0

3. Find the height of a right angled triangle



A. 40m B. 30m C. 20m D. 10m E. 5m

4. Find the radius of a circle if the circumference is 22cm.

A. 2.6cm B. 3 ½cm C. 5 1/3cm D. 7 ½ cm E. 7 1/3cm

5. The bearing of S40^0E is the same as

A. 040^0 B. 050^0 C. 130^0 D. 140^0 E. 150^0

6. The angle of depression of a boat from the top of a cliff 15m high is 60. Calculate the distance of the boat from the foot of the cliff, correct to one decimal place.

A.30.0m B.26.0m C. 13.0m D. 8.7m E. 7.5m

7. Find the volume of a cube if the length of one edge is 8m?

A. $64m^3$ B.$24m^3$ C. $512m^3$ D. $502m^3$ E. $515m^3$

8. From a point P, a boy observes that the angle of elevation of the top of a pole is 45. If the height of the pole is 15m, find the distance from P to the foot of the pole correct to the nearest meters.

A. 9m B. 11m C. 15m D. 21m E. 675m

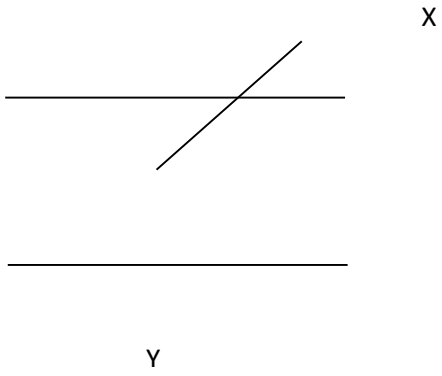
9. What is the height of a cylinder with radius 7 meters, and 770m3 volumes? (Take $\pi = 22/7$)

A.5cm B. 11cm C. 7cm D. 10cm E. 13cm

10. Find the circumference of a circle radius 7cm [Take $\pi = 22/7$]

A. 44m B. 44cm2 C. 4.4cm D.4.4cm2

11. In the diagram below the line XY is called



A. Parallel B .Perpendicular C. vertical line D. Transversal.

12. How many sides has a regular polygon with an interior angle of 144

A. 11 B. 20 C. 36 D. 10 E. 12

13. Which of the following gives the volume of a cylinder of height **h** and

Base radius **r**?

A. 2ii2h B. 2iirh C. 1/3 ii r2 h D. iir2h

14. Which pairs of angles are complementary?

A. 47, 83 B. 60, 6 C. 90, 90 D. 38, 52 E. 35, 15

15. How many edges has a cube?

A. 4 B.10 C. 8 D.12 E. 14

Solution:

POST – TEST ITEM

1.	D	2.	C
3.	A	4.	A
5.	E	6.	B
7.	A	8.	D
9.	D	10.	D
11.	D	12.	C
13.	C	14.	D
15.	D		

APPENDIX D

Attitudinal Scale Test For Geometry Learning

Feeling and attitude toward geometry and its learning are tested in each statement Rating scale were used. You are to indicate in five points – scale, the extent of agreement between the attitudes expressed in each statement. The five points are strongly Agree (SA); Agree (A). Undecided (U) ; Disagree (D) ; Strongly disagree (SD). Tick the letter giving the best indication of how closely you agree or disagree with the attitude expressed in each statement.

School ……Sex……..Age……..

S/N	Statement	SA	A	U	D	SD

1	I dislike geometry class					
2	I hate learning geometry and the subject itself					
3	When learning geometry always confuse and unable to think					
4	I fear geometry and its lessons					
5	I have never like geometry and it is my most hated subject					
6	Learning geometry makes me feel uncomfortable and restless					
7	Geometry makes me feel as if I am lost in a jungle of numbers and cannot find my way – out					
8	Whenever I learn geometry I feel as if the teacher goes with what he taught me					
9	I like learning geometry and practicing it					
10	I feel happy and comfortable when learning geometry					
11	Geometry is a subject I enjoyed because of its application to other subjects					
12	I enjoy learning geometry because of its steps and accuracy					
13	Students should take geometry very important to progress academically					
14	I have positive attitude toward learning geometry					
15	Brighter future comes will good knowledge of geometry					

APPENDIX E

Summary Of Mann-Whitney U-Test On Experimental Vs Control

Point estimate for $\eta 1 - \eta 2$ is -7.000

95.0 Percent CI for $\eta 1 - \eta 2$ is (-10.000,-4.999)

W = 4128.5

Test of $\eta 1 = \eta 2$ vs $\eta 1 \neq \eta 2$ is significant at 0.0000

The test is significant at 0.0000 (adjusted for ties)