EFFECT OF ENRICHED EXPOSITORY METHOD ON INTEREST AND PERFORMANCE IN GEOMETRY AMONG JUNIOR SECONDARY SCHOOL STUDENTS IN KADUNA STATE, NIGERIA

BY

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DECLARATION

I Bashirat Kikelomo HAMZAwith registration number P14EDSC8042 declare that the work in this thesis entitled "Effect ofEnriched Expository Method on Interest and Performance in Geometry among Junior Secondary School Students in Kaduna State, Nigeria" has been conducted by me in the Department of ScienceEducation underthe supervision of Prof. M. Musa and Dr. M. O. Ibrahim. The information derived from the literature has been duly acknowledged in the text and a list of references provided. No part of this thesis was previously presented for another degree or diploma at any University.

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Bashirat Kikelomo HAMZA Date

CERTIFICATION

This DissertationEntitled: “Effect of Enriched Expository Method on Interest and Performance in Geometry among Junior Secondary School Students in Kaduna State” written by Bashirat Kikelomo HAMZA with registration number P14EDSCE8042meets the regulations governing the award of Master’s Degree in Mathematics Education of Ahmadu Bello University, Zaria and approved for its contribution to knowledge and literary presentation.

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DEDICATION

This thesis is dedicated to my loving parents, siblings, my husband, and my children for praying and encouraging me to finish my study.

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ABBREVIATIONS USED

GCPT:	Geometry Construction and Performance Test
GII:	Geometry Interest Inventory
CLM:	Conventional Lecture Method
JSS:	Junior Secondary School
NCTM:	National Council of Teachers of Mathematics
NECO:	National Examination Council
NMC:	National Mathematics Centre
FRN:	Federal Republic of Nigeria
JAMB:	Joint Admission and Matriculation Board
NERDC:	Nigerian Educational Research and Development Council
WAEC:	West African Examination Council

OPERATIONAL DEFINITIONS OF TERMS

Expository Method: This is the process of teaching which takes the form of a lecture recitation to a full-class with explanations, examples and opportunities for practice and feedbacks.

Instructional Material: This means that materials which are helpful to teachers and students to achieve common educational goals

Construction: Is a geometric figure drawn accurately in accordance with given measurements.

Performance: This is the ability to assess student's learnt or attained after a learning period.

Interest: This is astrongest desire to achieve knowledge or learning

Experimental group: The group of students who were taught using instructional materials.

Control group: The group of students who were taught using the lecture method.

Enriched Expository Method: This is a method where by instructional material were used.

ABSTRACT

This study investigated the effect ofenriched expository method on interest and performance in geometry among Junior Secondary School Students in Kaduna State, Nigeria. The study determined the effect ofenrichedexpository method on student's interest and performance in geometry. Italso examined thedifferential effect ofenrichedexpository method on the performance of male and female students. The study was guided by four research question and four null hypotheses. The study adopted a Pre-test and Post-test quasi-experimental design. The sampleconsisted of 300 government JS.II students made of 146 males and 154 female students. This was drawn from a population of five thousand two hundred and sixty two (5262) students using stratified random sampling. The experimental group was exposed toenriched expository method and control group was taught using lecture method. The research instruments used were: Geometry Construction Performance Test (GCPT) and GeometryInterests Inventory(GII) with reliability coefficient of 0.73 and 0.83. The data collected were analyzed and presented using Descriptive statistics of mean and standard deviation for researcher question andinferential statistics of t-test to test all four (4) formulated hypotheses at $P \leq 0.05$levels of significant by aid of computer software Statistical Packagesfor Social Science (IBM version 20).The result obtained showed that students taught with enriched expository method generated more interest and better performances in geometry than those taught the lecture method. The study also revealed that male and female students taught enriched expository method did not differ significantly both interest and performance. The study therefore, recommend that the use ofenriched expository method should be considered for mathematics teacher as a better option for teaching and learning of mathematics particularly geometry. Conclusively, low performance can be reduced when there is positive interest in the process of solving problem in geometry. Finally, that government and professional bodies should organize seminars, workshops and conferences, with the aimof teaching junior secondary school teachers on how to use enriched expository method effectively in teaching and learning of geometry.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

Mathematics is the science of space and numbers. The study of space is called Geometry; the study of numbers is Arithmetic, while the hybrid of geometry and arithmetic is also called Algebra (Nguuma, 2010). Mathematics therefore can be said to be the bedrock of technology. For proper understanding of science, mathematics play a major role, hence referred to as the queen of all science (Odili, 2006). Bassey (2010) stressed that the position of mathematics in the National Curriculum and its roles towards technology and industrial development made it a compulsory subject at primary and secondary school education. It is because the government discovered the important roles of mathematics in National development that if mandated the ministry of education to demystify mathematics through innovative teaching (Ale, 2011). Despite the importance attached to mathematics and its crucial role in technology, students see it as a difficult subject and as such show little or no interest in the subject. The major problems faced by most students are inability to remember what they have learnt. This problem is often caused by too many theoretical expressions or formulae by the mathematics teachers, while learners remain passive listeners (Odili, 2006).

The report of the Chief Examiners on students areas of deficiency in Senior Secondary Certificate Examinations showed that students least understood geometry concepts as showed by their performance (WAEC, 2011). According to him the problem and difficulties experienced by secondary school students in geometry has been traced to inadequate knowledge of the rubrics of construction, measurement and identification of plane and solid shape to mention few. Kurumeh and Imoko cited in Iji, Abakpa and Takor (2013) attributed this ugly trend to a very weak mathematics foundation which

began at the primary level and wascarried over to the junior secondary and culminated in senior secondary school. According to Obodo (2004), there is a general low interest in the study of mathematics at all levels of education in Nigeria. Thus, it is necessary to initiate a deliberate action to remedy this situation as geometry has been identified as important sources of mathematics thinking (Hogan 2000). “Geometry is the 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 straight line that joins any two points on it wholly lies on the surface. A solid shape on the other hand is bounded by surface which may not wholly be represented on a plane surface” (Adolpaus, 2011) “Geometry is a branch of mathematics that deals with the measure and properties of point, line, curve and surface”. However, most students find geometry boring therefore absent themselves in geometry lessons. Those who stay in the lessons pay little attention to the teacher. As a result most students never learn to practice geometric problems on their own and concluded that it is too difficult. They prefer not to answer problems on geometry in examinations (Nguuma, 2010). These perceptions among other factors compel the students to become afraid and finally lose interest in geometry which has a negative effect on their performances (Odili, 2006).

It is no longer news today that teachers skip topic to avoid presumed difficulty concepts or in some cases rush such area to hide their deficiencies at the expense of the students’ performance (Nguuma, 2010). The problem of low performances in mathematics as a subject is a global issue and it is a concern to parents’and othereducational stake holders (Medulial, 2012). Yet the performances of students in mathematics have no remarkable result. The reason for this problem may vary but this could sometimes be related to teaching method being used to explain such topic and approaches to teaching which affected the level of motivation (Chianson,kurumeh,Obida,2011).Performance can be

defined as the quality of the results produced by students as reflected in the quality of their examination score (Musa 2000). Adeniyi (2000) stated that one's involvement in the marking of mathematics for WAEC is enough to get anyone sorrowful at the state of mathematics in the secondary schools. Many candidates, according to her submit their answer scripts without writing anything in them: some merely recopy the question, while high percentages who try to write anything have all scored below 40%. The analysis of the students' performance in WAEC mathematics from 2005-2015 indicated a high failure rate but the result for the year 2008 seemed to be fairly good as reflected in the Table 1:1.

Table 1:1: WAEC May/June Performance of Students in Mathematics from 2005-2015

YEARS	PERCENTAGE WITH CREDIT AND ABOVE (% PASS)	PERCENTAGE WITH PASS AND BELOW (% FAIL)
2005	38.20	61.80
2006	41.12	58.88
2007	46.75	53.25
2008	57.27	42.73
2009	47.04	52.96
2010	24.94	75.06
2011	39.98	60.02
2012	38.81	61.19
2013	36.57	63.43
2014	31.28	68.72
2015	38.68	61.32

Source: West African Examination Council (2015)

In addition to these, study for the low performance of the students in mathematics and particularly in geometry, some researchers viewed strategy of teaching as one of the contributing factors to the poor teaching of geometry, some of whom include: Habour

Peter (2001) and Madulia (2012). Teaching strategies are very vital in the teaching and learning processes. The method adopted by the teachers may promote or hinder learning. Mathew and Onyejebgbu (2013) stated that effective teaching of any subject will not only stimulate students' interest in the subject but also enhance their achievement in examination and to achieve effective teaching and learning process and there is the need for instructional materials. This study therefore employed avenue through which teaching of geometry in public secondary schools can be made more effective. The significant in this study include expository method–enriched with instructional materials, academic performances and interest. Expository enriched with instructional materials will be used to teach the concept of geometry. Expository method is the method of teaching where teacher is purely and simply getting across to the learner that which is specified by the curriculum requirement (Jarolimek & Foster 2005).

Instructional materials are devices developed or acquired to assist or facilitate teacher in transmitting organized knowledge, skills and attitude to the learners with instructional situation (Nwachukwu, 2006). The lower performance of students in mathematics has become a concern in mathematics(Kajuru&Kaura, 2010). Yet many students find it very difficult to solve and explain such topic(Madulia 2012).Teaching strategy are very vital in Teaching and learning activities have a lot to do with other variables, such as instructional materials, school environment, and students' factors among other. In this study instructional materials utilization is the main focus in order to determine their effect on the performances of the students.

Teachers use different instructional materials to motivate learning. Teachers often make use of textbooks, charts, models, graphics, regalia as well as improvised materials (Awotua-Etebo, 2001). Oteze (2011) suggested that mathematics teaching should be

structured in such a way that knowledge is built on a foundation already possessed, encourage students to learn by doing ensuring that learning grow out of useful experiences and experimentations by effective use of mathematics manipulative that stimulate cognitive, affective and psychomotor domains development. Ugama (2011) opined that the proper and meaningful study of mathematics should assist individuals in ordering organizing and investigating his/her environment he added that it is only possible through active personal interaction with material resources.

Many education researchers spend a lot of time to identify factors and condition that promote or hinder the teaching and learning of mathematics.

Their result shows that interest is the vital aspect that motivates learning and development (Nguurma, 2010). Kurumeh, Akure & Ogwuche (2007) supported that you cannot learn effectively unless you become interested in the subject matter at some level. Okigbo&Okeke (2011) posited that, interest is an important variable in learning because when one becomes interested in activity, one is likely to be more deeply involved in that activity. Powermediator between mastery and appropriation thus any subject can be interesting if you look at it in the right way or perspective. According to Obodo (2004), there is a general low interest in the study of mathematics at all levels of education in Nigeria and also the WAEC Chief Examiner (2005) reported and also confirmed low performance and went on to lament that this poor achievement resulted to students low interest in the subject. With this the researcher sought using the enriched expository method material if they will influence students' interest and performances in geometry and whether such influence could be affected by gender or not.

1.2 Statement of the Problem

In spite of the importance and popularity of mathematics among Nigeria students; performances at junior secondary school level had been low (Iwendi, 2012), other studies had shown that Nigeria students' performance in junior secondary school mathematics has been relatively low over the years (Osemwinyen; 2009 and Gimba 2013). Several factors had be attributed to the low performance in secondary school mathematics, among which are; poor methods of teaching (Harbour – Peters 2001), poor interest in mathematics (Badmus, 2002), gender differences (Agwagah 2000) and lack of appropriate instructional materials for teaching mathematics at all level of education (Gambari 2010). Despite all these efforts, the problem of low performances in mathematics had continued to surface in the nations' public examinations. Even though several research findings had confirmed that geometry was one of the abstract and complex aspects of mathematics which students find it difficult to learn and some teachers found it difficult to teach without using instructional materials (Akinlade 2004, WAEC, 2011). As a result, it makes the morale and interest of the students in mathematics low. This is because teachers adopt the verbal and theoretical methods as way of teaching and learning the geometry, mainly due to non-availability of instructional materials in schools (Gambari, 2010.) Mathematics has several branches and some of these branches are more difficult for teachers to teach and students to learn than others without the use of instructional materials. The basic geometry at junior secondary school level serves as background for understanding all branches of geometry at higher level. Also, teachers think constructing instructional materials is difficult, time consuming and needs so much money to construct as suggested by (Iyekekpolar&Tsue2008). Lack of provision and utilization of both improvised and conventional instructional materials by teachers of mathematics of geometry could be

one of the reasons for low academic performance in geometry. Several studies had been carried out to consider the use of expository as it affected low performance in mathematics but it could possibly be improved by enriching it with instructional materials. The focus of this study therefore is to determine if theenriched expository method on interest and performance of geometry among Junior Secondary School students in Kaduna State.

1.3 Objectives of the Study

This study investigated the effect ofenriched expositorymethodon interest and performance of Junior Secondary School students in geometry specifically; the study has the following objectives to:

1. Find out the effect of enriched expository method on students Performancetaught geometry and those taught lecture method.
2. Examine the effect of enriched expository method on students' interest taught geometry and lecture method.
3. Verified the effect ofenriched expository method on performance of male and female taught geometry.
4. Determine the difference in the interest of the female and male students taught geometry using enriched expository method.

1.4 Research Questions

In determining the effect ofenriched expository method on students' interest and performance in geometry construction the following research questions are formulated as guide to the study:

1. Is there any difference between mean performance score of the student taught geometry using enriched expository method and those taught using lecture method?
2. To what extent do the mean interest scores of students taught geometry using enriched expository method differ from those taught lecture method?
3. Is there any difference between the mean performance score of male and female students taught geometry usingenriched expository method?
4. To what extent does the interest of male and female students taught geometry using enriched expository method differ?

1.5 Null Hypotheses

The following Null hypotheses were formulated for testing at $P \leq 0.05$ levels of significance.

H_{o1}: There is no significant difference between the mean performance scores of students taught geometry using enriched expository method and those taught using the lecture method.

H_{o2}: There is no significant difference between the interest levels of students taught geometry using enriched expository method and those taught using the lecture method.

H_{o3}: There is no significant difference between the mean performance scores of male and female students taught geometry usingenrichedexpository method and those taught using the lecture method.

H_{o4}: There is no significant difference between the mean interest of male and female students taught geometry using enriched expository method and those taught using the lecture method.

1.6 Significance of the Study

The findings of the study will hopefully enhance the standard of mathematics education in the following ways:

To mathematics Students; the findings of the study would hopefully improve the performance of students in the learning of geometrical construction at the JSS level. The findings of the study will also provide the students with experiences that will improve their interest, motivate and promote meaningful understanding of the contents contained in the subject.

To mathematics teachers; the findings of the study will hopefully enhance mathematics teachers teaching of geometry construction at the JSS level. It will also help focus learners' attention on what the teacher required of themand make learning and teaching more enjoyable and memorable.

To curriculum Planners; this study will hopefully provide reliable information to curriculum planners. It will also equip the Nigerian Education Research and Development Council with information for mathematics curriculum development and modification.

To policy Makers; the study may help educate the policy makers for a suitable activity-based approach for studying mathematics at the Junior Secondary School Level.

To professional bodies and associations; this study will also be beneficial to professional bodies such as the Mathematics Association of Nigeria (MAN), Science

Teachers Association (STAN) and National Mathematics Society of Nigeria (NMSN) since the members meet annually to review and update their members' knowledge in current research in the field of mathematics education.

To researchers; this study may hopefully help other researchers to further investigate onenriched expository method of teaching in other areas of mathematics and hence reduce the rate of low performance among students in the subject and also serve as a information for further studies in mathematics. The findings of this study would add new knowledge to the existing literature.

1.7 Scope/Delimitation of the Study

This studyinvestigated the effect of enriched expository method on interest and performance in geometry among junior secondary school students in Kaduna State. The study cover four public co-educational junior secondary school studentsyear two (JS II) in Zaria Educational Zone of Kaduna State. The schools were, GJSS Kofa/Dokan, GJSS Gyellesu, GJSS Tudun/Jukun and GJSS Aminu. The choice of JSS 2 student are neither like JSS 1 student who are new to the environment, non like JSS 3 student who are busy preparing for final examination. Topics in geometry construction content of junior secondary school such as construction of parallel and perpendicular lines, construction of angles (30^o, 60^o, 90^o, and 45^o) solid shapes, angles of elevation and depression, selected from junior secondary school syllabus. These content were selected becauseover time students were performance low (Nguuma 2010). Two instruments were utilized in the study, the Geometry Construction Performance Test (GCPT) and the Geometry Interest Inventory (GII). GCPT is a 40 item multiple choice questions developed by the researcher from the JSS geometry content. GII is a 25 item open

ended inventory on interest for geometry adopted from Nguuma (2010) to elicit information from students on geometry construction.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter deals with the review of relevant literature for the study, the effect ofenriched expository method on interest and performance of geometry among Junior Secondary School students in Kaduna State. The discussions where done under the following sub-headings:

22 Theoretical Framework

The theoretical framework for this study is based onErtmer& Newby (2013).learning Theory. According to themlearningtheories are a source of verified instructional

strategies, tactics and techniques, knowledge of a variety of such strategies is critical when attempting to select an effective prescription for overcoming a given instructional problem. Designer must have adequate repertoire of strategy available and possess the knowledge when and why to employ each. This knowledge depends on the designer's ability to match the demands of the task with an instructional strategy that help the learner. Effective solutions to practical instructional problem are often constrained by limited time and resources (Ertmer& Newby, 2013).Learning theories also play an important role in design of instructional material. Theories such as constructivism, social learning and cognitivist help shape and define the outcome of instructional material. This research work base on these theories:

2.2.1 Constructivism

Constructivism believe the learning to be successful, meaningful and lasting, Learning must include all three of these crucial factors: activity (practice), concept (knowledge), and culture(context) (Brow, Collins, & Duguid1989). The constructivist position assumes that transfer can be facilitated by involvement in authentic task anchored in meaning contexts. Since understanding is indexed by experience. The authenticity of the experience becomes critical to the individual s ability to use ideas. (Brown etal 1989). Constructivism approach to learning and understand: knowledge "is a function of how the individual create his or her own experience. Constructivism has multiple roots in the philosophical and psychological viewpoints of this century, specifically in the works of Piaget, browner, and Goodman (Perkins 1991).Constructivism is a theory that equates learning with creating meaning from experience (Bednar, Cunnigham, Duffy&Perry 1991). Even though constructivism is consider to be a branch of cognitivist (both conceive of learning as a mental activity), It distinguishes itselffrom traditional cognitive theories in a number of way. Constructivism believes that mind

filters input from the world to produce its own unique reality (Jonassen, 1991). Constructivism believes that learner build personal interpretation of the world based on individual experiences and interactions. Constructivism crosses both categories' by emphasizing the interaction between two variables. Both learners and environmental factor are critical to the constructist, as it is specific interaction between these two variables that create knowledge.

Although the emphasis on performance and instruction has proven effective in teaching basic skills in relatively structure knowledge domains, much of what needs to be learned involves advanced knowledge in ill-structural domains, Janassens(1991a). Constructivism has describe three stage of knowledge acquisition (introductory, advance and expert) and argue that constructive learning environment are most effective for the stage of advanced knowledge acquisition, where initial misconception and bases acquire during the introductory stage can be discovered negotiated, and if necessary and modified and / or removed. The constructivist designer specifies instructional method strategy that will assist learner in actively exploring complex topic / environment and that will move them into thinking in a given content area as an expert user of that domain might think. Learners are encouraged to construct their own understanding and then validate through social negotiation, this new perspectives. Some of specific strategy utilized by constructivist includes situating task in real world context, using of constructive apprenticeships. (modeling and coaching a student toward expert performance), presentation of multiple perspectives (collaborative learning to develop and share alternative views).Clearly the focus of constructivism is on creating cognitive tools which reflect the wisdom of the culture in which they are used as well as the insight and experience of individual. Constructivist believe that learning experience

should be authentic and produce real world learning environment that the learner to construct their own knowledge(Reiser 2001).

The role of instruction in constructive view is to show student how to construct knowledge, to promote collaboration with other to show the multiple perspectives that can be brought to bear on a particular problem, and to arrive at self-chosen position which they can commit themselves why realizing basis of other view in which they may disagree.As one move along the Behaviourist-congnitivistcontinuum, the focus of instruction shift from teaching to learning, form the passive transfer of facts and routines to active application ideals to problem. The constructivists look at the learner as more than just active processor of information: the learner elaborate upon and interprets the given information [Duffy&Jonassen 1991]. As student gain more confidence and experiences, he would move in to a collaborative phase at learning professor and designers). Students become better able to articulate their own understanding of the assessment.

2.2.2 Cognitivism

Cognitivist theory has move to the forefront of current learning theories (bender etal 1991). This shift from a behavioral orientation (where the emphasis is on the prompting a student's over performances by the manipulation of the stimulus material) to a cognitivist orientation (where the enhances is on prompting mental processing) as created a similar shift for producers for manipulating the material to be presented by an instructional system to procedurefor direct student processing and interaction with the instructional designer system (Merrill kowaris, and Wilson 1981).Cognitive theories stress the acquisition of knowledge Internal metal structure and as such are closer to the rationalism and of epistemology continuum (Bower and Hilgard,1981). Learning is

consider with discrete changes between states of knowledge rather than change of probability of response cognitivist theories focus on the conceptualization of student learning processes and address the issues of how information is received, organized, store, and retrieved by mind. Leaning is concern not so much with what learners do but with what they know and how they come to acquire it (Jonassen1991b).knowledge acquisitions describe as a mental activity that entails internal coding and structuring by the learner. The learner is viewed as a very active participant in the learning process. Cognitivist emphasizes the role that environmental conditions play in facilitating learning. Instructional explanation, demonstration, illustrative example and match non example are all consider being instrumental in guiding students learning. Similarly, emphasis is placed on the role of practice with corrective feedback. However "active" nature of the learner is perceived quite differently. The cognitive approach focuses on the mental activities of learner that lead up to a response and acknowledges the process of mental planning, goal-setting and organizational strategies (Shuell 1986).cognitive theories contend that environmental "cues" and instructional components alone cannot account for all the learning that results from an instructional situation. The real focus of the cognitive approach is on changing the learner by encouraging him/her to use appropriate learning strategies. Teacher/designers are responsible for assisting learners in organizing that information in some optional way. Teachers use techniques such as advance organizers, analogies, heretical relationships and matrices to help learners relate new information to prior knowledge. When learner understands how to apply knowledge in different contexts, then transfer has occurred. Understanding is seen as being composed of a knowledge base in the form of rules, concepts, and discrimination (Duffy and Jonasses, 1991). Specific instructional or real world events will trigger specific particular response, but the learner must believe that knowledge is useful in

given situation before he/she will activate it. This theory is related to this research in the sense that inenriched expository method, learning out is highly interactive, open ended in terms of outcome, highly motivating or having interests and aided transfer retention of the learned materials among the students. Teachers assists the students in developing new insights, bring meaning out of the whole process and connecting them with their previous learning. The activities are student centered and students carry out their own experiment, make their own analogies and come to their own conclusions. For example when student uses instructional materials like card board or string to construct a cube or card board on shape, instrument like mathematical set toconstruct angle, the students may get motivated in mathematics lesson by expository instructional materials.

The actual goal of instructional for cognitivist theory is to transfer knowledge to the students in the most efficient, effective manner possible (Bednaretal 1991).Cognitivist makes use of feedback (knowledge of result) to guide and support accurate mental connection (Thompson Simon son and Hargrave 1992). Cognitive looks at the learner to determine his/her predisposition to learning. (How does the learner activate maintain and direct his/her learning) (Thomson etal 1992) in addition, cognitivists examine the learner to determine how to design instruction so that it can be readily assimilated (what are the learner's existing mental structures). Specific assumptions or principles that have relevant to instructional design include the following:

- Emphasis on the active involvement of the learner in the learning process [learning control mental cognitive training e.g. self-planning monitoring and revisiting techniques]
- Use of hierarchical analysis to identify and illustrate prerequisite relationships (cognitive task analysis procedure).

- Emphasis on structuring, organizing and sequencing information to facilities optimal processing [use of cognitive strategies such as outline, summaries, synthesis, advance organizers etc.].

2.3 Concept of Mathematics

Anywhere human activities are carried out; there exist mathematics either as arithmetic, algebra, calculus, geometry, trigonometry, or statistics that uses signs, symbols and or proofs to describe relationship(s). Hence Encarta (2007) defined mathematics as the study of relationship among numbers, shapes and quantities. Mathematics as an educational subject is taught primarily for development of thinking skill and reflections on oneself, environmental and societal issues and organizing ones experience for possible solution(s) to problems (LapanandSchram, 1998). On this basis, Otunu-Ogbisi (2009) defines mathematics teaching and learning as the act of imparting and acquiring of skills, knowledge, aptitude, abilities and attitude capable of making the individual functional and productive for effective all round achievement of nations developmental goal. Mathematics can be defined as the communication system for those concepts of shapes, size, quantity and order used to describe diverse phenomena both in physical and economic situation. Ezeude and Awagah (2000), in their study looked at mathematics as a scientific tool in realizing the nation scientific and technological aspirations. Also Usman (2002), considered mathematics as a subject that encroaches into all aspects of human endeavor and further describe mathematics as the life wire in the studies of various discipline. Mathematics as a subject can be seen in all facets life and in day-to-day occupations such as internet technology banking, construction, medicine, scientific discoveries and even in our planning of daily activities and many others mathematics remains a core subject in both the primary and secondary schools (FRN, 2008). Without a credit pass in mathematics at the senior secondary school level,

no student can access the tertiary education in Nigeria. The Joint Admission and Matriculation Board (JAMB) brochure 2010 indicated that 80% of universities in Nigeria mathematics department in the form of pure mathematics industrial/mathematics, mathematics/computer science, mathematics/statistics or mathematics/physics. A survey report also shows that all 100 level students in every university that offer science, engineering and technology courses, take mathematics as a general course. All these measure point to the importance of mathematics in the development of the nation. In spite of the importance attached to mathematics as a core subject in Nigeria school today and its application in everyday life, there had been consistent poor performance at all levels starting from the primary school level (Gambari&Adeghenro, 2008; WAEC & NECO May/June & Nov/Dec, 2007 – 2012) Studies have shown that Nigeria students' achievement in secondary school mathematics has been relating low over the years (Agwagah, 2000; Osemirinyen, 2009; WAEC, 2011; &Gimba, 2013).Several factors have been attributed to the poor performance in secondary school mathematics, among which are poor method of teaching (Harbour – Peter 2001) poor interest in mathematics (Badmus, 2002 &Obodo, 2004), gender difference (Agwagah, 2000) and lack of appropriate instructional materials for teaching mathematics at all levels of education in Nigeria (Gambari, 2010).

Various attempt such as have been made towards improving the low achievement and retention level of secondary school students in mathematics without any remarkable success (Gimba, 2006; Iwendi, 2009). Poor teaching method is one of the major factors influencing poor achievement and retention (Osemwinyen, 2009; Tolu, 2009).Mathematics has several branches and some of these branches are more difficult for teachers to teach students to learn than others (Nguuma 2010). The basic geometry

at junior secondary level serves as a background for understanding all branches of geometry at higher level. Research findings have confirmed that geometry is one of the topics among the abstract and complex aspects of mathematics, which students find difficult to learn and some teachers find difficult to teach without the use of instructional materials (Akinlade, 2004; WAEC, 2011)

2.3.1 Theories of Learning Geometry

The theoretical work concerned with geometrical ideas of Piaget and Inhelders (1967), work has two major themes. The first theme is that our mental representation of space is not a perceptual 'reading off' of what is around us. Rather, we build up from our mental representation of our world through progressive reorganizing our prior active manipulation of that environment. Second progressive organization of geometric ideas follows a definite order and this order is more experimental (and possibly more mathematical logical) than it is historical. That is initially topological relations, such as connectedness, enclosure and continuity are constructed, followed by projective recti-linearity) and Euclidean (angularity, parallelism, and distance) relations. The first of these Piagetian themes, concerning the process of the formation of spatial representation remain reasonable well supported by research. The second hypothesis has received at best, mixed support. The available evidence suggests that all types of geometric ideas appear to develop over time becoming increasingly integrated and synthesized (Clements 2001).

The Van Hiele model also suggests that learners advance through level of thought in geometry. Van Hiele characterized these levels as visual, descriptive, abstract relational and formal deduction at the first, the visual level. Student identifies shapes and figures according to the concrete examples. At the second the descriptive analytic level, student recognize shapes according to the properties and here a student might think of rhombus

as a figure which four equal sides. At the third level the abstract relational level, student can identify relationships between classes of figure (for example, that square is a special form of rectangle) and can discover properties of classes of figures by simple logical deduction. At the fourth level, students can produce short sequence of statements to logically justify a conclusion and can understand that deduction is the method of establishing geometric truth. According to this model progress from one of Van Hielers level to the next is more dependent upon teaching method than on age given traditional teaching method, research suggests that the most lower secondary student perform at level one or two with almost 40% of the students completing secondary school below level two (Jones, 2002). The explanation for this, according to the Van Hiele model, is that teachers are asked to teach curriculum that is at a higher level than the student. Consequently, Van Hiele mode it is not possible for learner to by-pass a level, they cannot see what the teacher sees in a geometric situation and therefore do not gain from such teaching. While research is generally supportive of the Van Hiele level as useful in describing student's geometric concept development (in absence of anything better). It remain uncertain how well the theory reflect children's mental representations of geometric concepts, various problems have been identified with specification of the levels for example that the labeling of the lowest levels as 'visual' when visualization is demanded at all the level and the fact that learners appear to show signs of thinking from more than one level in the same or different tasks, in different contexts, an integral component of the Van Hiele model is a specified teaching approach involving four phases. There is little research on this aspect of the model and hence little idea if it is successful.

2.3.2Geometric Concept

Geometry was originated from a point (.) which later extended to one dimension, two dimensions and three dimensions and every object in this world can never exceed three dimension.Adolphus (2011) Geometry is aspect of mathematics which deals with the study of different shapes. According to him, These shapes can either be plane solid shapes, plane shapes is a geometrical form such that straight lines that joins any two point on its wholly be represented on a plane surface while solid shape on the other hand is bounded by surface which may not wholly be represented on a plane surface, example of plane shape include triangle, rectangle, rhombus, kite etc. while examples of solid include cube, cuboids, cone, cylinder, sphere to mention a few. Nguuma (2010) grouped geometry into two, which are practical and demonstrative geometry. Demonstrative geometry deals with the shapes, size and position of figures, by pure reasoning based on definitions, self-evident, truths, assumptions and established geometrical truths. While practical geometry covers the construction aspect of geometric. In geometry, construction means to draw accurately (Kulbir, 1995).

The only instruments permissible in geometry construction at JSS depend largely on the use of some mathematical instruments contained in small box, commonly called mathematical set. Some of the instruments in mathematical set are ruler, divider, compasses, Set Square, pencil, and protractor. According to Nguuma(2010), efficiency in construction requires skillful manipulation of these instruments. Actual doing is very necessary; a student may know how to construct a certain geometrical figure and yet may fail to draw it accurately. The failure makes students avoid answering the question on construction in examination and hence developing negative interest toward constructed in the classroom.

2.3.3 Objectives of Geometry Teaching In Nigeria

The Nigeria national mathematics curriculum for high school learner seems generally to have emphasized mastery of three basic mathematics skills in the learning of geometry. These are the skills of geometrical construction using straight edges, compasses, protractors and Set Square; the skill of proving theorems in Euclidean geometry; and the skill of solving riders based on the theorems. The curriculum indicates that learners are expected to establish through geometrical constructions, the properties of and relationships between various geometrical shapes. For examples, the national mathematic curriculum stipulates that learners should be able to use the basic construction of given angles, perpendicular and parallel line to construct triangles, parallelograms, rhombus and more (FRN, MOE, 1985, P.7). Regarding the proof of theorems, the curriculum expects learners to follow step-wise logical deduction to arrive at valid conclusions. For example, the national mathematics curriculum states that teachers should let learners place emphasis on dependence of the truth of any statement on theorems previously accepted (and) emphasizes the step-by-step nature of deductive proof and the if then relationship (FRN, MOE, 1985, P, 14).

According to the national mathematics curriculum, riders in Euclidean geometry should be aimed at promoting students deductive reasoning. For example, the curriculum prescribes that teachers should give exercises and riders to help students reproduce arguments based on reasons theorems or axioms (FRN, MOE, 1985, P.8). Given the basic skills emphasized in the national mathematics curriculum, it would seem that the general objectives of senior secondary school geometry teaching in Nigeria are as follows;

1. Development of student's spatial awareness and visualization through geometrical constructions.

2. Development of student logical reasoning abilities through explicit teaching of deductive proof in Euclidean geometry field.

3. Development of students' problem solving ability in geometry that has made application in many other aspects of mathematics and related.

2.3.4 Teaching of Geometry Construction

1. Construction of Parallel Line: Instructional materialsrequired; ruler, set-square and pair of compasses.

Procedure

To construct a line XY parallel to a given line AB.

i. Construct a line through P so that it is parallel to XY.

ii. Place a set square so that one edge is accurately along XY.

iii. Place a ruler along one of the other edge of the set square.

iv. Hold the ruler firmly; slide the set square along the ruler towards P stop when the edge that was on XY reaches P. Draw a line along this edge of the set square through P.

METHOD I: Using pair of compasses and ruler.

Procedure

i. Construct a line through P. so that it is parallel to XY.

ii. On the line XY mark any two point A and B.

iii. With centre at P and radius AB draw on arc above B.

iv. With centre at Y at radius PA draw an arc to intersect the first arc at Q.

v. Draw a line passing through P and Q. PQ is parallel to X

2. Construction of Perpendicular Lines

Two lines are perpendicular to each other when they meet at right angle(90^0) Instructional materials required; ruler and set square.

Procedure

i. Draw a line AB mark a point Q on the line.

ii. Place the edge of the set square which contain its right angle on line AB place a ruler along the hypotenuse.

iii. Press firmly on the ruler slide the set square until it reach as the point Q. hold the set square firmly, draw a line CD through Q. CQ is perpendicular to ABC .

METHOD II: construction of perpendicular line instruction materials a pair of compasses and ruler. Procedure

i. Draw a line AB, given a point C on a straight line.

ii. With C as Centre draw on arc to cut AB at D and E.

iii. Place a pair of compasses on the Centre D, E and equal radii draw arcs to cut each other at F.

iv. Join CF, CF is perpendicular to AB, therefore < COD $=90^0$

3. Construction of Angle 60^0

For the perfect construction of angle 60^0 and 30^0, there must instrument in place such as sharp pencil, a pair of compasses, ruler and protractor and eraser in place.

Procedure

I. Draw a straight line.

II. Open your compass a little wide draw an arc to cut a straight line given the arc XY.

III. Reduce the wideness of your compass then place your compass on centre X, draw an arc to cut XY at P.

IV. With centre p and the same radius as in draw an arc to cut the first arc at W.

V. Join WX <WXY=60^0, then use a protractor to check that WXY is equal to 60.

4. Bisection of Angle 30^0

Instructional materials required; compass, ruler, a sharp pencil protractor.

Since $30^0$is half of 60^0. To construct an angle of 30^0 first construct an angle of60^0 and then bisect it.

Procedure

i. Draw straight line.

ii. With centre X and any radius, draw an arc to cut XY i.e. that arc is extended well above XY.

iii. With centre P and the same radius, draw an arc to cut the first arc at W.

iv. Join WX which given <WXY =60^0

v. With the same radius put your compass at centre P, W draw arc to cross each other at Z.

vi. Join the XZ which given <ZXY =30^0

5. Construction of Angle 90^0

For students to construct angle 90^0 perfectly, there must be following items in place such as a sharp pencil, ruler,apair of compass, protractor and eraser.

Procedure

i. Given a point B on a straight line AC.

ii. With centre B and any radius draw arc to cut AC at P &Q.

iii. With centre P, Q and equal radii, draw arc to cut each other at R.

iv. Join BR: BR is perpendicular to AC. Thus RBA =RBC =90^0 use a protractor to check this result.

6. Bisection of Angle 45^0

Instructional materials required; compass, ruler, protractor, a sharp pencil and eraser.

Since $45^0$is a half of 90^0. To construct an angle of 30^0, first construct an angle of 90^0 and then bisect angle 45^0.

Procedure

i. Given a point B on a straight line AC.

ii. With centre B and any radius draw arc to cut AC at P and Q.

iii. With centre P,Q and equal radii, draw arcs to cut each other at R.

iv. Join BR, which given <RBC =90^0.

v. With the same radius put your compass at centre of B, draw an arc to cut line BQ and BR at XY with centre XY, draw an arc to cross each other at z and join BZ which given XBZ=YBZ=45^0 use a protractor to check XBZ=45^0.

7. Construction of Solid Shapes

Paper Models

Instructional materials required; cardboard paper or stiff-card, sell-tape, ruler, pair of compass, and sharp objects.

Procedure

i. Draw a net of a required object (cube, cuboid, cylinder, pyramid, cone and more) using a pair of compass or ruler.
ii. Cut out the net of the object.
iii. Fold along the edge.
iv. Use glue, gum or sell-tape to hold the edges in place.

METHOD II

Skeletal model

Instructional materials required; sticks, wires, drinking straws and strings.

Procedure

i. Cut the stick/wires/straw as required in terms of equal side (cubes, cuboids, pyramids, frustum of a pyramid.
ii. Set up the network in stages by toughing the sticks/wires/straws at the vertices where they meet.

8. Cones

Instructional materials required; sticks, straw and wire.

Procedure

i. Cut equal length of the stick/wire.

ii. Make a hoop.

iii. Tire one end of each stick to the hoop at different point.

iv. Tire all the other ends of the sticks together at a point.

v. Tire other sticks to the hoop to show the diameter and the base radius of the cone.

9. Frustum of a cone

Instructional materials required; sticks and wires

Procedure

i. Makes two hopes, one bigger than the other.

ii. Cut sticks of each length.

iii. Tie the ends of each sticks, one end to each hoop.

2.4 Method of Teaching in Mathematics

The method in any teaching and learning situation is very important because the way a teacher present subject matter to learners may make them to have interest or non interest in the subject. According to Mtsem(2011) that teaching method affects the response of the student and determines whether they are interest motivated and involved in a lesson in such a way as to engage in a good learning.Jonah, Caleb and Stephen (2012) described mathematics teaching as an interactionbetween teacher and learners that leads to acquisition of knowledge. This teaching method refers to procedure or way of organizing the instructional content, instructional material and manner of presentation to the learner. There exist a number of teaching methods available for teachers to use and they include:

Discovery or Activity Method:is a centered teaching method where students learn by doing Herwit (2002) asserted that children learn best by doing not just by sitting and listening. This method have been founded to superior in developing students' abilities in apply concepts and personal growth developing positive interest attitudes, motivations and encouraging appropriate group social skills Odili (2006), reported that activity method guides learners to discover fact for themselves. Abah (2006) advice that for effective teaching of mathematics to occur the teacher should get the learners involved as much as possible in activities that enable them to develop that needed process skills and attitude relevant to scientific life.

Mathematics instructional materials are a practical subject that needs to be learnt by doing or through application of adequate and efficient human and physical facilities. As defined by Adenegan (2003), the mathematics laboratory is a unique room or place, with relevant and up to date equipment known as instructional materials, designated for the teaching and learning of mathematics and other scientific or research work, whereby a trained and professional qualified person (mathematics teacher) readily to interact with learners (student) specified set of instructions. Mathematics laboratory is relatively new in the teaching and learning of mathematics, it is a practical oriented classroom or place where instructional materials useful for the effective teaching and learning of mathematics are kept. The term laboratory method is teaching and learning of mathematics which provides opportunity to the learners to abstract mathematics ideas through their own experiences, that is to relate symbols to realities. Teacher could be employed in laboratory method to teach student construction using the instructional materials found in mathematics laboratory and teachers could be demonstrating with apparatus teaching the practical aspect of the lesson.

Lecture method: This is a teaching procedure in which there is a one-way channel of communication where the teacher makes an oral presentation of the subject matter content and students react by silently listening and takes notes (Oche, 2012). Lecture method is the process were by the teacher verbally delivers a pre-planned body of knowledge to his students. In this method the teacher gives out all the fact he wants the student to know and master, and the students takes them passively. Nwagbo (2006) stated that most of the topics are carried out by the teacher while students remain as passive listeners taking down notes hence; It is referred to as didactic approach or talking chalkboard.

Discussion method: involved a group of people in a class who come together to exchange ideas, facts, opinions and expressions orally about topic mutual concern and interest under a guide (Oche, 2012). This involves a class in oral exchange of ideas facts and opinions about a topic of mutual concern and interest (Obeka, 2010). Discussion makes for active participation of a student, stimulates them to think individually and to learn to express themselves freely.

Guided Inquiry Teaching Method: This is a teaching method which enables students to more step by step from the identification of a problem defining the problem formulation hypotheses, collection of data, verification of results and generalization to the drawing of conclusion (Massialas, 2005). This method is also described as the teaching of science through a process which encourages students to solve problems in logical and systematic manner using scientific process (Chukwuneke, 2006).

Problem Solving Approach Method: Hutchinson (2006) defined problem solving approach method as a skill that requires finding a solution that is unique to an identified problems and it is also the ability to adopt relevant techniques from task only

marginally related to the task at hand and to generate possible strategies to solve that are familiar. According to Dejong et al (2008), problem based on leaning is a model which centered on students, develops active and motivated learning, problem solving skills and broad field knowledge are based on the deep understanding and problem solving.

Expository Method: The expository method approach is the process whereby the teacher provides facts, ideas and other essential information to learners. Itspurpose is purely and simply getting across to the learners that which is specified by curriculum requirements (Jarolimek and Foster, 2005). Glasgow (2007), states that in the expository mode, the learner is expected to meet requirements to learning that are established by the teacher. According to him This usually includes reading required materials, answering assigned questions, discussing topics or problems presented by the teacher, demonstrating skills deemed to be Important. In view of this, Agbulu and Idu(2008) posit that expository approach seeing as verbal presentation of ideas, concepts principle, generalization and fasts. The objective is to impart or inculcate information to the students. According to them expository approach harbors two basic skill which every teacher must endeavor to explore for effective dissemination of information to the students.

2.4.1 Enriched Expository Method

An enrichment activity can be any activity that promotes critical thinking, listening memorization, visualization and concentration. According toBezuk, Cathcart,Vance andPotheir (2001).Students construct their own understanding of mathematics ideas by means of mental activities and through interacting with physical models of the ideas. These activities would allow leaner to interact with one another and construct their own

knowledge. The activities are students –centred and students carryout their own experiments make their own analogies and come to their own conclusion. Kurt and Sombai (2009) in their study on constructivism also found that students participate more in the classroom activities and gained content knowledge when constructivism approach was used. The activities should try to approach the varied interest of the student and involve construction of cardboard, puzzles, singing, science experiments and art activities. The purpose of enrichment activities is to enhance the educational learning being done in the classroom. The enrichment activities should be cross-curricular and consider the interest of the students .According to Khan (2005) enrichment programs are often interactive and project focused. They enhance the student's education by bringing new concept to light or using old concept in new ways. The activities are fun for the students, but they also impart knowledge and other benefit from enrichment activities. These skills can help to build greater self-esteem and higher goal achievement in performance of students. Several active learning strategies have been developed and experiment worldwide in different level of education (Teili ,Yildrim, sensory and Yakim2004; and Bandleraand Bruno 2006). Studies have shown that have learning experience through active learning do better compare to those students in a traditionally class when using actives learning, student are engaged in more activities than just listening. Bonwell 2003 states that actives learning involves students in doing things and thinking about the thing they are doing..

Enriched expository method is method or strategy where by instructional materials were used. According to Waji (2006), Instructional materials are resources that the teacher uses in presenting his lessons so that the students can easily understand what is being taught. These instructional materials make the teaching and learning process more meaningful, effective, productive and understandable when they are proper utilized in

teaching and learner process. Instructional material should help learner to retain most of the concept that have been learnt as a result of active involvement in the lesson.

The purpose of the instructional material or resources was help to arouse student interest in the topic taught and give room for effective retention of lesson. This method (instructional material) fostered good teaching and learning -student relationship make learning more realistic and memorable and interaction with one another in the class room. Or give interaction between the student and the environment. Instructional material must be relevant and appropriate for the fulfillment of the lesson set objectives. Instructional material serves as stimulus to learning, help learner to understand the concept and meet the objectives of learning. Expository method enriched-with instructional material strategy would use to teach the concept of geometry. Expository should also compel teachers to use learner center approaches when teaching and help to sustain learner's interest in learning (Mohan 2010). Various aids such as charts, models, work sheet, work cardboard, mathematical set, expert human resources, chalkboards and computer game are used by teacher to facilities teaching and arouse interest. It aim to a equip learners with useful skill to improve their knowledge and capabilities to their participation in mathematics particularly geometry teaching and learning. The Enriched Expository method is applied in this study in which mathematics is seen as participatory process where learners gradually become actives knowledge though the used of instructional material for the students to be able to learn some of the abstract concept of geometry. Enriched Expository method using instructional materials could provide actives participation of student, capture the learner's interest. Make mathematics lesson more lively and give room for effective retention of lesson. This is aimed at help learner in the learning experiences that could enhance their interest and improve their academic performance in geometry.Enriched Expository method instructional materials were also

guide with active role of learner which gives the learner to interact with one another and construct their own knowledge (Bacon 1972). Enriched Expository method goes beyond just presenting students with the facts. It involves presenting clear and concise information in purposeful way that allows students easily make connection from one concept to the next.

2.5 Instructional Materials

Betiku(2001) defined instructional materials as the entire devices that assist the teacher to teach the facts, skills, attitudes and knowledge to the learners. While Abdullahi (1982) viewed that instructional materials are materials or tools locally made or imported that could have made tremendous enhancement of lesson impact if intelligently used. Isola (2010) referred them as objects or denies which help the teacher to make a lesson much clearer to learners. Instructional materials are also described as concrete or physical object which provide sound, visual or both to the sense organs during teaching (Agina Obu,2005) Coombs (2003) also defined instructional material as all the resources which facilitates acquisition of skills and knowledge by the learner. Any resources that assist the teacher to enhance teaching and learning process are known as instructional material (Den Wigwe 2008).

2.5.1 Classification of Instructional Materials

Instructional materials are in various classes such as audio-visual. Audio instructional refer to the devices that make use of the sense of hearing only, e.g. radio, audio tape recording and television. Visual instructional materials are those devices that appeal to the sense of sight only such as chalkboard, chart and film strip. And audio-visual

instructional materials however are a combination of devices which appeal to the sense of both hearing and seeing such as television, motion picture and computer. Among the instructional materials, the classroom teacher uses the visual outnumbered the combination of the audio and audio-visual. In harnessing human and material resources for a sustainable development, Ema and Ajayi (2004) elaborated that instructional facilities like any other subjects has its own language and instruction, and further consider the following terms which are very much related to instructional technology.

i. **Instructional materials:** all materials used in process of teaching examples: textbooks, real object, charts, maps, globes, audio and visual aids.
ii. **Hardware:** all machine and equipment's used in an instructional process of teaching, e.g. television, tape recorded, cameras, computer sets, video sets, projector display boards, etc.
iii. **Software:** all materials used in the machine and tools those are the carriers of the requirement of information tapes, slide, films trips, textbooks, workbooks, and other transferences.
iv. **Audio aids:** this concerned the sense of learning along they includes record player, radio cassette, tape recorded.
v. **Visual aids:** these are materials that appear to the sense of sight examples picture, calculators, mathematical set, computer, hand set, projected and non-projected materials, etc.
vi. **Audio visual aids:** these are the materials that have to do with the sense of hearing as well as visual example television, video tapes, etc.
vii. **Projected materials:** these are materials containing relevant teaching materials on the concept involve which can be projected on the field e.g. film, slide and film strip, etc.

viii. **Non-projected materials**: these are the teaching materials that need no projection examples, maps, chart, porter, real object, etc.

ix. **Realia:** this is real objects used for teaching examples, leaf, feathers, tables and chalkboard.

2.5.2 Importance of Instructional Materials

Importance of instructional materials in effective teaching study, instructional materials review/frame work.Mathematics involves thinking logically and reasonable so as to understand how formulae derived and their applications. In order to enhance learners' mastery and meaningful learning of Geometry in mathematics, it is necessary to reduce to the bearable minimum its level of abstraction with use of instructional materials. Adenegan (2010) testified to this that instructional materials when properly used in the teaching and learning situation, can simply concrete bases for conceptual thinking high degree of interest for students in making learning more permanent.

According to Oyekan (2000) 'instructional materials are those things that can facilitate effective teaching and pleasant learning that is teaching aids through which learning process may be encouraged and motivated under the classroom situation'. The enhanced the teaching learning process when adequately and appropriately used. Abimbade (2004) observed that an availability of good facilities increase the degree of success in the teaching strategy adopted by the teacher. All teachers are expected to prepare to improvise and used initiative in utilizing available local material.The success in the skill and knowledge acquisition in an instructional situation depends on the suitability of the instructional materials, adequacy and effective utilization of the available materials (Olaitan and Agusiobo, 2001).

Onabanjo and Akinsola (2000) revealed that the use of instructional materials assist the teachers to properly convey the topic content for students to learn better and effectively grasp the instructional objectives. RhertHeinch (2001) stated that instructional materials in teaching and learning generally make the teaching process easier, focus attention on high light of key points and lastly gain and hold the attention of learners. The use of learning materials is to enhance achievement in science general has been supported by Betiku (2000) and Akinsola (2003). In these view, Usman and Adewumi (2006) stated that the use of instructional materials stimulates pupils' interest and achievement. Also, Ajayi and Ifegbo (2004) have reported the effectiveness of teaching materials in teaching and learning among the students can only be achieved if students are opportune to manipulate this equipment.

2.5.3 Instructional Material and Academic Performance in Geometry.

In a planned program, teachers usually have objectives set out to be achieved by students such achievement could be ascertained through test evaluation or performances assessment (Nguuma, 2010) for this study, achievement is used in the context of test performance.According to Fan, (2010) performance denotes "attainment" which draws on a variety of mental process including memory, perception, thinking and reasoning. Morgan (2010) added that performance is an assessment strategy by which the evidence about student's learning is gathered, through students' work on a performance task. Igboegwu, (2012) attributed that if a learner accomplishes a task successfully and attains the specified goals for a particular learning experiences, he is said to have achieved performance can be extent to which an investment or ability is profitable, i.e. is achieved or success. They further defined ability as demonstrative knowledge or skills performance as one can see in this context is the feedback derived from the program of curriculum and instruction. There is no doubt that much is expected from

our educational system in term of preparing future citizens, workers and leaders to perform better.

Most students carried out within and outside Nigeria show concern about the generally performance of candidate in mathematics, the WASC chief examiner (2007) reported that candidate were observe to be weak in geometrical, IjiOgbole and Uka (2014) stated that, Geometrical is an aspect of school mathematics that has every day application in the life of the child. It helps the child in the development of aesthetismaround his/her environment as well as reason skill. Ugwuanyi (2000) stated that geometry is one aspect of mathematics that is mostly fear by student, (Herber-Peter 2001 and Obodo 2007) have been continual exploring ways of ensuring that s is properly taught and learned in schools. The effective teaching of mathematics should emphasize active learning Clement and etal (2013). That is learners must personally be involved.Agwagah (2000) has noted that mathematics teacher in most cases do not use instructional materials on their mathematics classroom, so most of the mathematics concept are taught abstractly. This may be use some of the mathematics teachers believed that instructional materials to be used for teaching these mathematics concepts are not in existence, even when they are available, there is complain of lack of money by the teacher. This may be one of the factors responsible for student continuous failure in public mathematics examination in Nigeria.

Abimbade (2004) had noted that the approach of using improvised material in mathematics class assist in proper introduction and new skill a develop understanding as well as show the appropriate way of doing things. It was on this ground that Kurumeh (2000) Observed that the utilization of improvised instructional material takes adequate care of the three domains (Cognitive, Effective, Psychomotor). There by reducing the abstractness of the mathematics concepts. The problem of poor

performance in mathematics has been recurring; this had necessitated consistent effort by mathematics education. According to Kurumeh and Iroko (2008) attributed this ugly trend to a very weak mathematics foundation which begin in the primary level and carried over to the Junior secondary and is culminated in senior secondary school. Oteze (2011) posit that the cause of mass failure in mathematics performance in most countries of the world including Nigeria is mathematics educator's tendency not to do what they are supposed to do.

Among other suggestion, the WAEC chief recommend effective teaching that would lead to clear understanding of the various concept or principles and their applications, and the teachers should allow their students, such concepts teaching should be practical and made to sink into the children's minds.Oteze (2011) suggested that mathematics teaching should be structured such that knowledge is built on a foundation already possessed; encourage students to learn by doing, ensuring that learning grows out of useful experiences and experimentations by effective use of mathematics manipulative that stimulate cognitive, effective and psychomotor domains development.Ugama (2011) opined that the proper and meaningful study of mathematics should assist individual in ordering organizing and investigating his/her environment. This he added is possible through active personal experience with material resources. With this reasoning Aligba(2005) who posits that, it is worthy of note that no pattern of curriculum implementation can be done effectively without relevant instructional materials to present various mathematics concept.

2.6 StudentsInterest towards Geometry

Interest is the most important motivational factor in learning and development (Nguuma 2010).According to Kurumeh, Akure and Ogwuche (2007) buttressed that the first thing

that affect students is the level of intense enjoyment and interest for the topic you are about to study. Interest therefore is the feeling of wanting to know about something for the purpose of this study. Interest can be defined as one of the strongest desire to know or learn or to achieve knowledge; if students have quality curiosity in a topic or subject he/she will be able to perform well or successful in learning geometry.

The variable interest is one of the most important factors that affect effective learning and relate to achievements. According to Imoko and Agwagah (2006), interest is an important variable in learning because when one become interested in an activity, one is likely to be more deeply involved in that activity.Nguuma (2010) stated that interest in on activity may lead to a definite attitude pattern to such an activity. Therefore students who have interest in mathematics might develop a positive attitude toward mathematics. Osemmwingen (2009) found that students' interests and retention could be aroused and retained through the use of appropriate instructional media like learning. These imply that interest in study may lead to retention. .Therefore students who have interest might keep or retain the knowledge of geometry learnt and be able to recall it when requires.According to Odili (2006) there is a relationship between attitude and interest. Odili in Nguuma (2010) define attitude as a mental state of readiness organized through experience, exerting a direction or dynamic influence upon the individual's response to all object and situations with which it is related. It is therefore, interest in mathematics that predicts one attitude lead to retention, which in turn will determine the performance of the individual in mathematics. Thus a student with positive attitude studies mathematics because he enjoys it will lead to retain. Ajai (2008) posits that if a student as a positive attitude toward mathematic, he will not only enjoy studying it, but will also derive satisfaction from the knowledge of mathematics idea he/she gain. However research findings have seen that secondary school students have negative attitude

toward mathematics as result of poor interest (Odili, 2006, Mbakwem, 2007 &Nguuma 2010).This hatred among other factors compares the students to become phobic whenever the word mathematics is mentioned consequently they perform very poor in mathematics examination. The researcher therefore wishes to investigate if instructional material will enhance students' interest and performance in geometry.

2.7 Over View of Similar Study

In the view of related studies on instructional Materials, several studies have been carried out on effects of instructional materials on interest and performance in science education such as integrated science, Chemistry, Physics, Biology and Mathematics. The review of this studies help to throw more light on effects of expository enriched with instructional materials on interest and performance of students.

Akusoba and Okeke (2009) investigated the effect of activity centered teaching approach using low cost learning kits in facilitating students achievement and interest in mathematics. The study was quasi-experimental study with the sample of 162 subjects. The instruments used included Mathematics Test (MAT) and Mathematics Interest Scale Questionnaire (MIS) for data collection. In analysis, mean score and standard deviation were used to answer the research questions, while analysis of Convenience (ANCOVA) was used to test the null hypothesis at 0.05 level of significance. The result showed that the significant difference exist between the experimental group and the control group. Adaptation of activity centered approach using low-cost learning kits as an alternative to conventional method would improve higher achievement and interest in Mathematics. The study did not target a particular area of mathematics where

students are found to have difficulty. The present study is interest in geometry which students have been found to dread.

In another study of Onasanya and Omosewa (2010) on the effects of improvised and standard instructional materials on secondary school students' performance in Physics in Ilorin has shown a greater impact on performance. The researchers employed quasi-experimental study. This comprises of 60 students and assigned to 3 groups (improvised, standard and control groups). In this study, performance test in Physics (PTP) comprising of 50 multiple choice items was used for data collection. The mean scores, standard deviation and t-test statistics were used to compare the pre-test and post-test scores in the various groups. Result indicate that no significant difference exist in the performance of the subject taught with improvised and those taught with standard materials, also, no significant difference according to gender. This shows that improvised materials had almost the same effect as the standard materials, as long as they save relevant to the lesson context. The study was well implement and served as a model for the present one. However, it only had performance as the only variable which was tested; the present research had interest as well in the geometry.

In another study, Usman (2008) on enhancing the academic achievement in integrated science using improvised materials among JSS student. This study was carried out on 100 subjects from Zaria Local Government Area of Kaduna State. Integrated Science Achievement Test (ISAT) comprised of 20 multiple choice test items was used for data collected were analyzed using t-test. The results showed significant difference between subjects taught with improvised and control groups but no significant difference among gender in experimental group (those taught with improvised materials). Therefore, the government and science teachers should make use of resource personnel in the construction and repairs of improvised materials. The study reviews only the

performances and gender which is important variable in education. The research had interest of students in geometry.

More also, (Folorunso and Nwosu, 2006) in their study of the effects of students' and teachers' improvised materials in students' achievement in senior secondary school certificate biology: implication for resource supply in state education. In this study, 107 students were involved (Experimental I, II and control groups). The instrument used was Ecological Achievement Test (EAT) for data collection. The data were analyzed using Analysis of Covarence(ANCOVA) and Scheffe tests to test the hypothesis. From the result, it was revealed that students taught with their own constructed improvised materials achieved better than those taught with teachers' improvised instructional materials. The study recommended that, science teachers should encourage students' participation in supplying and improvising resource in science classroom. The study reviews only the performance of the students. The current study has gender and student's interest in geometry as a specific area of mathematics as a problem.

Etukudo (2000) conducted study on the effect of computer assisted instruction on gender performance of junior secondary school student in mathematics. This study carried out in River state Nigeria. It adopted a quasi-experiment design with a population of 40 students (20 male and 20 female) it finally found that student mathematics performance is not dependent on gender. The study was well implemented and served as a model for the present one. However, it only had performances as the only variable which was tested. The present research had interest as well.

Iji, Ogboleand Uka(2014) carried out a study titled on effect of improvised instructional material on students' achievement in geometry at upper basic education level in Makurdi Metropolis, Benue State. The study was quasi-experimental design of non-

randomized per-test, post-test control group with a population of 1680 universal basic education (UBE) students. The instrument of the study was geometry achievement test using descriptive statistic of mean and standard deviation while analysis of co variances was used to test the null hypothesis at 0.05 level of significance. The finding of the study revealed that students taught with improvised instructional material improved on their geometry achievement also that both male and female students in the experimental group improved more on their geometry achievement than those of the control group. The study recommend that teacher should been encourage to used improvised instructional material in the mathematics. This study had a specific area of geometry to compare and also consider the issue of gender which was important variable in education. The present research is interested in comparing the interest level of students when exposed to the expository method enriched with instructional material.

Wushishi, Ezenwa and Safo (2013) investigation effect of computer assisted instructional package on junior secondary school students' achievement and rendition in geometry in Minna Niger State, Nigeria.The study was a quasi-experimental design with samples of eight (80) student. The experimental groups were taught using tradition method. The instrument for the data was geometry achievement test (GAT). A 40 item multiple-choice objective test were used form selected topic in geometry the t-test statistic was used to analyze the hypothesis at 0.05 level of significance the finding revealed that experimental group performed better than control group. The study recommended that government should organized seminar, workshop and symposium for teachers on the development computer assisted instructional package to enhance learning among students. The researchers in the study under review did not consider the issue of gender which important variable in education research and interest level of the

students in geometry. The current study has gender and interest of students in geometry as a specific area of mathematics problem.

Achor, Imoko And Ajai (2010) in study effect of game and simulation on student performance and interest in geometry examined the effect of games and simulation on the performance of male and female student with a sample size of 287 SS1 students and quasi-experimental design, date collected was analyzed using descriptive statistic of mean standard deviation finding of the study viewed that student exposed to game and simulation techniques exhibited higher performance and greater interest in geometry than those were not. In addition, male and female student taught using games and simulation did not differ significantly both in performance andinterest. The study is related to this research in the sense that both seek to improve student academic performance and interest in geometry.

Illiyasu(2002) in the study students' perception of mathematic conducted in Plateau state with a sample of 200 students, look into areas of difficulty of 55 students in SSCE mathematics syllabus. Based on the research question and hypotheses formulated twenty-eight item questionnaire was used to collect data for the study. Data collected was analyzed using standard deviation and t-test. The result of the study showed that students rated geometry and trigonometry among the most difficult areas in the secondary school syllabus. The study thus recommended that teachers should make do with all the available innovational activities that could help in reducing the difficulty level of mathematics before the students.The researcher therefore wishes to this Carrion call by Illiyasu by investigating into the effect of instructional material on students' academic performances and interest in geometry.

2.8 Implication of the Literature Reviewed on the Present Study.

From the literature reviewed, some significant observations to this study were made thus. The literature review in this study indicated that instructional material can be apply in any academic level from kindergarten to secondary school and it promote positive effect to the teaching and learning. The literature also revealed that instructional material help the teacher to make a lesson much clearer to learner, it also been revealed from the literature that instructional material provide active participation of the students, capture the learners interest, make mathematics lesson more lively, stimulate imagination, give room for effective retention of lesson.

The literature also revealed that this ugly trend to a very weak mathematics foundation which begin in the primary level and carried over to the junior secondary and culminated in senior secondary school, so the remedy situation should be adapted by using instructional material. It has also been revealed in this literature that the average person using instructional material achieved at about 70^{th} percent of the student working with lecture method. The examined literatures have indicated that performance and interest of the student in geometry mathematics were full of apathy, that is the students' performance and interest in primary, junior and senior secondary school examination is not attained.This imply that it is worthy of note that no pattern of curriculum implementation can be done effectively without relevant instructional materials to present various mathematical concept.It has been discovered in this literature that instructional material with respect to geometry construction of JSS was not conducted in Kaduna state. As far as the researcher is concerned from the literature available, therefore this study was set to fill the gap, several studies where done in several field such as Chemistry, Physics and Basic Science but relatively non in geometry more specifically JSS II in Kaduna State. The researcher wish to made efforts to employ instructional material to guide JSS II student in Kaduna state on geometry

construction of JSS to see if it could improve their performance and interest in geometry mathematics.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presented the outline of the procedure for the study, the effect of enriched expository method on interest and performance in geometry among junior secondary school students in Kaduna state. The aim of the study was to investigate the effect of enriched expository method.It also to determine the performance and interest of students in geometry. In each case the issue of gender was also exposed. The methodology was discussed under the following sub-headings:

3.2 Research Design

3.3 Population of the Study

3.4 Sample and Sampling Technique

3.5 Instrumentation

3.6 Pilot Testing

3.7 Validation and Reliability of the Instruments

3.8 Procedure for a Data collection

3.8.1 Administration of the Instruments

3.9 Procedure for Data Analysis

3.2 Research Design

The design of this study was quasi-experimental research design.Specifically; pre-test post-test nonequivalent control group design was adopted. This was adopted because it was possible to have a complete randomization of the subject into experimental and control groups.Emaikwu (2008) give this as a condition for using quasi-experimental

design in order not to disrupt school activities and organization, Intact classes were randomly assigned to the experimental and control groups respectively. The two groups were given a pre- test in order to find out whether there was no significant difference in their ability level before the treatment of the study. The experimental group was exposed to expository method enriched with instructional material and the control group using the lecture method. After the treatment period is over, a posttest on interest and performance was administered to the two groups. The same instrument geometry constructional performance test (GCPT) was used for pretest and posttest.

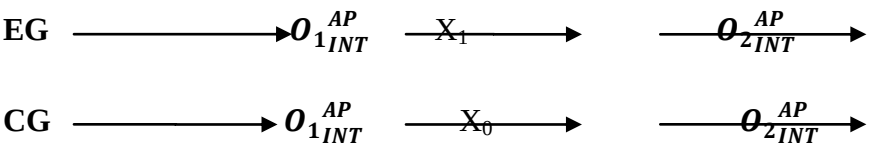

Fig. 3.1: Research Design

Where

EG= Experimental group

CG= Control group

X_1=Treatment (Enriched Expository Method)

X_o= No treatment (Lecture Method)

O_1= Pretest

O_2= Posttest

AP= Academic Performance

INT= Interest

3.3 Population of the Study

The population for the study consisted of 30 public junior secondary schools in Zaria educational zone in Kaduna state which sum up to a total of five thousand two hundred and sixty two(5262) students. The number of male students was two thousand nine

hundred and fifty (2950) while that ofmale was two thousand three hundred and twelve (2312). The number of single sex school was ten (10) while the coeducation schools were twenty (20). The population was limited to only public coeducational schools in Zaria. There are 30 junior secondary school which comprised of five (5) all boys and five all girls and twenty coeducation schools scattered all over two local government areas namely Sabon-Gari, andZaria Local Government in Table 3.1.The population was also limited to only public coeducation school while the private and federal schools were not included.

Table 3.1: Population of the Study

S/No		Location	Sex		Total	
			Male	Female		School Type
1	GJSS Aminu	S/ Gari	267	108	375	Co-education
2	GSS T/ Wada	T/ Wada	272	121	343	Co-education
3	GSS K/ Jatau	Zaria City	100	121	221	Co-education
4	GJSS Awai	Awai	40	19	59	Co-education
5	GJSS Gyallesu	Gyallesu	126	70	196	Co-education
6	GJSS Kinkiba	Kinkiba	33	09	42	Co-education
7	GJSS Magaya	Zaria	77	38	115	Co-education
8	GSS T/Jukun	T/Jukun	110	124	234	Co-education
9	GJSS Manji	Manji	08	42	50	Co-education
10	GJSS Richifa	Richifa	40	07	47	Co-education
11	GJSS Bogari	Zaria City	30	10	40	Co-education
12	GJSS Yakasai	Zaria City	35	17	52	Co-education
13	GJSS T/ Saidu	T/ Saidu	117	46	163	Co-education
14	GJSS K/ Doka	Zaria City	288	152	440	Co-education
15	GJSS Aba	Zaria	25	07	32	Co-education
16	GJSS Muchia	S/ Gari	278	143	371	Co-education
17	GJSS Matari	Zaria	24	07	31	Co-education
18	GSS Dinya	Dinya	34	15	49	Co-education
19	GJSS Chikaji	S/ Gari	100	109	209	Co-education
20	GJSS Gimba	Zaria	30	20	50	Co-education
21	GGJSS Pada	Zaria City	Nil	200	200	Single Girls
22	GGJSS D/ Bauchi	S/ Gari	Nil	333	333	Single Girls
23	GSS Chindit Junior	S/Gari	Nil	207	207	Single Girls
24	Barewa College	Gaskiya	155	Nil	155	Single Boys
25	GJSS K/ Gaya	Zaria City	Nil	252	252	Single Girls
26	GJSS Chindit Boys Junior	S/ Gari	234	Nil	234	Single Boys
27	GGSS (WTC)	Zaria	Nil	135	135	Single Girls
28	GSS Alhudahuda	Zaria City	325	Nil	325	Single Boys
29	GJSS Zaria	Zaria City	212	Nil	212	Single Boys
30	SSS Kufena	Zaria	40	Nil	40	Single Boys
	Total		**2950**	**2312**	**5262**	

Source: Zaria Inspectorate Division (2016)

3.4 Sample and Sampling Technique

In selecting the sample for the study,a sample size of 300 students was selected for the study;this is in accordance with central limit theorem that regarded a minimum of 30 samples size viable for experimental research (Tuckman, 1975, Usman, 2000 Franker& Waller, 2000,Alices, 2011). In order to ensure that each school had an equal chance of being chosen. Asample random sampling technique of hat and drawn method was used to select the schools and the level of students which were grouped into experimental group and control group. Oneintact class from the JSS2was selected by sample random method from each of these schools for the study. The choice of JSS 2 student are neither like JSS 1 students who are new to the environment, non like JSS 3 student who are busy preparing for final examination. This was because the school administration will not allow disorganization of classes for the purpose of research. The schools and class were grouped into experimental group and control group using random sampling technique (use of balloting) by picking paper from the hat, involving rolling four (4) paper with code E1 E2 C1 C2 respectively the schools in which code E1 and E2 were experimental group which C1 and C2 were for the control groups. Thus this research considered 300 JSS2 studentscomprising of 146male and 154 female.

Table 3.2: Sample Selected for the Study

S/N	Name of School	Group	M	F	Total
1.	GJSS, Gyallesu	Control	36	37	73
2.	GJSS, Aminu	Control	37	39	76
3.	GJSS, Tudun/Jukun	Experimental	37	41	78
4.	GJSS, Kofar/Doka	Experimental	36	37	73
Total			**146**	**154**	**300**

3.5 Instrumentation

The instruments used to collect data for this study were geometry construction on performance test (GCPT) and geometry interest inventory (GII).

3.5.1 Geometry Construction Performance Test (GCPT)

Geometry construction performance test (GCPT) wasused to collectdata for thisstudy. Geometry construction performance test (GCPT) was 40 items multiple choiceobjective test with four options (A, B, C and D) covering the topics selected for the study shown in (Appendix B). The contents are construction of perpendicular lines, parallel lines, construction of angles such as 60^0,30^0,90^0 and 45^0, angle of elevation and depression, solid shape and plane shape. The test was administered by the researcher in the selected school with the help of mathematics teacher. GCPT was scored out of 40each item correctly answer was 1 markand duration was two hours. The items of GCPT were developed using lower and higher order questions. The lower order question cover knowledge and comprehension of cognitive domain while the question involving higher thinking process cover application as shown in the test blue print of GCPT.

Table 3.3: of Specification for Geometry Performance Test based on Blooms Taxonomy

Objective/ Content	Knowledge	Comprehension	Application	Total
Construction of parallel and perpendicular lines	2	2	2	6
Construction of angle $60^{o}$and 30^{0}	2	2	2	6
Construction of angle $90^{o}$and 45^{0}	2	2	2	6
Angle of elevation and depression	2	2	2	6
Solid Shape	3	3	2	8
Plain Shape	3	3	2	8
Total	14	14	12	**40**

The content was taught both the experimental and control group. The experimental groups received the treatment using expository method enriched with instructional material while the control groups were taught using lecture method. The table 3.4.show the Distribution of GCPT questions based knowledge, comprehensive and application of cognitive domain.

Table 3.4: Distribution of Questions based on knowledge, comprehension and Application

Topics	Knowledge	Comprehension	Application
Construction of parallel and perpendicular lines	3,11	23,28	1,7
Construction of angle $60^{o}$and 30^{0}	15,16	6,17	4,8
Construction of angle 90^{o} and 45^{0}	12,30	5,20	14,22
Angle of elevation and depression	13,18	10,21	9,14
Solid Shape	26,27,39	24,25,40	2,29
Plain Shape	31,32,37	33,34,39	35,36

3.5.2 Geometry Interest Inventory (GII)

The Geometry Interest Inventory (GII) was pretest and posttest to help students express their feeling towards mathematics generally and geometry in particular. The instrument was adopted from Nguuma (2010) for collecting information from students concerning their feeling toward geometry .it consisted of two sections. Section A constituted of information about respondents sex, while section B contained 25 items on students interest in geometry. Eachitemwas 5points likert scale with 5response options. The options are: strongly agree (SA), agree (A), undecided (U), Disagree (D), Strongly disagree (SD) rated 5 4 3 2 1 for all positive statements and 1 2 3 4 and 5 in that order for all negative statements.

3.6 Pilot Testing

Forty (40) students in JSS II fromGovernment Junior Secondary School, Kwangila, Zaria in Giwa Educational Zone were used for the pilot study, but not in the sample

used. The tests GCPT and GII were administered twice within an interval of two weeks. The purpose of the study was to obtain the reliability of the instruments as well as determine the appropriateness of the items of the instrument. The pilot study also enabled the researchers determine the duration of time for the completion of the main study. From the result of the pilot study, test items found too difficult or too easy were either rejected or re-modified and improved. Also items found to have low level of discrimination were dropped using recommendation of Sambo (2008). The pilot study enables the researcher to prepare on what to expect in the main study which was not too different during the conduct of the main study. Their corrections and observation were fully in cooperated in the final draft.

3.7 Validation and Reliability Instruments

The instruments for this study are geometry construction performance test and geometryinterest inventory were subjected to validity and reliability test before they are to use.

3.7.1 Validity of Geometric Construction Performance Test (GCPT)

The geometric constructional performance test was validated by two senior lectures each with a PhD in mathematics education from ABU Zaria and one senior secondary school teacher with BSc mathematics and at least twenty years of teaching experience at the senior secondary school level. The expert assessed the suitability of the instrument to ascertain whether or not the instrument is related to the objective of the study. Their criticism and observation were incorporated into the test items. After validation of the instrument it was suggested that the content of the instrument was appropriate and relevant to the objective of the study.

3.7.2 Reliability of Geometry Construction Performance Test(GCPT)

In this study test- retest was used with interval of two weeks was used as recommended by Tuckman(1975). The results of the plot test were used for geometry construction performance (GCPT). Pearson product moment correlation statistic was used for analyst. The internal consistencies GCPT were 0.73 as its reliability coefficient. This implies that instrument are reliable therefore appropriate for the study.

3.7.3 Validity for GeometryInterest Inventory

The geometry interest inventory was validated by two senior lecturers each with a PhD in social science department from ABU, Zaria. They were requested to ascertain whether the face validity and content validity are appropriates.

3.7.4 Reliability of Geometry Interest Inventory

The results of pilot study were used to calculate the reliability of geometry interest inventory. Test-retest method with interval of two week was used as recommended byTuckman(1975). Pearson product moment correlation coefficient statistics as used for analysis. The reliability coefficient for GII 0.83 which show that the instrument is reliable and used for data collection in the study

3.8 Procedure for Data Collection

The researcher with the help of research assistants administered a pre-test to both the experimental and control groups. The essence of the pre-test was to determine the status of the learner. The researcher then taught the experimental group using expository method enriched with instructional materials and the control group using lecture method for six weeks respectively after the treatment. Therefore, at a close interval of the one week, post-test was administered on the two groups of the students. The script

for the both pretest and posttest for experimental and control group were collected marked and recorded for analysis.

3.8.1 Administration ofthe Treatment

A pretest was administered to the two groups before the treatment. This was to determine whether there is no insignificant difference in their ability level. The researcher handled both the control and experimental group. At the end of the of the six weeks posttest was administer to the experimental group and control group to see the significant difference between the two group

3.8.2 Teaching the Control Group

The teaching of the control group follows the normal lecture method used in schools. The lesson lasted for six week. A minimum of 3 periods per week was used by the researchers. The normal time table of the school was followed. At the end of six weeks the post test was administer to control group. The lesson plan for the control group was prepared by the researcher. See appendix G.

3.8.3 Teaching the Experimental Group

Teaching of experimental group was done twice in a week using only double period on the school timetable 1hr20min. The experimental group was taught geometry construction using enriched expository method as treatment. The step adapted from teachingenriched expository method comprised the following:

Step 1: The teacher introduces the lesson. The teacher asks questions based on students' previousknowledge which helps to get them ready for the lesson at hand.

Step 2: Teacher divides students in to groups and the group formed by the mixture of terms; example gender.

Step 3: Each group gives the instructional materials to be used to facilitate students' in to complete their activities problems given by the teacher.

Step 4: Students should solve and give answers to the question that is on activity that has been given by the teacher

Step 5: Teacher monitors the students' activities as they complete them, guide the students activities as they complete them, guide them in the right direction as the need them.

Step 6: Teacher ask a question on what students learn and explains the areas where students were observed to have difficult, both teacher and students concluded the final answer.

It was an adaptation of Kagan(1994) Model. The lesson plans for the teaching of the students was attached as Appendix F. See Figure 3.2

The flowchart of the EnrichedExpository Methodgiven in figure 3.2

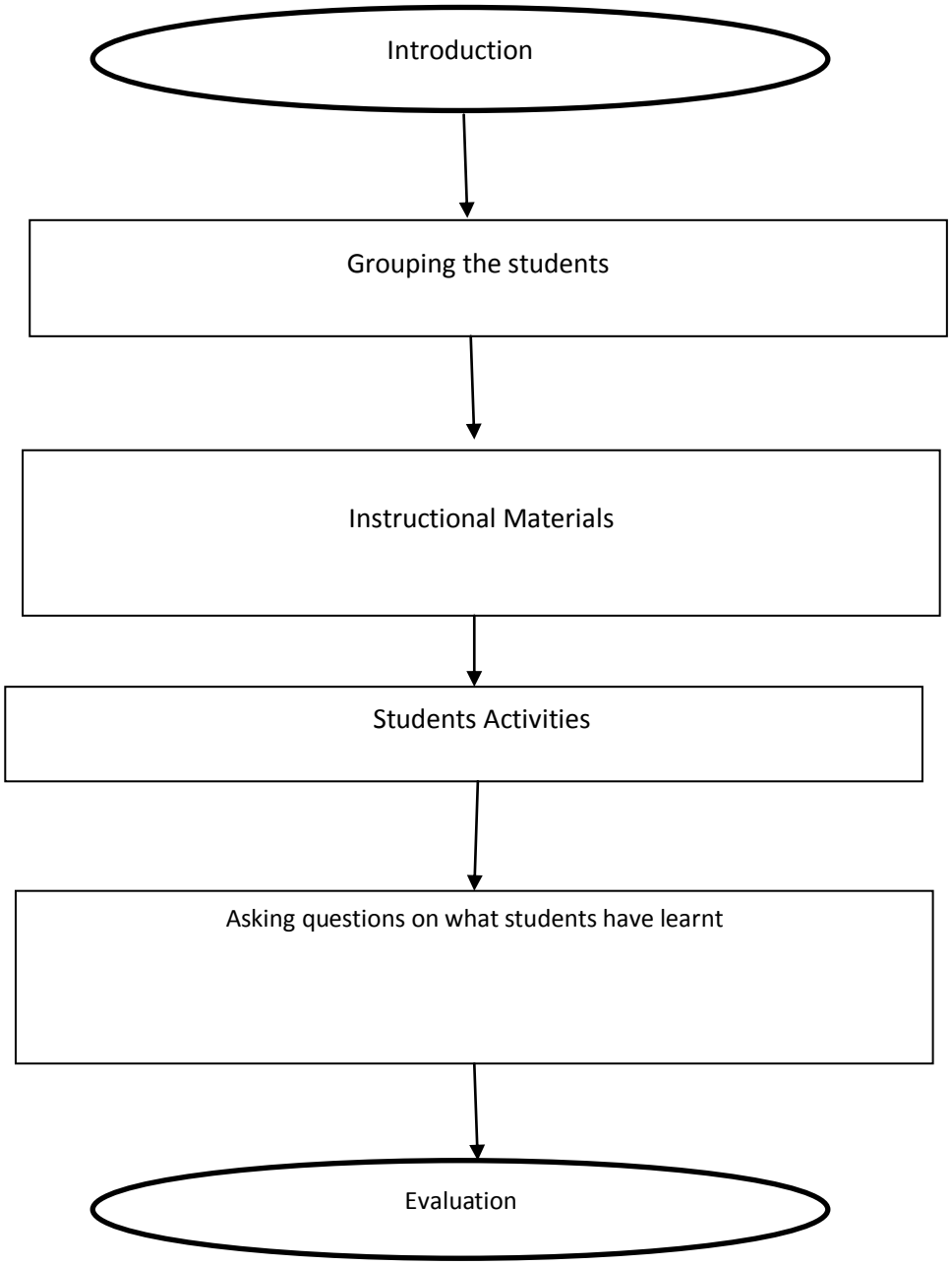

Figure 3.2: A flowchart of the Enriched Expository Method Adapted

Source: Kagan (1994)

3.9 Data Analysis

Data collected through the GCPT and GII were classified into pre-test and post-test for experimental and control groups as well as into male and female. Since the study has gender as a moderation variable. Data were analyzed with respect to the research question and hypothesis formulated for the study. Descriptive statistics of mean and standard deviations was used to analyze the research questions. The inferential statistics of two sample t-test procedurewere used to test the hypotheses at 0.05 significant levels. To test null hypotheses, independent sample (t-test) statistic was used because it is the most suitable test for testing significant difference between two groups of values that are normally distributed.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND DISCUSSIONS

4.1 Introduction

The study was conducted to investigate the effect of expository method enriched with instructional materials on interest and performance in geometry among junior secondary schools students in Kaduna State. Descriptive statistics of mean and standard deviation were used to analyze the data and inferential statistics of independent t-test was used to test research hypotheses at 0.05 level of significant of the study with the aid of using the statistical package for social science (SPSS) computer software. Therefore this chapter highlighted sub-headings such as; Data Analysis, Answer to Research Questions, Hypotheses Testing, Summary of the Major Findings and Discussions were presented.

4.2 Data Presentation and Analysis

The data collected using Geometry Construction Performance Test (GCPT) and Geometry Interest Inventory (GII)for this study are presented and analyzed according to research questions and research hypotheses that guided the study. Four research questions were used and Four research hypotheses were tested, in all case table contained the summary of the findings was presented followed by the brief discussion of the contain of the table as well as possible answer to research question stated and the decision taken as whether the stated hypotheses was accepted or rejected **Table4.1: Mean and Standard Deviation of Students' Performances inPre-test**

Groups	N	Mean	Std. Dev.	Mean difference
Experimental	149	12.62	7.64	

				0.05
Control	151	12.57	3.589	

The Table 4.1 showed that the pre-test mean and standard deviation of students' performance in experimental group were 12.62 and 7.64 while control group were 12.57 and 3.589 respectively. The mean performance difference was 0.05. This implies that two groups basically have the same level of performance before the treatment.

Table 4.2: Mean and Standard Deviationof Students' PerformanceinPost-Test

Groups	**N**	**Mean**	**Std. Dev.**	**Mean Difference**
Experimental	136	20.1	4.132	5.21
Control	115	14.89	3.741	

The Table 4.2 revealed that the post-test mean and standard deviation of students' performance score in experimental group were 20.10 and 4.132 while control group were 14.89 and 3.741 respectively. The post-test mean difference of the two groups was 5.21 in favor of experimental group. This implies that the experimental groupperformed better than the control group. This was a clear indication that the improvement obtained among students in experimental group should be attributable tothe use of enriched expository method.

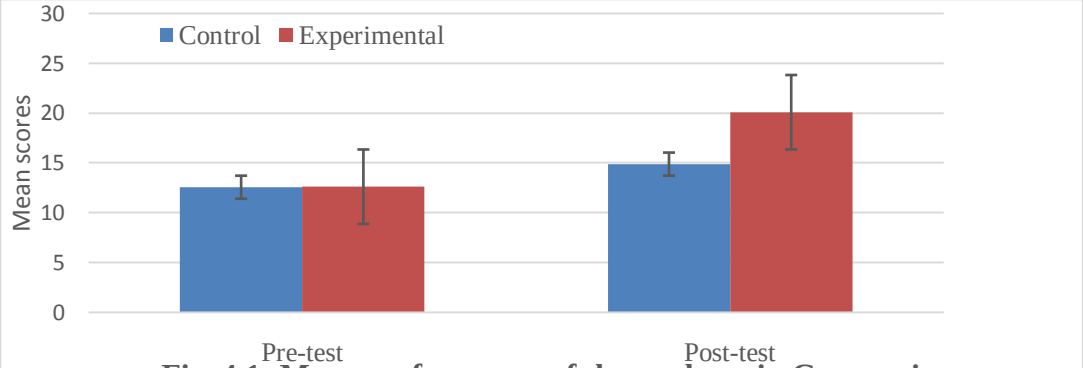

Fig. 4.1: Mean performance of the students in Geometric Construction Test before and after the experiment

Figure 4.1 Diagrammatical Presentation of Pre-test and Post-test

The diagram showed that the pre-test performance of the two groups basically have the same level of performances while the post-test performance of the students in experimental group is higher than control group.

4.2.2 Data for Experimental Group and Control Group in Students' Interest

Table 4.3 Mean and Standard Deviation of Students' Interest in Pre-Test

Group	N	Mean	Std. Dev.	Mean Diff.
Experimental	149	86.05	14.689	-0.78
Control	151	86.83	14.463	

The table 4.3 indicated that mean and standard deviation interest of two groups control and experimental were basically the same. The mean and standard deviation score of pre-test were 86.05 and 14.689 in experimental group while the mean and standard deviation of pre-test in control group were 86.83 and 14.46 respectively. The mean difference between the experimental and control group in pre-test interest was -0.78.

Table 4.4: Mean and Standard Deviation of Students' Interest Rank in Post-Test

Group	N	Mean	Std.Dev.	Mean Diff

Experimental	136	96.06	13.969	12.16
Control	115	83.9	13.713	

Table 4.4 showed that the mean and standard deviation of post-test interest scores of experimental group were 96.06 and 13.989 while the control group had post-test mean and standard deviation of 83.9 and 13.713. The mean differences between experimental and control group was 12.16. The result shows that there is difference in students' interest between the two groups. This shows that experimental group gain more interest score than control group.

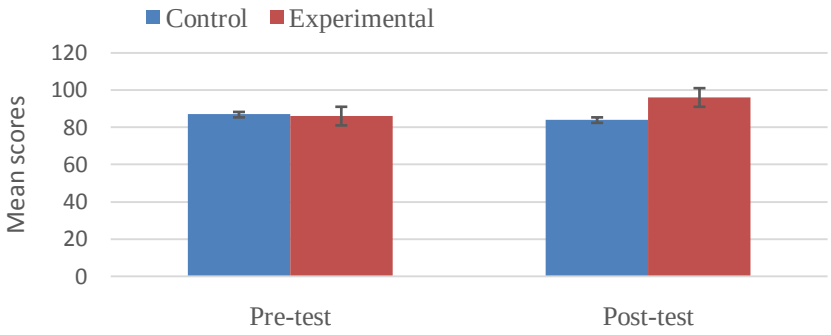

Fig.4.2: Mean interest of the students in Geometric Construction before and after the experiment

Figure 4.2 Diagrammatical Presentation of Pre-Test and Post-Test of Interest

The diagram showed that interest score of experimental group is higher than those of control group in the post-test. This shows that students that were guided with instructional material have more interest in geometry construction knowledge than those taught using lecturing method.

Data for performance score of gender in experimental

Table 4.5: Mean and Standard DeviationPerformances by Gender in Experimental Group

Gender	N	Mean	Std. Dev.	Mean difference

Male	72	20.39	4.287	
Female	64	19.78	3.958	0.61

Tables 4.5 showed that the mean and standard deviation scores of male and female of experimental group in post-test were 20.39 and 4.287 while the female 19.78 and 3.958 respectively. The mean difference of male and female in experimental group was 0.61. This shows that male had slightly higher score than their female.

Table 4.6: Mean and Standard Deviation Performance by Gender in Control Group.

Gender	**N**	**Mean**	**Std. Dev.**	**Mean difference**
Male	59	14.88	2.871	
Female	56	14.89	4.507	0.01

The table 4.6 showed that the mean and standard deviation of male performance score was 14.88 and 2.871 while the mean and standard deviation of female performance score were 14.89 and 4.507 respectively. The mean differences of male and female performances score was 0.01. This shows that the performances of male and female in control group did not differ.

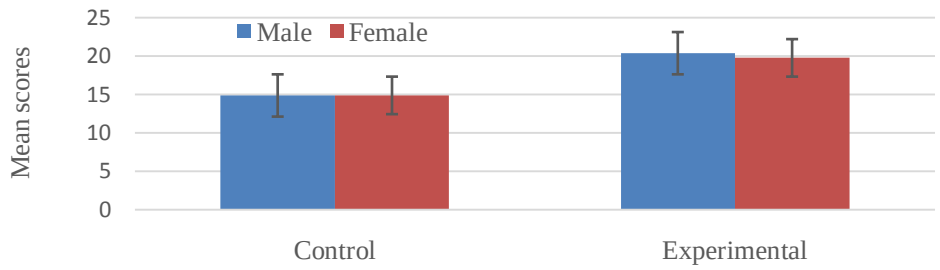

Fig.4. 3: Mean performance of control and experimental group of male and female students in Geometric Construction Test after the experiment

Figure 4.3: Diagrammatical Presentation of Post-test of male and female in the two groups.

The figure showed thatperformancesof male and female in post of experimental andcontrol groups it shows that the performance of male and female students in control group did not differ while the performance of male students in the experimental group had slightly higher than their female. This shows that the use of enriched expository methodhas enhanced the performance of the students irrespective of their gender. The test of the variability in the mean performances is conducted in the related hypothesis of the study.

Table 4.7: Mean and Standard Deviation of Students' Interest by Gender in Experimental Group.

Gender	N	Mean	Std. Dev.	Mean Diff.
Male	72	97.81	14.312	
				3.60
Female	64	94.21	13.478	

Table 4.7 indicated that the mean and standard deviation score of gender in the experimental group respectively. The male had mean score of 97.81 and standard deviation of 14.312 while the female had mean score of 94.21 and standard deviation of 13.478. The mean difference was 3.60.This implies that male students greater than their counter part female.

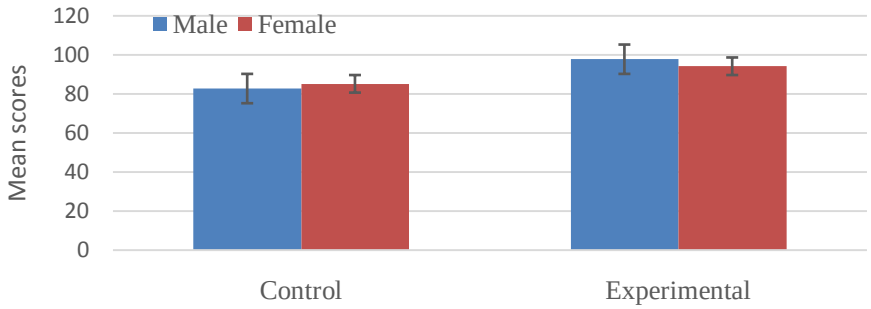

Fig. 4.4: Mean interest of comtrol and experimental groups of male and female students in Geometric Construction Test after the experiment

The figure showed that the interest score of female is higher than their counter part male in the control group of posttest while the interest score of male is higher than the counterpart female in the experimental group of post-test.

4.3 Hypotheses testing

Null Hypothesis One:

There is no significant difference between the mean performance of students taught geometry using Enriched Expository Method and those taught using the Lecture Method.

This hypothesis was tested using two t-test statistic. The summary of the computation was presented in table 4.8.

Table 4.8: T-test onStudents' Performancein Post-test

Status	N	Mean	Std. Dev.	Std. Error	t-val.	t-crit	DF	P-value
Experimental	136	20.10	4.132	0.354	10.404	1.96	249	0.000

Control	115	14.89	3.741	0.349

From the Table 4.8t-calculated value was 10.404 and t-critical value was 1.96 at the 249 degree of freedom with $\alpha = 0.05$. Since t-calculated value was greater than t- critical value and also the p-value of the test was 0.000 which is lower than the significant level value test at p=0.05 level of significance. Therefore, the null hypothesis one was rejected. This implies that there was significant difference between the mean performance scores of students taught geometry usingenriched expository method and those taught using the lecture method.

Null Hypothesis Two:

There is no significant difference between the mean interest levels of students taught geometry using enriched expository method and those taught using the lecture method.

This hypothesis was analyzed using the T-test statistic. The summary of the result is presented in Table 4.9

Table 4.9: T-Test on MeanStudents' Interest in Experimental and Control Group

Group	N	Mean	Std.Dev.	Std.Error.	T-val.	T-crit.	DF	P-value
Experiment	136	96.06	13.698	1.303				
6.938	1.96	249	0.000					
Control	115	83.90	13.713	1.176				

The result in Table 4.9 reveal that, the observed variability in the interest of the two groups exposed to the two methods for teaching the geometric construction was statistically significant. T-calculated value was 6.938 and. T-Critical value was 1.96 at α=0.05 level of significance. The p-value was significant since p= 0.000 is less than p=0.05 level ofsignificance. Therefore the null hypothesis two was rejected. The null hypothesis that there is no significant difference between interest levels of students

taught geometry using enriched expository method and those taught using the lecture method.

Null Hypothesis Three:

There is no significant difference between the mean performance scores of male and female students taught geometry using enriched expository method and those taught using the lecture method.

The data for hypothesis three was analyzed using two sample independent t-test as presented in the table 4.10.

Table 4.10: T-test onStudents' Performance by Gender inExperimental Group

Group	Gender	N	Mean	Std. Dev	Std. Error	T-val.	T-crit.	DF	P-value
Experimental	Male	72	20.39	4.287	0.505	0.855	1.96	134	0.394
	Female	64	19.78	3.958	0.495				

Table 4.10 review that t-critical value was 1.96 and t- calculated value was 0.855 at 134 degree of freedom. This value is not significant since p=0.394 is greater than p=0.05 level of significance. Therefore the null hypothesis three was retained. This implies that there was no significant difference between mean performances of male and female students taught geometry construction using enriched expository method. This means that the gender did not have a significant effect on the use of enriched expository method in experimental is therefore accepted.

Null Hypothesis Four:

There is no significant difference between the interest level of male and female students taught geometry using enriched expository method and those taught using the lecture method.

The data for hypothesis four was analyzed using independent t-test on statistics at $p \leq 0.05$. The summary of the result was presented in table 4.11.

Table 4.11: T-test on students' interestby gender in experimental group.

Group	Gender	N	Mean	Std. Dev.	Std. Error	t-value	t-crit	DF	P-value
Experimental	Male	72	97.81	14.312	1.863	1.387	1.96	134	0.168
	Female	64	94.21	13.478	1.801				

From the Table 4.11, showed that t-critical value was 1.96 and the t-calculated value was 1.387 at 134 degree of freedom.This value is not significant since p=0.168 is greater than p=0.05 level of significance.Therefore, the null hypothesis four was retained. This implies that there was no significant difference between interest level of male and female students taught geometric construction using-enriched expository method.

4.4 Summary of Major Finding

The major findings from the data analysis and test of the hypotheses are summarized as follows:

- Students exposed to use ofenriched expository method performed significantly better than those who were taught the geometry construction with the use of the lecture method.

- The student taught with enriched expository method generated significantly higher interest than those taught lecture method.
- The male and female students] exposed to enriched expository method did not differ in performance
- The male and female students exposed to enriched expository method did not offer significantly in the interest generated.

4.5Discussion of Results

This study investigated the effect ofenriched expository method on interest and performance in geometric construction among Junior Secondary School students in Kaduna state, four null hypotheses were tested in line with research question and objectives of the study. From the test of hypothesis I, where the effect of the two methods were compared and the data relating to the first research question, it was found that students exposed to the use of theenriched expository method performed significantly better than those who were taught the geometric construction with the use of the lecture method. The null hypothesis was therefore rejected. From subsequent analysis of the data, this finding is consistent with the report of Onabanjo and Akinsola(2000) who revealed that the use of instructional materials assists the teachers to properly convey the topic content for students to learn better and effectively grasp the instructional objectives. The finding is in line with the report of Usman andAdewumi (2006) who stated that the use of instructional materials stimulates pupils' interest and achievement. The finding agrees with the finding of Akusoba and Okeke (2009) who reported from their investigation on the effect of activity centered teaching approach using low cost learning kits in facilitating students' achievement and interest in mathematics where it was found that significant difference existed between the

experimental group and the control group. The reason for better performance of the experimental group is that the students were able to manipulating instructional materials in the lesson and help to retained what they learnt for a long period of time.

In the test of hypothesis two of the study where the interests generated by the use of the enriched expository method was compared with those generated by the use of the lecture method was conducted, it was revealed that the use of the enriched expository method generated significantly higher interest than the lecture method used in the control group. The null hypothesis was therefore rejected. The finding here is in line with the report of Adewumi (2006) who stated that the use of instructional materials stimulates pupils' interest and achievement and Osemmwingen (2009) who reported that students' interests and retention could be aroused and retained through the use of appropriate instructional. The finding reflected the finding of Adenegan (2010) who reported that instructional materials when properly used in the teaching and learning situation, can simply concretizes bases for conceptual thinking high degree of interest for students in making learning more permanent. This study, thus asserts that the adaptation of enriched expository method hadled to high interest of students, which in turn enhance meaningful learning and improve performance in geometry.

Hypothesis III tested for significant difference between performances of male and female students who were taught the geometric construction with the enriched expository method and those taught with the conventional lecture method. The result of the test revealed that male and female students exposed to the methods did not differ significantly within their groups in the performance but the male and female students in the experimental group were found to differ significantly from the male and female students who were in the control group. On the basis of the sex differences, the null hypothesis could not be rejected. The observation here was that the gender of students

has no significant effect on either the lecture or theenriched expository method used in the experiment. The finding here are consistent with the observation of Abimbode (2004) observed that an availability of good facilities increase the degree of success in the teaching strategy adopted by the teacher.Enriched expository method is a gender friendly from the result of male and female performed better therefore is gender friendly. This might be due to fact that male and female like to manipulate Instruction materials, this may be contribute to their better performance in geometry concept.

Hypothesis four tested for significant difference between male and female students' rated score interest generated in the geometric construction when taught with use of enrichedexpository method and when taught with the conventional lecture method. The result of the test revealed that the interest generated by the methods did not differ significantly between male and female within each of the group. But the groups were found to differ significantly. On the basis of sex, the null hypothesis could not be rejected. The observation was that gender did not have a significant effect on any of the method used in the experiment. The finding here is consistent with the report of Imoko and Agwagah (2006) who stated that interest is an important variable in learning because when one become interested in an activity, one is likely to be more deeply involved in that activity. The observations show that the adaption of enrich expository method in the experimental group produce better result in terms of students interest in subject. Hence The Enriched Expository method is a gender friendly method.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter summarizes the investigation into the effect of enriched expository method on interest and performance in geometry among Junior Secondary School students in Kaduna State. The chapter was presented under the following subheadings:

5.2 Summary of the study

5.3 Conclusions

5.4 Recommendations

5.5 Contributions to knowledge

5.6 Limitation of the study

5.7 Suggestions for Further Studies

5.2 Summary of the study

In this section, major finding of the study were discussed, conclusions were reached and recommendations were made. The finding of the study and limitation were highlighted and suggestions for further research were also provided. The study considered a sample of 300 students out of 5262 junior secondary school student with average of 16years old- by random assignment to treatment. The samples were formed into four groups, two experimental groups and two for control groups. Pretest and posttest quasi experimental designs were developed and were tested for validity and reliability through pilot study. All the groups were taught the same selected topic for six weeks, with the pretest given before the treatment began, while the posttest were administered at the end of the treatment therefore, this study investigated the effect of expository method- enriched with instructional material on interest and performance in geometry

among junior secondary school students in order to determine its effect ofenriched expository method on interest and academic performances. The study was structured into five chapters,

The chapter one introduced the background to the study, statement of problem, objectives of the study research question and hypothesis. The chapter also includes the scope of the study and significances of the study could be used to improvement of mathematics teaching and learning at all level of secondary schools.

Chapter two was made up of a review of related literature under the following headings Theoretical Framework, Concept of Mathematics, Theories of Learning Geometry, Geometry Concept,Method of Teaching in Mathematics, Objective of Geometry Teaching in Nigeria.Instructional materials, Students Interest toward geometry, overview of relate study and implications of reviewed literature for the study.

Chapter three described the research methodologies. This was pre-test post-test quasi experimental research design. The researcher develops two instruments for the study which are Geometry Construction Performance Test (GCPT) and Geometry Interest Inventory (GII). They are used for data collection and were subjected to validity and reliability tests. The study also groups the students into two groups which was experimental group and control group. The experimental group were taught geometry construction with expository method-enriched with instructional materials while control group were taught with lecture method. The data were collected and recorded for analysis.

Chapter four consisted of data analysis, discussion and summary of finding. Meansand standard deviations were used to analysis the result of research question while four null hypotheses were formulated at $P \leq 0.05$ level of significance test using t-test.

The major findings from the tests and analysis of the data are summarized below.

1. Students taught geometry using enriched expository method had a higher mean performance score compare to those taught by lecture method also a significant method. These results implied that the enriched was more effective in improving students' performance in geometry.
2. In terms of interest in geometry, the students taught using enriched expository method had a higher mean rank score for geometry, interest level compared to their counterpart taught using the lecture method, also a significant different was found between the mean interest level of students taught geometry using the enriched expository method and those taught using lecture method.
3. A slight difference was observed in mean performance score of students with respect to gender in favour of the male students. This difference was not significant when further analysis was done. Hence enriched expository method is a gender friendly.
4. When the mean interest level of students taught geometry was compared with respect to gender in experimental groups. It was found to not significant. Hence enriched expository method is a gender friendly.

5.3 Conclusions

From the findings of this study,this study revealed that the use ofenrichedexpository method in teaching of geometry has better enhancing capabilities of generating students' interestand also improves students' performances than lecture method. And also has no gender bias in interest and performances of the student who participated in

experimental group. Therefore based from the findings of the study,the following conclusions are drawn:

1 Students taught using of the enriched expository method hadlead to better performance in the geometry construction than the lecture method.
2 The students taught geometry usingenrichedexpository method enhance higher interest than those taught lecture method.
3 Male and female students taught using enriched expository methodhad no gender difference in performance.
4 Also male and female students taught geometry using enriched expository method had no gender difference in interest.

Hence Enriched Expository Method improved positively on students' interest and better performance on geometry among junior secondary schoolinkaduna state.

5.4 Recommendations

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

1. The study investigated enriched expository method to improved students' interest and performance. Therefore, mathematic teachers should be able tousedenriched expository method in teaching and learning geometry lecture.
2. Where there are adequate resources, the use of enriched expository method should be considered as a better option for teaching the geometry.
3. There is a need to de-emphasize the use of the lecture method in the teaching of geometric construction in view of its inherent disadvantages.
4. Enriched Expository method can also be applied to other mathematics concept/topic to arouse interest and made available many simple ways of engaging mathematics learner.

5. Government and professional bodies should organized seminars, workshops and conferences,the teacher should be made to update their knowledge and skills in improvisation of instructional materials through seminars, workshops and conferences with the aim of teachingat junior secondary school teachers on how to use enrich expository method for effect teaching in geometry.
6. The performance of students could be increased when there is positive interest in the process of solving problem in geometry. Therefore teachers at junior secondary school level should try to adopt the used of enriched expository method.

5.5 Contribution of the Study to the Knowledge

1. The study has provided an avenue for teachers interested in the enhancement of their students' interest and academic performance in geometry, therefore the use of expository method enriched with instructional materials is a variable option.
2. For the educational inspectorate and supervisory board, this study serves as a guide on what they should supervise or expect in the teaching of mathematics particularly geometry at JSS levels.
3. From the finding of the research work, it is observed that expository method – enriched with instructional materials is a good alternative to lecture method used in the teaching and learning of geometry.

5.6 Limitations of the Study

1. Mathematics periods are always in the morning hours, persisted behavior of students coming late to school, prevented the researcher from getting the total sample of the study from the pretest to post-posttest.
2. Due to lack of enough chairs, the environment was not conducive for effective activities of enriched expository method. Due to these limitations, the outcome

of this study could not be generalized but serves only to raise additional questions and give suggestions for further reading.

5.7 Suggestions for Further Studies

Based on the findings of this study the following suggestions were put forward

1. The study could be replicated in other states of the Federation towards improvement in the interest and performance of students in the subject.
2. Related study should be carried out in other topic in mathematics such as algebra, trigonometry among others.
3. Further research study on the use of enriched expository method could be extended to secondary school and tertiary institution so as to provide detailed and through investigation needed to understand the practice of effective teaching.

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APPENDIX A

GEOMETRY INTEREST INVENTORY (GII)

SECTION A

Please tick the appropriate box.

Male ( ) Female ( )

SECTION B

Below is a list of items to ascertain to your level of interest in mathematics. Please read the statement carefully and tick the correct column SA, A, U, D, SD, which you feel answers the items/ statement. The attention of the researcher/assistants should be drawn to any item found difficult to understand for explanation.

Key: SA – Strongly Agree, A – Agree, U - Undecided, D – Disagree, SD – Strongly Disagree.

S/N	QUESTION / STATEMENT	SA	A	UD	D	SD
1.	I like mathematics just as other subject.					
2.	Mentioning of mathematics does not make me feverish.					
3.	I enjoy studying mathematics more than other subject.					
4.	I feel so bad when I miss mathematics lesson.					
5.	I feel unhappy as mathematics is made a compulsory subject in secondary school.					
6.	I will like to study mathematics after my					

	secondary school education.					
7.	Mathematics should be made compulsory for boys only.					
8.	The best way to learn mathematics is to practice after lesson.					
9.	There are topics in mathematics that are quite difficult to understand.					
10.	Geometry construction is among such difficult topics in mathematics.					
11.	I was taught geometric construction but I did not understand the topic very well.					
12.	I spent more time practicing geometry construction after lessons, if compared with other topics in mathematics.					
13.	I often consult my mates with problems on geometric construct for clarification					
14.	I enjoy geometric construction lesson.					
15.	I find geometry construction boring.					
16.	My attitude towards geometric construction is related to the course l will like to read in the university.					
17.	I will make efforts on my own to study geometric construction if I am not taught before JSCE.					

18.	I will attempt questions on geometric construct whenever I meet such in mathematics examination.					
19.	I don't fail questions on geometric construction in mathematics examination more than other topics.					
20.	Questions on geometric construction demands too much of my time in the examination leaving me with little time to solve other questions.					
21.	The way my teacher taught me geometric construction has affected my feeling towards it.					
22.	I will prefer another way to teach me geometric construction in a more interesting manner.					
23.	More periods should be given to geometric construction to make sure the topic is well covered.					
24.	I don't like geometric construction because naturally I don't like drawing.					
25.	Studying hard cannot make some one pass mathematics examination except if the person is born with mathematics blood.					-

APPENDIX B

Geometry Construction Performance test (GCPT)

Pre-Test study

School:

Male ( ) female ( )

Time allows: 1hr

Instructions: answer all questions by choosing the option that correctly answers the question.

1. In construction of _____ a straight line must be drawn.

(a) Graph (b)Angle (c) Drawing (d) Compasses

2. In constructing net of solid shape the following material are necessary except.

   (a) Graph (b) cardboard (c) sell tape (d) sharp blade.

3. In construction of a _____ a set square is need.

   (a) Perpendicular line (b) angle (c) parallel line (d) straight line.

4. Which of the following instrument are necessary for drawing angle in geometric construction (i) ruler (ii) compass (iii) set square (iv) divider

   (a) I and ii only (b) i, ii and iii only (c) ii and iii only (d) i, ii, iii and iv

5. When an angle is less than 90^0it is called _____.

   (a) Acute angle (b) obtuse angle (c) right angle (d) reflex angle.

6. What do we use in measuring degree of an angle?

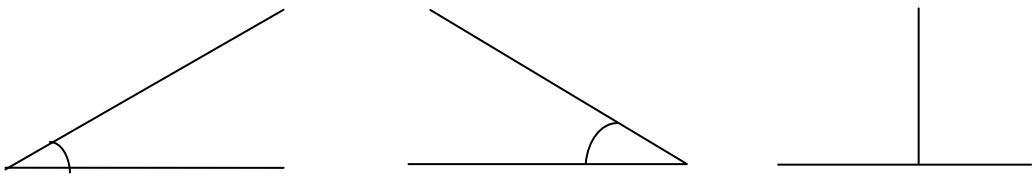
   (a) Set square (b) protractor (c) ruler (d) compasses

7. _____ are two lines moving on the same direction without meeting at any points?

   (a) Angle (b) line (c) protractor (d) parallel line

8. Which of the following diagram demonstrate the correct way of constructing angle 60^0

   i. ii. iii.



   (a)i only (b) ii only (c) I and ii only (d) ii and iii only

9. Which of the following is not correct about construction?

(a) All construction should be made with a sharp point pencil.

(b) Some construction lines should be seen

(c) Smooth straight edges must be used.

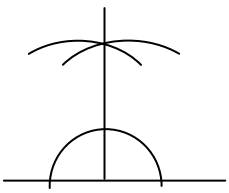
(d) Avoid using of a pair of compass during constructions

10. These are objects that can be observed when your head is raise except.

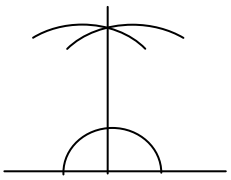
(a) Top of tree (b) moon (c) tower (d) cup on the table

11. Which of these diagrams shows the correct method of constructing a perpendicular line to another line PQ at a given point X on PQ?

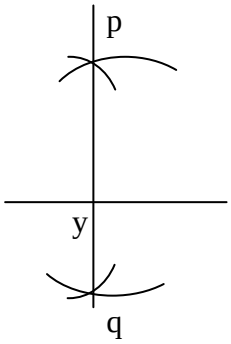
i.



ii.

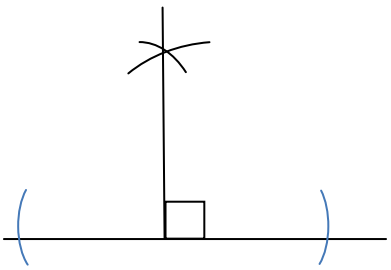


iii.



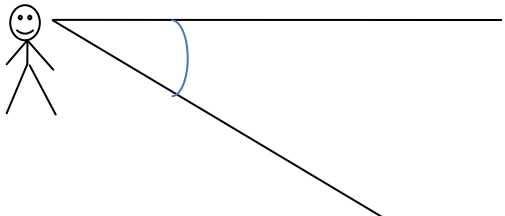
(a) i only (b) ii only (c) i and ii only (d) i, ii and iii

12. The following diagram shows an angle of



(a) 90^0 (b) 60^0 (c) 45^0 (d) 30^0

13. The following figure shows an angle of



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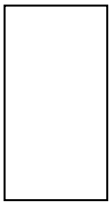
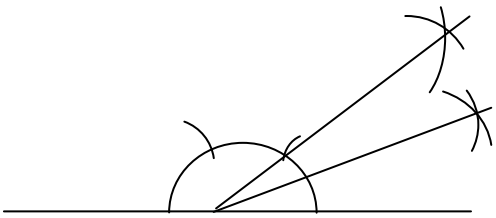


(a) Angle of elevation (b) angle of depression (c) angle of horizontal (d) angle of vertical

14 Angle of elevation and depression can be measure by an instrument called

(a) set square (b)protractor (c) compasses (d) pencil

15 The diagram below illustrates ____



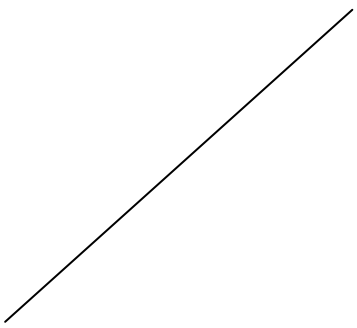
1 construction of angle 60°

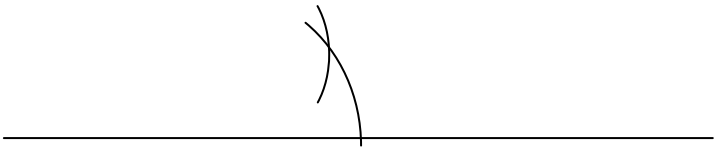
11 construction of angle 30°

111construction of angle 90°

(a) 1 only (b) 11 only (c) 1 and 11 (d) 1, 11, and 111

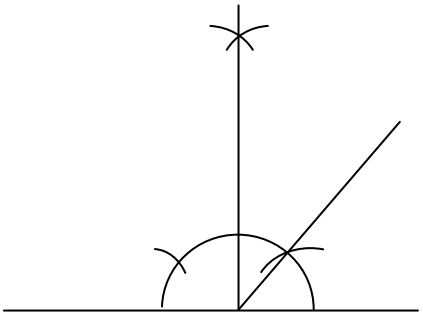
16. The following figure shows an angle of





(a) 30^0 (b) 45^0 (c) 15^0 (c) 60^0 (d) 90^0

17. The diagram below is a construction of angle 75^0 which of the following was a necessary in the construction and is omitted.



(a) Bisection of angle 90^0 (b) bisection of angle 60^0 (c) bisection of the angle between 60^0 and 90^0 (d) construction of angle 45^0

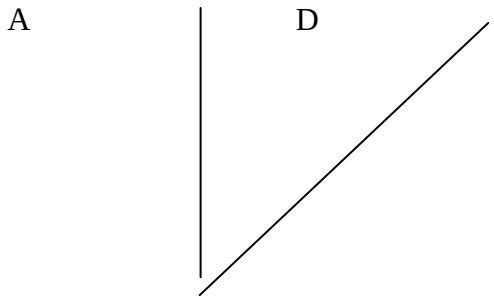
18. A girl is at a horizontal direction toa palm tree, she looks at the top of the tree, the angle that she will form is called

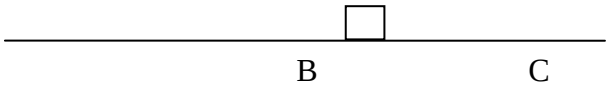
(a) Angle 90° (b)angle of elevation (c) angle of depression (d)angle 60°

19. Which of the following is not the type of angle

(a) acute (b) obtuse (c) parallel (d) reflex

20. In the following figure, one of the following is called right angle





(a) < DBC (b) BD (c)ABC (d) D BC

21 Angle of elevation and depression are _____ to each other

(a) corresponding (b)alternate (c) adjacent (d)horizontal

22. Constructs an angle of _____ it would be easier if an angle of 90^0 is constructed.

(a) 30^0 (b) 45^0 (c) 75° (d) 60^0

23. When two straight lines meet at right angle we say that _____is formed.

(a) Parallelline (b) perpendicular (c) angle (d) line

24 All these are the properties of cuboids except

(a) it has 8 vertices (b) it has 12 edges (c) it has 6 faces (d) it has equal length

25 _____have one face, one edge and no vertex

(a) sphere (b) cube (c)prism (d) cylinder

26 The formula to calculate total surface area for cone is

(a) $2\pi r^2$ (b) $2\ \pi r\ (\ r + l\ )$ (c) $\pi\ r\ (r+ l)$ (d) πr^2

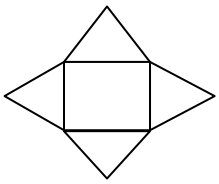
27. Find the volume of cuboids with length of 7 cm, breadth 5 cm and height of 4cm

(a) $140cm^3$ (b)$150\ cm^3$ (c) $160cm^3$ (d) $180cm^3$

28. Which of the following statement is / are true about two parallel line intersected by transversal line? (i) Adjacent angles are supplementary (ii) corresponding angle are equal. (iii) interior opposite angles are supplementary.

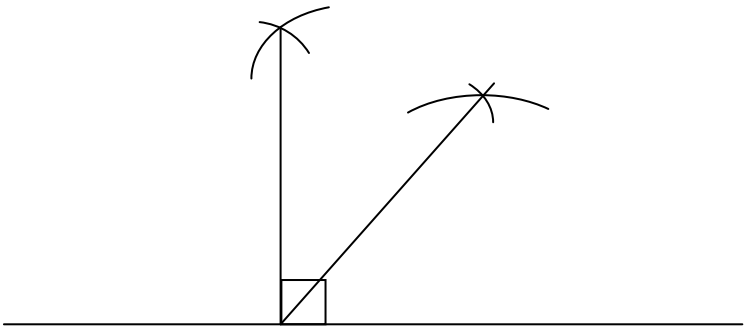
(a) ii only (b) i and ii only(c) i and iii (d) ii and iii only

29. The below diagram show the net of _____



(a) Cube (b) cylinder (c) rectangular pyramid (d) cuboids

30. The following figure shows angle of



(a)30°,60° (b)45° , 90° (c)60° , 75° (d)90 °,60

31 ---------- Has all the side angle equal and three line of symmetry

a. Isosceles b. Right angle c. Quadrilaterals d. Rectangle

32 Example of plane shape are the following except

a. Triangle b. Rectangle c. Cylinder d. Circle

33 The properties of rectangle are the following expect

a. It has opposite side equal and parallel
b. All angle are equal to 90
c. It has two line of symmetry

d. It has no diagonal

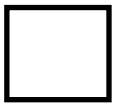
34 A rhombus has ----------

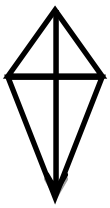
a. All side are equal and opposite side are equal
b. Has two acute angle and one right angle
c. The shortest side is opposite to the smallest angle
d. The hypotheses is the longest side

35 An arc is any part of ----------

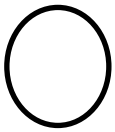
a. Circumference b. Chord c. Diameter d. Segment

36 The following shape is kite----------

a. 

b. 

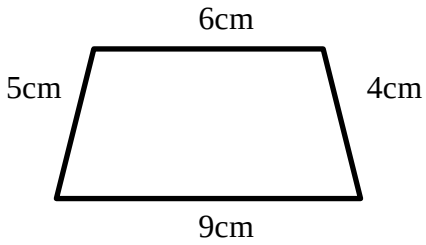
c. 

d. 

37 The length of rectangular box is 5cm and the breadth of 3cm. what is the area of box

a. 15cm² b. 10cm² c. 8cm² d. 6cm²

38 The perimeter of



a. 24cm b. 25cm c. 26cm d. 27cm

39 The typical example of cube is a

a. Cylinder b. Cube of sugar c. Tin d. An empty box of materials

40 From the diagram below how many faces does the pyramid have

a. 5 b. 6 c. 7 d. 8

APPENDIX C

Geometry construction performance test (GCPT)

Post-Test study

School:

Male ( ) female ( )

Time allows: 1hr

Instructions: students to answer all questions by choosing the option that correct answers to the question.

1. Which of the following instrument are necessary for drawing angle in geometric construction (i) ruler (ii) compass (iii) set square (iv) divider

   (a) I and ii only (b) i, ii and iii only (c) ii and iii only (d) i, ii, iii and iv
2. When an angle is less than 90^0 is called

   (a) acute angle (b) obtuse angle (c) right angle (d) reflex angle.
3. What do we use to measure the degree of an angle

   (a) set square (b) protractor (c) ruler (d) compasses
4. In construction of _____ a straight line must be drawn.

   (a) Graph (b)Angle (c) Drawing (d) Compasses
5. In constructing net of solid shape the following material are necessary except.

   (a) Graph (b) cardboard (c) sell tape (d) sharp blade.
6. In construction of a _____ a set square is need.

   (a) Perpendicular line (b) angle (c) parallel line (d) straight line.
7. ___ are two lines moving on the same direction without meeting at any points?

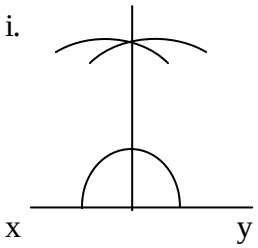
(a) angle (b) line (c) protractor (d) parallel line

8. These are object that can be observed when your head is raise except.

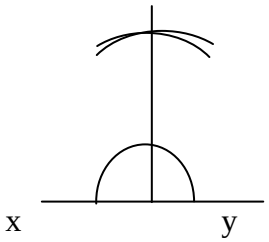
(a) Top of tree (b) moon (c) tower (d) cup on the table

9. Which of these diagrams shows the correct method of constructing a perpendicular line to another line PQ at a given point X on PQ?

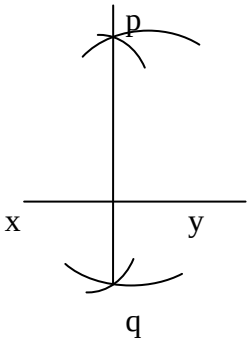
i.



ii.

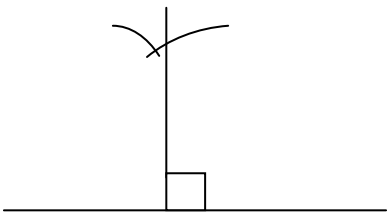


iii.



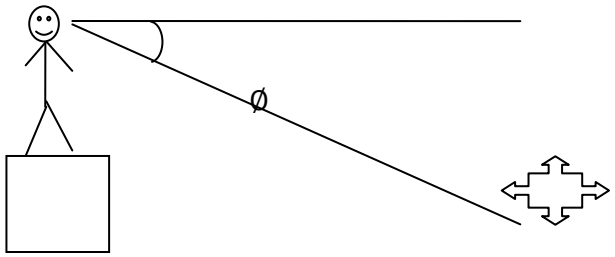
(b) i only (b) ii only (c) i and ii only (d) i, ii and iii

10. The following diagram shows an angle of



(b) 90^0 (b) 60^0 (c) 45^0 (d) 30^0

11. The following figure show an angle of

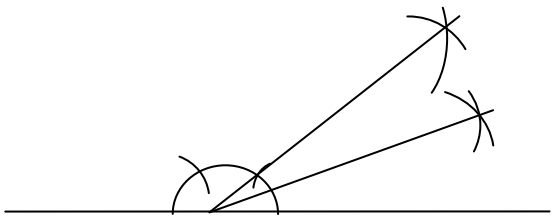


(b) Angle of elevation (b) angle of depression (c) angle of horizontal (d) angle of vertical

12. Angle of elevation and depression can be measure by an instrument called

(b) set square (b)protractor (c) compasses (d) pencil

13. The diagram shown illustrate



i. construction of angle 60°

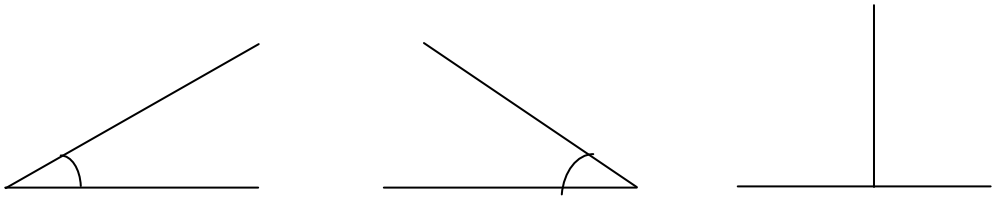
ii. construction of angle 30°

iii. construction of angle 90°

(b) i only (b) ii only (c) i and ii (d) i, ii, and iii

14. Which of the following diagram demonstrate the correct way of constructing angle 60^0?

ii. ii. iii.



(a)i only (b) ii only (c) I and ii only (d) ii and iii only

15. Which of the following is not correct about construction?

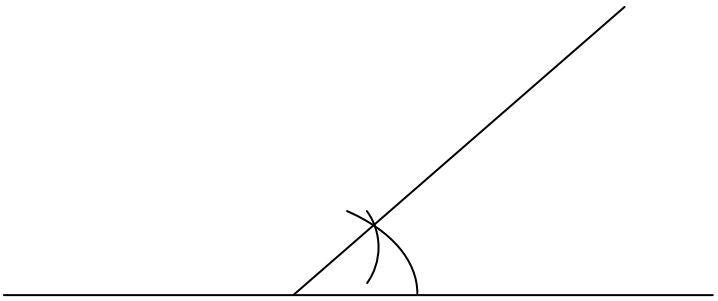
(a) All construction should be made with a sharp point pencil.

(b) Some construction lines should be seen

(c) Smooth straight edges must be used.

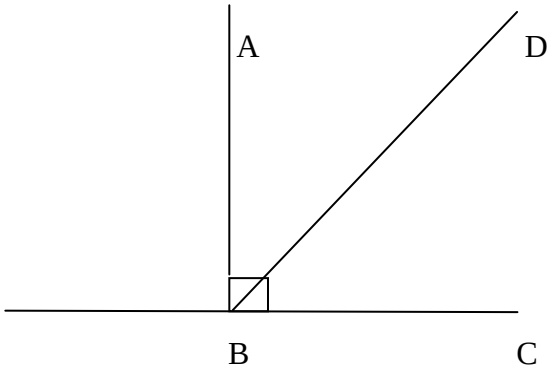
(d) Avoid using of a pair ofcompass during construction.

16. The following figure shows an angle of



(b) 30^0 (b) 45^0 (c) 15^0 (c) 60^0 (d) 90^0

17. In the following figure, one of the following is called right angle

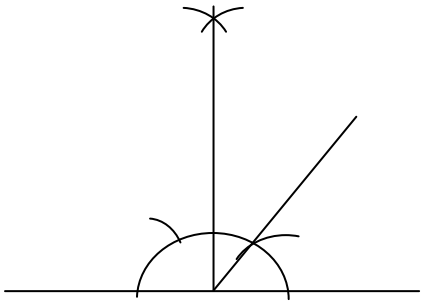


(b) < DBC (b) BD (c)ABC (d) D BC

18. Angle of elevation and depression are _____ to each other

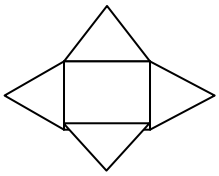
(b) corresponding (b)alternate (c) adjacent (d)horizontal

19. The diagram below is a construction of angle 75^0, which of the following was necessary construction omitted?



(b) Bisection of angle 90^0 (b) bisection of angle 60^0 (c) bisection of the angle between 60^0 and 90^0 (d) construction of angle 45^0

20. The below diagram show the net of _____



(a) Cube (b) cylinder (c) rectangular pyramid (d) cuboids

21. Which of the following statement is/are true about two parallel line intersected by transversal line? (i) Adjacent angles are supplementary (ii) corresponding angle are equal. (iii) Interior opposite angles are supplementary.

(a) ii only (b) i and ii only(c) i and iii (d) ii and iii only

22. A girl in a horizontal direction at the palm tree, she looks at the top of the tree, the angle that she will form is called

(a) Angle 90° (b) angle of elevation (c) angle of depression (d) angle 60°

23. Which of the following is not the type of angle?

(a) Acute(b) obtuse (c) parallel (d) reflex

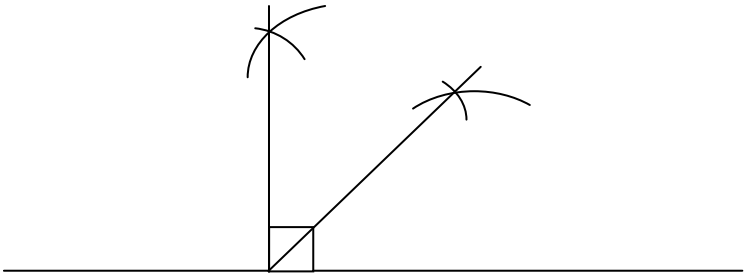
24. The formula to calculate total surface area for cone is

[41] $2\pi r^2$(b) $2\pi r (r + l)$ (c) $\pi r (r+ l)$ (d) πr^2

25. Find the volume of cuboids with length of 7 cm, breadth 5 cm and height of 4cm

(b) $140cm^3$ (b)$150\ cm^3$ (c) $160cm^3$ (d) $180cm^3$

26. The following figure shows angle of



(a)30°,60° (b)45° , 90° (c)60° , 75° (d)90 °,60°

27. In construction of _____ a straight line must be drawn.

(a) Graph (b)Angle (c) Drawing (d) Compasses

28. Constructs an angle of _____ it would be easier if an angle of 90^0 is constructed.

(a) 30^0 (b) 45^0 (c) 75°(d) 60^0

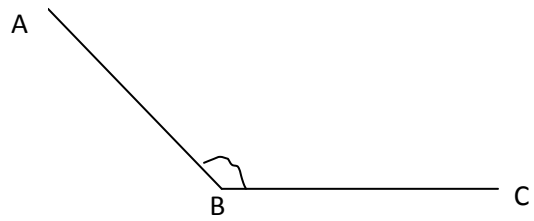
29. _____have one face, one edge and no vertex

(a) sphere (b) cube (c)prism (d) cylinder

30. All these are the properties of cuboids except

(a) it has 8 vertices (b) it has 12 edges (c) it has 6 faces (d) it has equal length

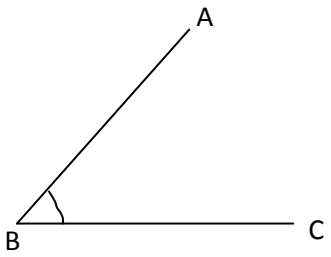
31. In the following figure < B is called



(a)reflex angle (b) obtuse angle (c) acute angle (d) angle 60^0

32. When an angle is constructed we use _____ to measure the degree.

(a)protractor(b) set square (c) compasses (d) ruler



33. In the above diagram which of the following is called arm of the angle

(a) AC (b) CA (c) B (d)AB& BC

34. Construction of angle of _____ would be simple if an angle of 60^0 is constructed.

(a) 90^0 (b)180^0(c) 360^0(d) 30^0

35. The typical example of a cube is a. tin b. cylinder c. a cube of sugar d. an empty box of matches.

36. A point or corner where three or more edges meet is called _____

(a)sharp point (b) plane (c) vertex (d) rectangle

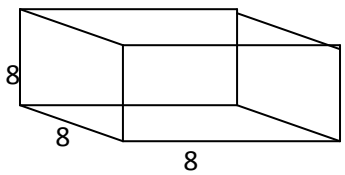
37. With the aid of the diagram below identify the formula of a curved surface area of a cone.

(a)$\pi\ r\ l$ (b)$\pi r^2\ h$ (c)$\pi\ r\ h$ (d)$\pi r\ l^2$

38. Which of the formula is correct to determine the volume of a cylinder

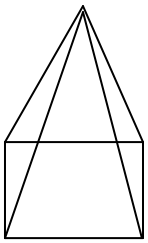
(a)$\pi\ r\ h$ (b) $\pi r^2\ h$ (c)πr (d)π r h

39. Calculate the volume of the cube shown below?



(a) 384cm^3 (b) 512cm^3 (c) 288cm^3 (d) 206cm^3

40. From the diagram below how many faces does the pyramid have?



(a) 5 (b) 6 (c) 7 (d) 8

APPENDIX D

ANSWER TO GEOMETRY CONSTRUCTION PERFORMANCE TEST

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

APPENDIX E

LESSON PLAN FOR EXPERIMENTAL GROUPS

Lesson One

Teachers strategy	Enriched Expository method
Topic:	Geometrical Construction
Sub topics:	Construction of parallel and perpendicular line
Subject:	Mathematics
Class:	JSS 2
Class size	
Duration:	1hr 20min
Group:	Experimental
Instruction material:	Ruler, set square, pair of compasses, chalkboard, chart that showing the construction of parallel and perpendicular line, solution sheets and plane sheet
Objective of the method:	the objective of this method was to get students to answer all question correctly.
Introduction:	Teacher exposed the students to lesson by use of Enriched expository method byshown the construction of parallel line and perpendicular line on a cardboard paper and defines parallel line and perpendicular line.

i. Procedure: At the start, teacher group the students in theExperimentalgroupThestudentswereassigned into 12 different groups each consisted of 6 students in each groups. The group comprised of both boys and girls to allow interaction with the subgroup.

1Teacher gives each group mathematical set, which include

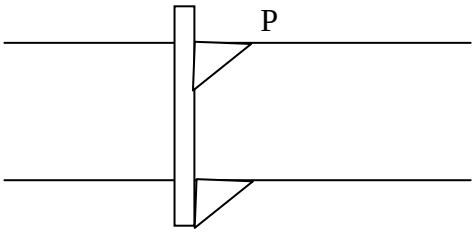
I. Rule with edge smooth
II. Hard sharp pointed pencil
III. Tighten pair of compasses
IV. Plane sheet for construction
V. Eraser
VI. Sharpener

Students Activities

teacher reads out the activity to the student as follows.

Construction of parallel line using the following step:

i. Constructing a line through p so that it is parallel to XY.
ii. Place a set square so that one edge is accurately along XY
iii. Place a ruler along one of the other edge of the set square
iv. Hold the ruler firmly slide the set square along the ruler to word p stop when the edge that was on XY reaches p. draw a line along this edge of the set square through p.



The teacher goes round the class monitoring the students as they practice the construction of parallel line.

Students Activities II

Teacher reads out the activities to the students to follow.

Step in construct perpendicular line.

i. Draw a line segment AB and a point M outside the line

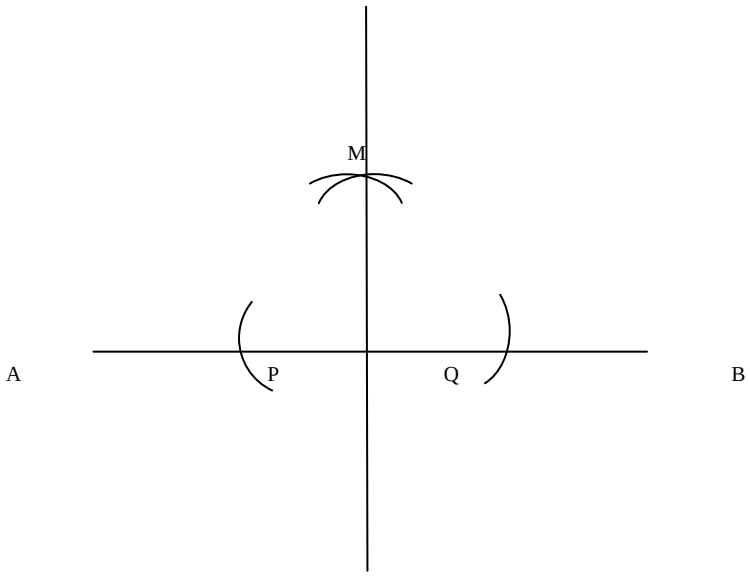
ii. Open the pair of compass with m as the center, draw an arc to cross AB at p and q

iii. With p as center, using the same radius, draw an arc below AB do the same for q as center so that the two arcs meet at point y

iv. Join m and n, MN is the perpendicular line from m to the line segment AB.

v. MNperpendicular to AB therefore MOB=MOP $=90^0$

M



Teacher goes round the class supervising the students as they practices the construction of perpendicular. M

Evaluation: Teacher evaluate the lesson by given the student class work,

i. Construct two parallel lines with 3cm apart.

ii. Construct a perpendicular line

Conclusion: Teacher concludes the lesson by explaining to the students the main points in the construction of parallel and perpendicular line.

CONSTRUCTION OF ANGLE 60 and 30

Lesson plan	Two
Teaching strategy	EnrichedExpository Method
Topic	Construction of angle 60 and 30
Subject	Mathematics
Numberof students	72
Group	Experimental
Duration	1hr 20min
Instructional material	Ruler, pair of compasses, pencil, cardboard Paper showing construction angle $60^{o}$and 30^{o}
Objective of the method	The objective of the method was to get students to answer all questions correctly.
Introduction	Teacher exposed the student to lesson by use ofenriched expository method with instructional material shown the construction of angle 60^{0} and 30^{0} on a plane sheet.
Procedure	Teacher group the students in the experimental group. The students were assigned into 12 differentgroups each consisting of 6 students. The group comprised both boys and girls to all interaction within the sub-group Teacher give each group of the students materials to be used: I. Ruler with edge smooth II. Hard shape pointed pencil III. Tighten pair of compasses IV. Plane sheet for construction V. Eraser VI. Sharpener or razor blade.
Student activity	Teacher readout activity to practice as follows: 1. Draw any line AB with A as the center and suitable radius draws an arc to cut AB at P 2. With P as center and the same radius as step one draw an arc to cut the first arc at c

3. Join A to C so that angle CAB=60^o

Student activity2

Teacher also read out the step to construct angle 30^o

1. With P at center at the first construction of AC and AC, draw two arc to meet at D
2. The bisector of CAB give CAD= DAB=30^0

Teacher goes round the class supervising the students as the practical for the construction of angle 60^0 and 30^0, all complete activity by each sub group sheet are to be collected and mark by the research assistant.

Evaluation

Teacher evaluate the lesson by given the student class work.

1. Bisect angle $60^0$to obtain 15^0

Conclusion

Teacher conclude the lesson by summarize the lesson that angle can beconstructed by bisecting another angle, bisect reduce angle to two equal sides

CONSTRUCTION OF ANGLE 90^0 AND 45^0

Lesson	Three
Topic	Construction of angle 90^0 and 45^0
Subject	Mathematics
Duration	1hr 20mins
No of the students	72
Group	Experimental
Teaching strategy	enriched Expository method
Instructional material	Ruler and pair of compasses, pencil, plane sheet, cardboard paper.
Objective of the method	The objective of the method was to get students to answer or to know question correctly
Introduction	Teacher exposed the student to lesson by use enrichedexpository method shown the construction ofangle 90^0 and 45^0 on a cardboard paper.
Procedure	Teacher group the students into 12 groupeach group have 6 students. The group comprised of boys and girls. Teacher give each group of the students materials to be used: I. Ruler with edge smooth II. Hard shape pointed pencil III. Tighten pair of compasses IV. Plane sheet for construction V. Eraser VI. Sharpener or razor blade
Students'activity	Teacher writes out the activity for the group as follows: - Construction of angle 90^0 - Given a point B on a straight line AB - With center PQ with equal radius draw an arc to cut each other at R - Join BR so that BR is perpendicular to AC

- Thus RBA = RBC=90^0

Activities ii

Teacher writes out the activities for the group as follows:

With the same radius put your compass at center at B draw an arc to cut line BQ and BR at XY

- With center XY draw an arc to cross each other at Z
- Join BZ which given XBZ = YOZ = 45^0

Teacher goes round the class to monitor the students as they practice construction of angle $90^0$and 45^0

Evaluation

Teacher evaluate the lesson by given the students class

Works

- Bisect angle 90^0 twice to obtain angle $221/2^0$

ConclusionTeacher conclude the lesson by summarize the lesson that angle can be constructed by bisecting other angles .Bisect reduce an angle by half or two quarter sides.

Lesson Four

Topic:	Angle of Elevation and Depression
Subject:	Mathematics
Class:	JSS3
Duration:	1hr 20min
Group:	Experimental
Instructional Material:	Ruler, pencil, plain paper, blackboard, protractor etc.
Objectives of the method:	the objective of the method was to get students to answer all questions correctly
Introduction:	Teacher exposed the students to lesson by use of enriched expository method by showing the chart of angle of elevation and depression on a cardboard paper.
Procedure	Teacher groups the students into 12group eachconsistedof 6students.the comprised of both female and male to allow interaction with one other. Teacher gives each group of the students' materials to be used: I. Ruler with edge smooth II. Hard shape pointed pencil III. Tighten pair of compasses IV. Plane sheet for construction V. Eraser VI. Sharpener or razor blade
Teacher Activities	Teacher usedinstructional material to explain the angle of elevation to the

students.by shown the angle of elevation and depression on the cardboard paper.

Angle of Elevation

When you stand on the horizontal ground you realize that there are object that are very high in order to view such object there is the need to raise your head.

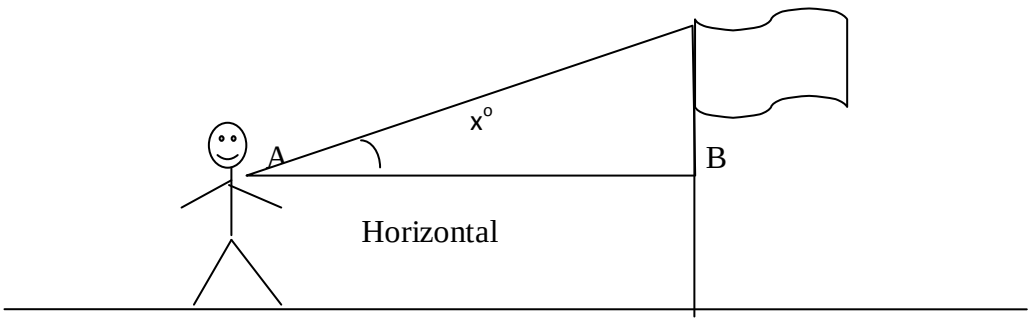
Angle of Depression

When you are on top of a building or plate form. Object below can also be observed in order to view such object. There is the need to lower your head.

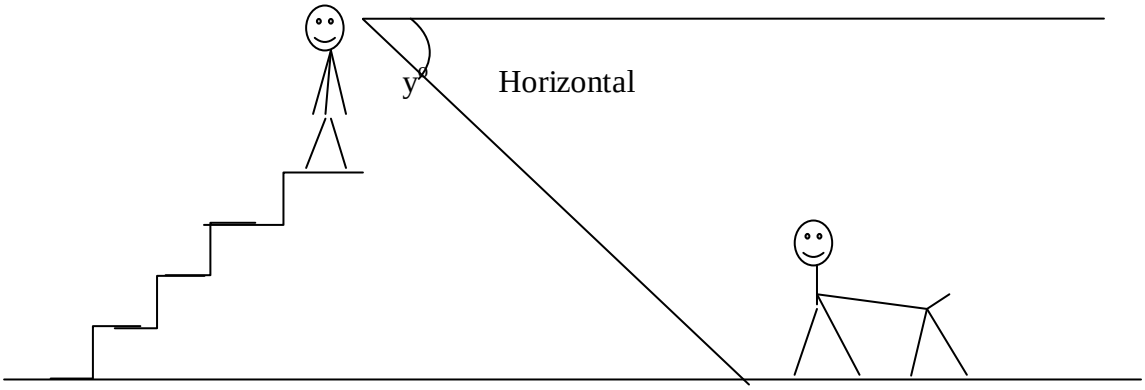
Student Activities1

teacher write out activities to the students as follows

Draw a boy at a distance from a flagpole of 9cm view the flag flying of 12cm measure the angle of the boy view from a flag



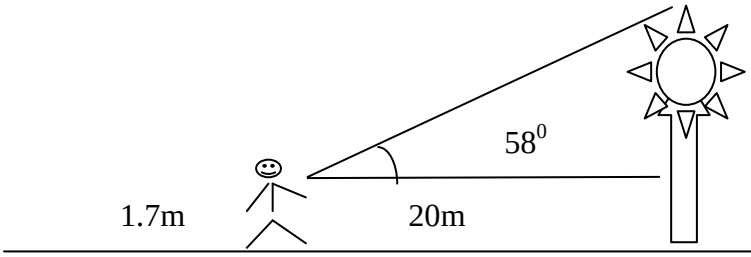
Students Activities II show a girl on top of a stair case viewing a dog.



Teacher goes round the class supervising the students as they practices how to construct the height and distance of angle of elevation

Evaluation: Teacher evaluates the lesson by given the students class work.

1 Yusuf is 20cm always from a tree and he observes that the angle of elevation of a bird on the tree is 58^0 he is 1.7m tell how high the tree is. Use a scale of 1cm to represent 3m.



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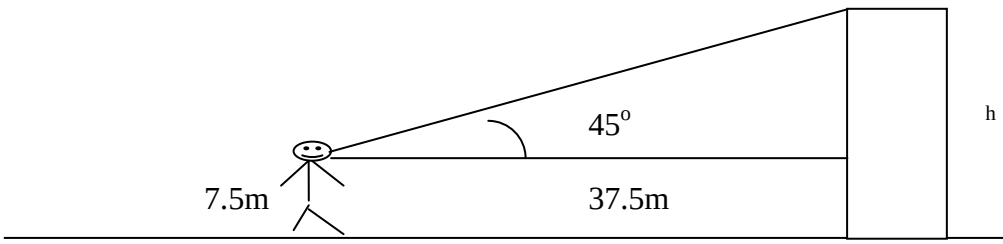


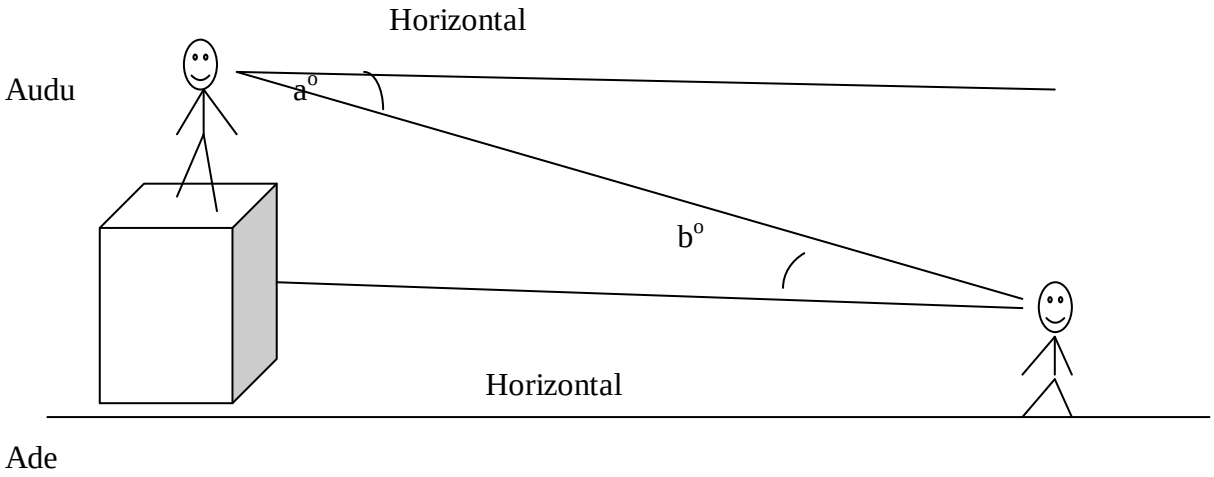
Find the height of tower in the diagram above use the scale of 1cm to represent 3cm.

Conclusion: Teacher concludes the lesson by summarize the lesson that

i. Choosing an appropriate scale we can draw an accurate diagram of a plane object.

ii. We can calculate height and distance using angles of elevation and depression and scale drawing.

iii. Angle of elevation and angle of depression are alternate to each other e.g. We can now see that there is a connection between the angle of elevation and depression which show below



The angle of elevation of Audu from Ade i.e. a^0 is equal to the angle of depression at Ade fromAudu. angle a^0 and b^0 are alternate angle.

Lesson Five

Teaching strategy	Enriched Expository method
Topic	Plane shape
Subject	Mathematics
Number of student	72
Class	J.S.S 2
Group	Experimental group
Duration	1hr 20min
Instructional materials	pencils, ruler, and eraser, scissor or razor cardboard paper and plane sheet, mathematical set
Objective of the method:	The objective of the method to was to get student to answer all questions on plane shape correctly I. Draw and cut out different shapes II. List the difference shapes and their properties
Introduction	Teacher expose the students to the lesson by use of enriched expository method showing the different type of plane shape to the student
Procedure	At the start, teacher groups the students in the experimental group. The students were assigned into 12 different groups each consisted of 6 students in each groups. The group comprised of both male and female in order to interact within the group Teacher gives each group of the student's material to be used: Pencil, cardboard paper or plane sharp, ruler, razor blade
Student activities	Teacher writes out the activity for the group as follows;

- Draw the shape needed on the paper
- Cut out the shape on a single sheet
- Fold along line of symmetry, diagonals. For instance.
- Cut along a straight line
- Spread out the sheet to obtain a shape.

Teacher activities

teacher goes round the class supervising the students as they practice the construction of the plane shapes

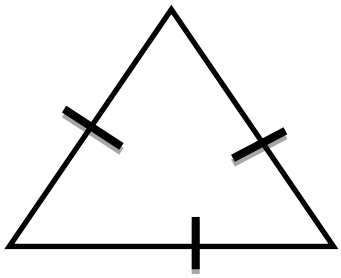
Teacher used the model to identify the properties of the plane shape.

Common shapes and their properties

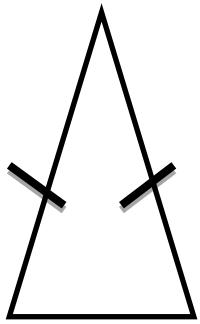
1. Triangles :

These are three sided closed shape, it has three sides and three angles. The sum of its interior angle is 180.

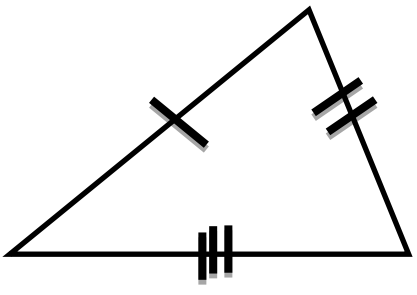
Types of triangle



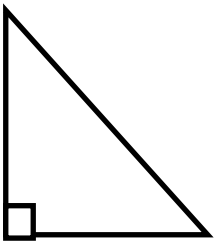
a. Equilaterals triangle has all the sides and all the angle are equal and also has three line of symmetry



b. Isosceles triangle has two sides equal, two angles equal and one line symmetry, the equal side are opposite the equal which are called the base angle



c. Scalene triangle has no line equal and no angle equal. It has no line of symmetry, the shortest side isopposites, the smallest angle and the longest side is opposite the largest angle.

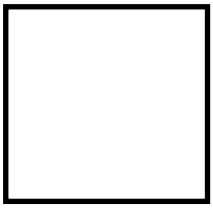


d. Right angled triangle has two acute angles and one right angle. The hypotenuse is largest side and it is opposite the right angle.

2. QUADRILATERIALS

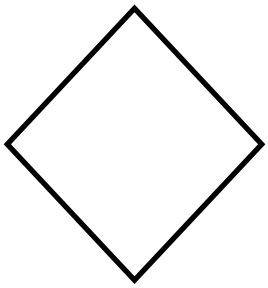
A Quadrilateral has four side and four angles. The sum of the interior angles is 360

TYPES OF QUADRILATERALS



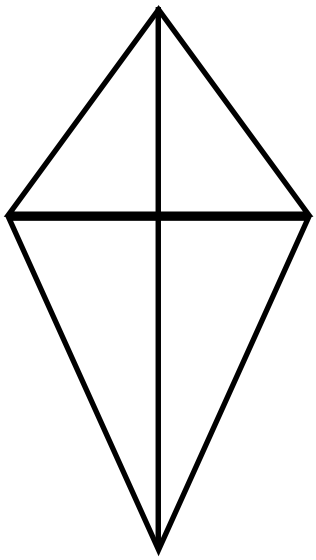
a. Square has all the side equal all angle to 90, equal diagonals, diagonals bisect the angles and each other at right angle and it has four line of symmetry

b. .Rectangle has opposite side equal and parallel, allangle equal to 90^0Equal diagonals, diagonals bisect each other and has two line of symmetry.

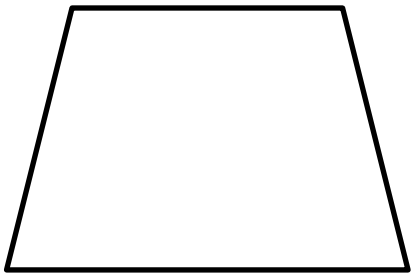


c. A Rhombus has all sides equal opposite sides parallel, opposite angles equal, diagonals bisect the angles diagonal bisect each other at right angles and also has two line of symmetry.

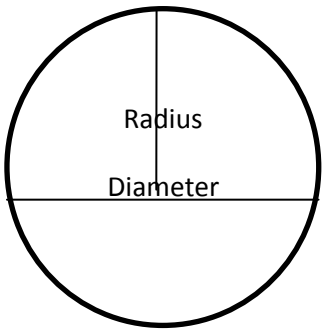
d. A Parallelogram has opposite sides equal ,opposites sides parallel , opposite angles equal ,diagonals bisect each other

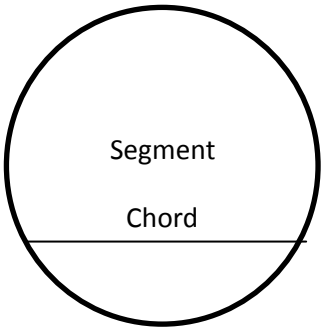


e A kite has two pair of adjacent sides equal diagonal intersect at right angles, one line of symmetry.



f. ATrapezium has at least one pair of opposite side parallel





g A Circle is closed plane figure bounded by a curve, all point which is of equal distance form a fixed point called the Centre of circle. The curve or the total length is called the circumference. It has a semi

ACircle is half a circle.

An arc is any part of the circumference
A minor arc is one that is less than a semicircle
A major arc is one that is more than a semicircle
A radius is a line form at the Centre of the circle to any point on the circumference of the circle
A chord is a line joining any two points on the circumference of the circle
A diameter is a chord that passes though the Centre of the circle
A segment is the portion inside a circle bounded by a chord and arc
A sector is portion side a circle bounded by two radius and an arc.

Model of two dimensional shape can be made from paper cut out , stick ,wires or strings , wooden model arc also come and more durable.

Evaluation	Teacher goes round the class supervising the student as they practice the plane shape
Conclusion	Teacher discussed more on properties of plane shape.

Lesson Six

Topic:	Three dimensional shape (solid shape)
Subtopic:	Identification of solid shape and their properties
Subject:	Mathematics
Class:	JSS 3
Class size	
Duration:	1hr 20min
Group:	Experimental
Instructional materials:	Cardboard or stiff cards, line sell tape, ruler, pair of compasses, blade or shape object, pencil, etc.
Objective of the method:	the objective of the method was to get student to identify the solid shape and their properties. I. Draw and cut out different solid shape.
Previous knowledge:	Students were familiar with different shape such as cube of sugar, empty canton of soap, funnel, bucket, ball, etc.
Introduction:	Teacher exposed the students to lesson by use of enriched expository method showing the construction of solid shape
Procedure:	at the start, teacher group the students in the experimental group. The students

assigned into 12 different groups each consisted of 6 students in each group. The group comprised both boys and girls in order to interact within the group.

`

Teacher gives each group of the student's material to be used.

Teacher Activities: Teacher expose the students the procedure to construct net of required object (cube, cuboids, cylinder, cone, pyramid etc. and read out the activity for the students as follows:

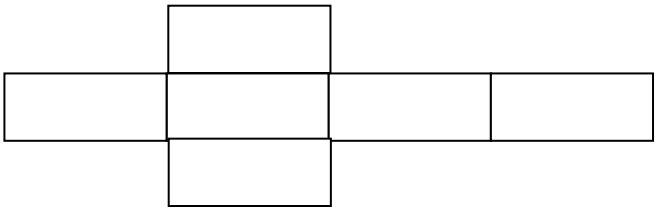
Students Activities: Draw a net of the required object (cube, cuboids, cylinder, pyramid,cone, etc. using a pair of compasses and ruler.

i. Cut out the net of the object.

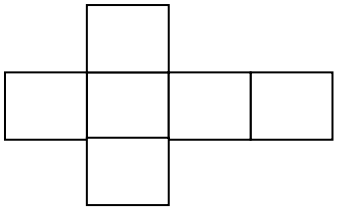
ii. Fold along the edges.

iii. Use glue or gum or sell tape to hold the edge in place.

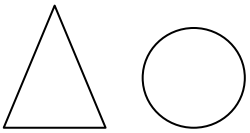
NETS OF SOME MODEL



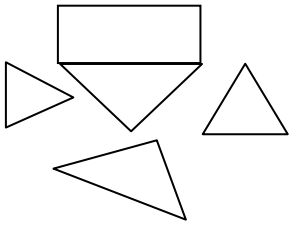
Net of Cubic



Net of Cube



Net of Cylinder



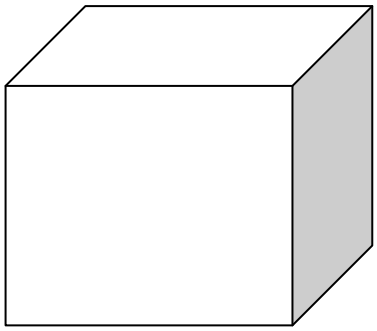
Net of Cone

Net of Pyramid

Teacher goes round the class supervising the students as they practices the construction of solid shape.

Student Activities II: Teacher used the construction or the model to identify And discover the properties of solid shape

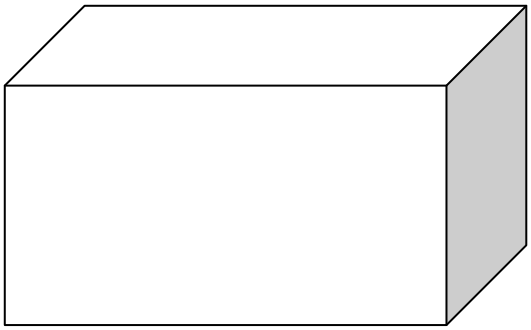
CUBE



Properties of cube

- It has 6 surfaces
- It has 8 vertices
- It has 12 edges

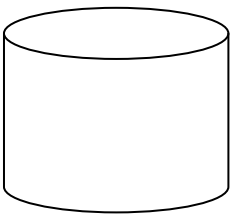
CUBOID



Properties of cuboids

- It has six surfaces
- It has eight vertices
- It has twelve edges

Cylinder



Properties of Cylinder

-It has 3 surfaces

-It has 2 circular surfaces

-It has one curved surface

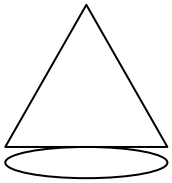
-It has two (2) round edges and no vertex

Teacher guides student discover its surface area and the volume

Total Surface area = 2(πr^2+ πr^2h) =πr^2 (r+h)

Volume = πr^2h

Cone



Properties of Cone

-It has 2 surfaces, one circular and one curve surface

Surface are = πr(r+I)

Volume = 1/3πr2h

Evaluation

teacher asks the students to Constructtetrahedronand gives their Properties i.e. number of vertices, edges and faces

Conclusion

teacher carry out the practical activates in the classroom and use it to guide students to discover the volume and the surface area of the solid shape

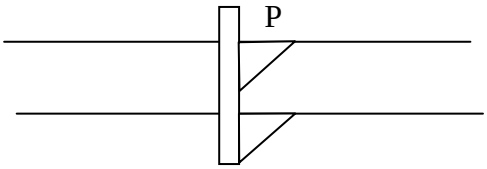
APPENDIX F

Lesson Plan for Control Group

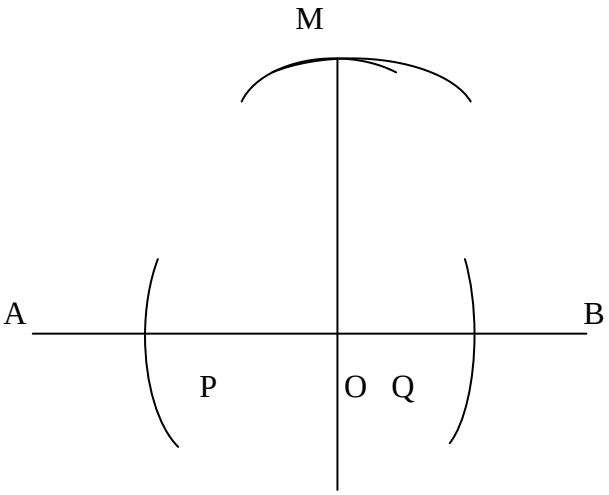
Lesson One

Topic:	Geometry
Sub-topic:	Construction of parallel and perpendicular line
Subject:	Mathematics
Class:	JSS2
Class size:	66
Duration:	1 hr. 20min
Group:	Control
Instruction material:	Ruler, set square, pair of compasses, pencil, chalkboard etc.
Behavioral objective:	By the end of the lesson students should able to: i. Construct a parallel line ii. Construct perpendicular line.
Previous knowledge:	Students were familiar with parallel line and perpendicular line.
Introduction:	Teacher introduces the lesson by asking question based on their previous lesson.
Presentation:	Teacher presents the lesson by explain to the students the following measure that is very useful when making geometrical construction

Step I: Teacher explain and how to the construction of parallel lines to students



StepII: Teacher explains and demonstrates the construction of perpendicular line using a ruler and compasses



The teacher goes round the class supervising the students as they practices the construction of perpendicular line.

Evaluation: The teacher evaluate the lesson by gives the students class work

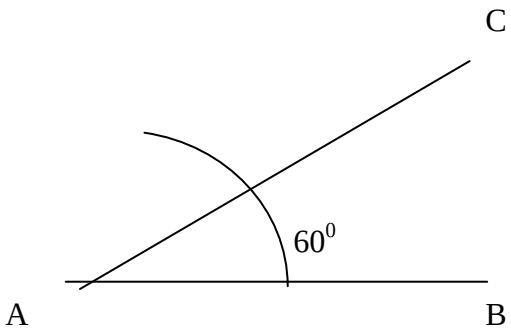
i. Construct two parallel lines with 3cm a part.

ii. Construct a perpendicular line.

Conclusion:	The teacher concludes the lesson by explaining to the students the main points in the construction of parallel and perpendicular lines.

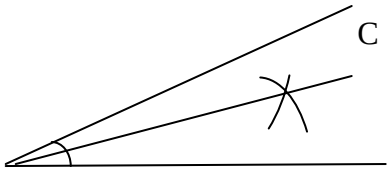
Lesson Two

Topic:	Geometry construction
Sub-topic:	Construction angle 60^0, 30^0
Subject:	mathematics
Class:	JSS 3
Class size:	
Duration:	1hr 20min
Group:	Control group
Instructional material:	Ruler, pair of compass, pencil, chart
Behavioral objective:	By the end of the lesson students should be able to: i. Construct angle 60^0 and 30^0 ii. Construct angle 90^0 and 45^0 iii. Construct any other angle
Pervious knowledge:	The students were taught how to construct perpendicular line.
Introduction:	Teacher introduces the lesson by asking the students question base on their pervious knowledge.
Presentation step:	Teacher presents the lessonto students.
Step I:	Teacher explains and how to the construction of angle 60^0 and 30^0 using a ruler and compass



Construction of angle 30^0

StepII Teacher explain and bisect the angle 60^0 to give 30^0 .



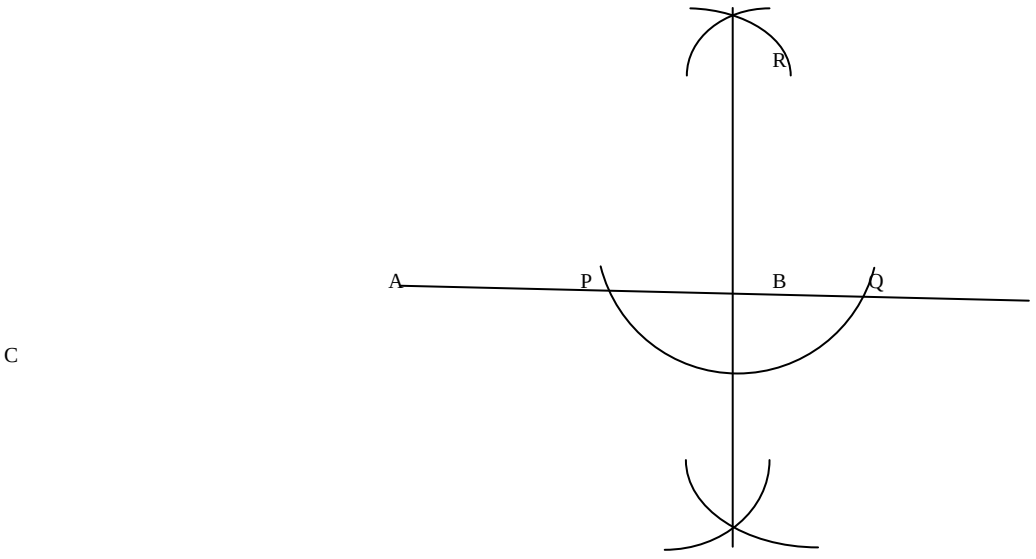
Evaluation: Teacher evaluates the lesson by given the students class work.

i. Bisect angle 60^0 twice to obtain 15^0.

Conclusion: Teacher concludes the lesson by summarize the lesson that angle can be constructed by bisection other angles. Bisect reduces an angle by half it side or two equal sides.

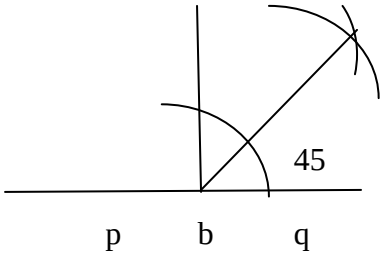
CONSTRUCTION OF ANGLE 90 AND 45

Lesson	three
Topic	construction of angle 90 and 45
Subject	mathematics
Duration	1hr 20mins
No of the students	64
Group	experimental
Teaching strategy	expository method- enriched with structural material
	Instructional material ruler and pair of compasses
Behavioural objective	by the end of the lesson students should be able to construct angle 90 and 45
Previous knowledge	students were taught lines and perpendicular
Introduction	teacher introduces the lesson to students by asking question on their previous lesson e.g.
	What is perpendicular?
	What is bisecting of an angle?
Presentation	Teacher explain how to constructangle 90^0 and 45^0 to the students
Step	Teacher demonstrates the construction of angle 90^0 and 45^0 using ruler and compass in the following steps:



StepII

Teacher explain how to construct angle 45^0or bisect angle 90^0 to gives angle 45^0



Teacher goes round the class to monitoring the students as they practices of construction of angle 90^0 and 45^0

Evaluation:

Teacher evaluates the lesson by given the students class work.

i. bisect angle 90^0 twice to obtain angle $221/2^0$.

Conclusion:

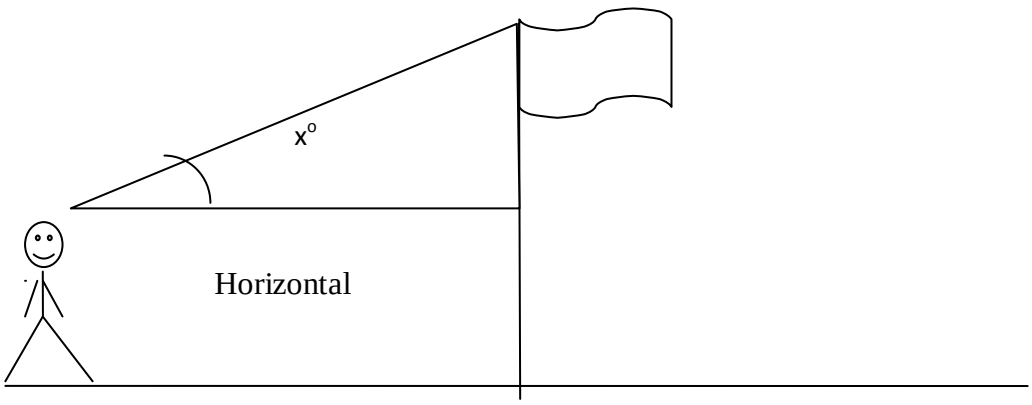
Teacher concludes the lesson by summarize the lesson that angle can be constructed by bisection other angles. Bisect reduces an angle by half it side or two equal sides.

Lesson Four

Topic;	Angle of Elevation and Depression
Subject:	Mathematics
Class:	JSS 2
Duration:	1hr 20min
Group:	control
Instructional Material:	Ruler, pencil, plain paper, blackboard, protractor etc.
Behavioral objectives:	By the end of the lesson students should be able to: i. Distinguish between horizontal and vertical line ii. Discover what analysis of elevation and depression mean. iii. Calculate height and distance using scales drawing
Previous knowledge:	The students were familiar with horizontal and vertical
Introduction:	Teacher introduce the lesson by asking the students question based on their previous knowledge i. What do you understand by horizontal line and vertical line?
Presentation:	Teacher presents the lesson to the students

Step I: Teacher explains and demonstrates the angle of elevation for the students. Angle of elevation.

When you stand on the horizontal ground you will realize that there are object that are very high in order to view such object there is the need to raise your head. E.g. show a boy at a distance from a flagpole view the flag flying

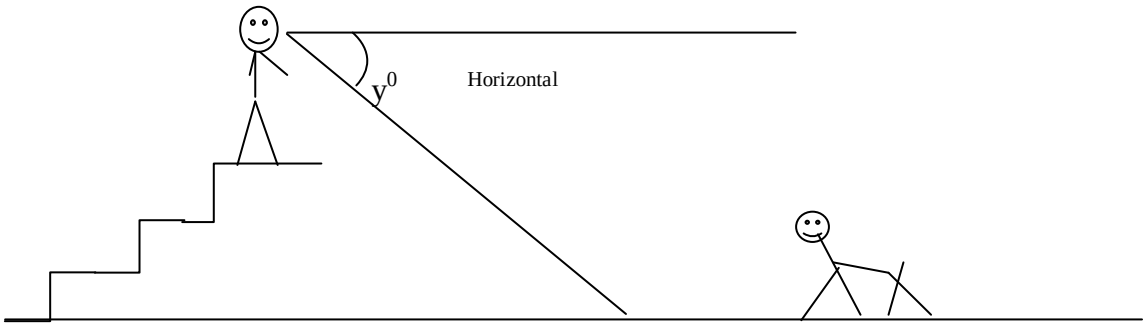


In order to view the flag flying he has to raise his head from the horizontal position an angle is formed. The angle is called angle of elevation.

The angle is the angle of elevation of the flag from the horizontal AB to point AC is called the angle of elevation of C from A.

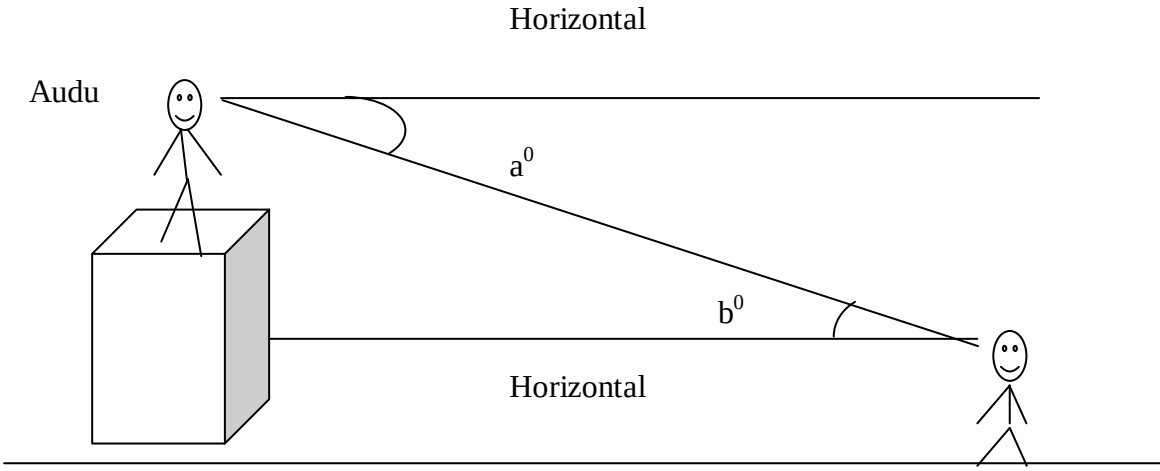
Step II: Teacher explaining and demonstrate the angle of depression. When you are on top of a building or platform, objects below can also be observed in

order to view such object. There is the need to lower your head. E.g. show a girl on top of a stair case viewing a dog.



To view the dog the girl has to lower her head from the horizontal position through an angle y^0. The angle is called the angle of depression

We can also see that there is a connection between the angle of elevation and depression which show below

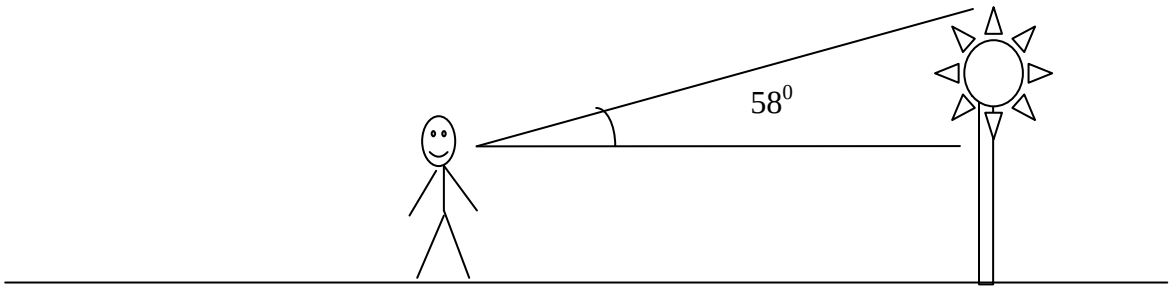


The angle of elevation of Audu from Ade i.e. a^0 is equal to the angle of depression at Ade from Audu i.e. angle a^0 and b^0 are alternate angle.

Step III: Teacher explains how to calculate height and distance using ruler and protractor. Examples

Yusuf is 20cm always from a tree and he observes that the angle of elevation of a bird on the tree is 58^0 he is 1.7m tell how high the tree is. Use a scale of 1cm to represent 3m.

Solution



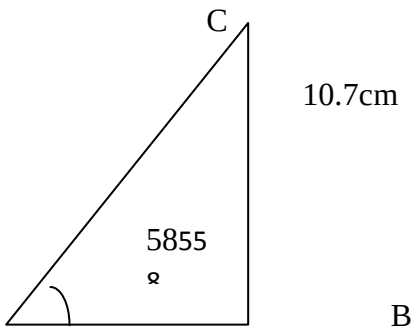
Since the scale is 1cm: 3m

Yusuf height =1.7/3 =0.56

=0.57cm

Distance of Yusuf from the tree 20/3 =

6.66=6.7cm



6.7cm

From the diagram BC=10.7cm

height of the tree = 10.7 +0.57 = 11.27cm

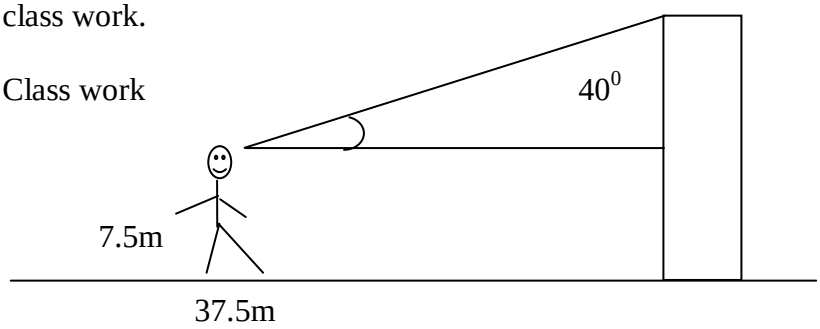
The actual height of tree is 11.27 x 3m = 33.81m

Teacher goes round the class supervising the students as they practice how to construct the height and distance of angle of elevation.

Evaluation:

Teacher evaluates the lesson by given the students class work.

Class work



Find the height of tower in the diagram above use the scale of 1cm to represent 3cm

Conclusion:

Teacher concludes the lesson by summarize the lesson that

I.Choosing an appropriate scale we can draw an accurate diagram of a plane object.

II. We can calculate height and distance using angles of elevation and depression and scale drawing.

Lesson Five

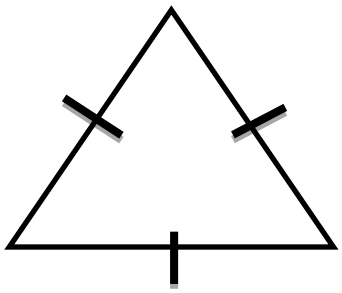
Topic	plane shape
Subject	mathematics
Number of student	64
Class	J.S.S 2
Group	control group
Duration	1hr 20min
Behaviouralbehaviour	by the end of the lesson students should be able to ; - draw and cut out different shapes - list the difference shapes and their properties
Previous knowledge	Students were familiar with plane shape.
Introduction	Teacher introduce the lesson to the students by asking question on the previous knowledge - what is plane shape - Give example of plane shapes
PresentationstepI	Teacher explainplane shape and type of plane shape. Plane shape are shapes that have flat surfaces i.e. Triangle, Quadrilaterals , Circle, and other polygons. Teacher presents the lesson to the students.

COMMON SHAPE ANDTHEIR PROPERTIES

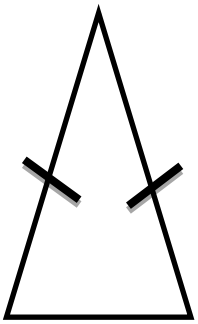
TRANGLES:

These are three sided closed shape, it has three sides and three angles. The sum of its interior angle is 180.

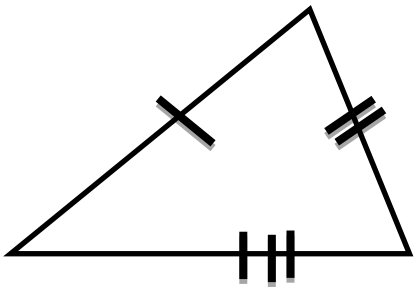
TYPES OF TRIANGLE



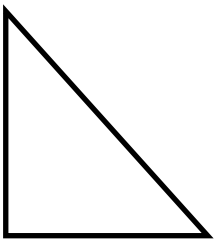
a Equilaterals triangle has all the sides and all the angle are equal and also has three line of symmetry



b. Isosceles triangle has two sides equal, two angles equal and one line symmetry, the equal side are opposite the equal which are called the base angle



c. Scalene triangle has no line equal and no angle equal. It has no line of symmetry, the shortest sides isopposites, the smallest angle and the longest side is opposite the largest angle.

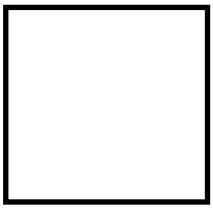


e. Right angled triangle has two acute angles and one right angle. The hypotenuses is largest side and it is opposite the right angle.

2. QUADRILATERIALS

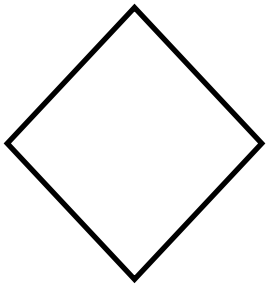
A quadrilateral has four side and four angles. The sum of the interior angles is 360

TYPES OF QUADRILATERIALS



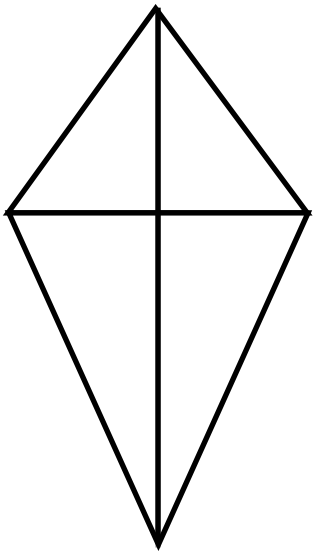
f. Square has all the side equal all angle to 90, equal diagonals, diagonals bisect the angles and each other at right angle and it has four line of symmetry

g. Rectangle has opposite side equal and parallel, all angle equal to 90^0 Equal diagonals , diagonals bisect each other and has two line of symmetry .

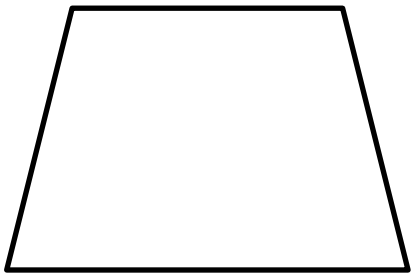


h. A rhombus has all sides equal opposite sides parallel , opposite angles equal , diagonals bisect the angles diagonal bisect each other at right angles and also has two line of symmetry.

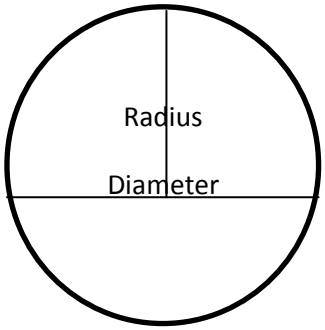
i. A parallelogram has opposite sides equal ,opposites sides parallel , opposite angles equal ,diagonals bisect each other



A kite has two pair of adjacent sides equal diagonal intersect at right angles, one line of symmetry.



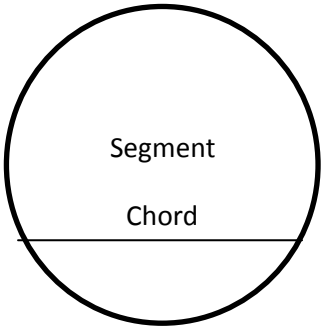
j. A Trapezium has at least one pair of opposite side parallel



Circle is closed plane figure bounded by a curve, all point which are of equal distance form a fixed point called the centre of circle. The curve or the total length is called the circumference.It has a semi Circle is half a circle.

An arc is any part of the circumference

A minor arc is one that is less than a semicircle



A major arc is one that is more than a semicircle

A radius is a line from the centre of the circle to any point on the circumference of the circle

A chord is a line joining any two points on the circumference of the circle

A diameter is a chord that passes though the centre of the circle

A segment is the portion inside a circle bounded by a chord and arc

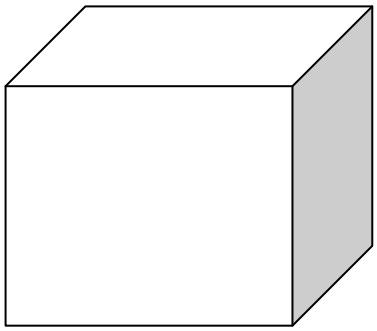
A sector is portion side a circle bounded by two radius and an arc.

Evaluation	Teacher geos round the class supervising the student as their note on the blackboard
Conclusion	Teacher discussed more on properties of plane shape.

Lesson	Six
Topic:	Three dimensional shape (solid shape)
Subtopic:	Identification of solid shape and their properties
Subject:	Mathematics
Class:	JSS 3
Class size	
Duration:	1hr 20min
Group:	Control
Instructional materials:	Cardboard or stiff cards, line sell tape, ruler, pair of compasses, blade or shape object, pencil, etc.
Behavioral objective	Bythe end of the lesson students should be able to:
	i. Identify the solid shape and their properties.
Previous knowledge:	Students were familiar with different shape such as cube of sugar, empty canton of soap, funnel, bucket, ball, etc.
Introduction:	Teacher introduces the lesson to the students by asking question on previous knowledge.
	i. What are the object or shape you can see in your environment.

PresentationStep I: Teacher explain the type and properties of solid shapes

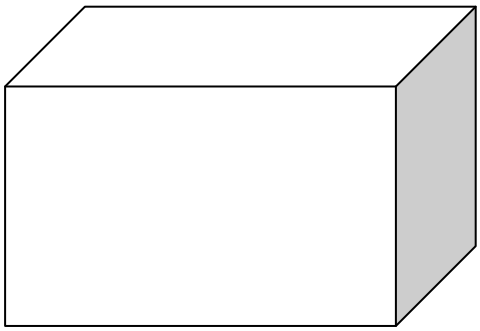
CUBE



Properties of cube

- It has 6 surfaces
- It has 8 vertices
- It has 12 edges

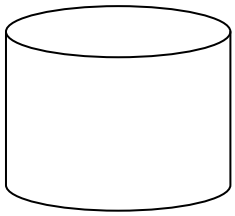
CUBOID



Properties of cuboids

- It has six surfaces
- It has eight vertices
- It has twelve edges

Cylinder



Properties of Cylinder

- It has 3 surfaces
- It has 2 circular surfaces
- It has one curved surface
- It has two(2) round edges and no vex

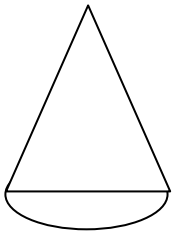
Teacher explain to student how to get the surface

areaof cylinder = 2(πr^2+

πr^2h) =πr^2 (r+h)

Volume = πr^2h

Cone



Properties of Cone

- It has 2 surfaces, one circular and one curve surface.

Surface are = πr(r+I)

Volume = 1/3 πr^2h

Evaluation

Teacher asks the students todraw tetrahedron and gives their Properties i.e. number of vertices edge and face

Conclusion

Teacher explain more in properties of soli shape