EFFECT OF GUIDED DISCOVERY METHOD ON MATHEMATICS PERFORMANCE OF LOW AND HIGH AVERTED SECONDARY SCHOOL STUDENTS IN FCT ABUJA, NIGERIA

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DECLARATION

I Andrew Ojoka Okwute declared that this thesis entitled “Effect of Guided Discovery Method on Mathematics Achievement of Low and High Averted Secondary School Students in FCT Abuja, Nigeria”has been performed by me in the Department of Science Education under the supervision of Dr Mamman Musa. The information derived from the literature has been duly acknowledged in the text and a list of reference provided. No part of this thesis was previously presented for another degree at any university

…… ……..

Ojoka Andrew OKWUTE signature date

CERTIFICATION

This Thesis entitled: Effect Of Guided Discovery Method On Mathematics Performance of Low and High Averted Secondary School students in Abuja Federal Capital Territory written by OKWUTE Andrew Ojoka M.ED/EDUC/10455/2007-2008 meets the regulations governing the award of the degree of masters in Mathematics Education of Ahmadu Bello University, Zaria, and it is approved for its contribution to knowledge and literary presentation.

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Member, Supervisory Committee(Signature)Date

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DEDICATION

This work is dedicated to my father Okwute Daniel Nwadobu, my mother Angelina Okwute Nwadobu, my wifeFlorence Okwute Ojoka and my children Jemimah and Esther Okwute,for praying and encouraging me to finish this arch resework.

I love you all with my heart of love.

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ABSTRACT

This study find out the effect of guided discovery method in teaching students with low or high mathematics aversion. The study examined the academic performance of high and low averted students in mathematics and the relationship between guided discovery and expository. Chapter one focuses on the background of the study, it also examine the research problem, research objective, research hypotheses, the significant of the study and the scope/delimitation of the study. Chapter two dealt with the review of related literature by renowned scholars on problems militating against the effective teaching of mathematics and how to tackle such problems like aversion to achieve more functional teaching and learning of mathematics, which was reviewed under the following headings: Theoretical Framework,Conceptual Framework, Concept of Aversion in Mathematics Teaching, Sources of Mathematics Aversion in Secondary Schools, Effects of Aversion on Learning Mathematics in Secondary School, Methods of Teaching Mathematics in Senior Secondary Schools, Mathematics Aversion, Instructional Methods, Achievement and Implication of Literature Reviewed for the Study. Chapter three described and discussed the research design, population, sample and sampling techniques, instrumentation, data collection, data analysis and also the pilot study. Chapter four focused on the result and analysis of data collected for the study. It also gives general description of the data, hypothesis-by-hypothesis testing, analysis and interpretation of findings. Statistical techniques, such as the means score, standard deviations and the t-test were used. All hypotheses were tested at 0.05 level of significance. Chapter five reviewed the summary of the procedure and findings of the study. Recommendations are made on how to carry out further studies on the effect of guided discovery methods on mathematics achievement of low and high averted students in senior secondary schools. The data for the study was collected by administering two forms of test (MAT & MARS) to 207 students selected from Government senior secondary school kwali, Government senior secondary school Yangoji, Government Girls Senior Secondary school Dutse Sagwari and Government Day Senior Secondary School Bwari all from Bwari and Kwali area councils respectively in Federal Capital Territory. First, a modified fennana-sherma mathematics aversion rating scale was used to identify students with high and low mathematics aversion levels. Then students within each level of mathematics aversion were randomly assigned to treatments of guided discovery and expository methods. Four groups, with each group forming a cell. The students were taught for eight (8) weeks at the end of it, mathematics achievement test (MAT) was administered. The results of the tests form the main data for the study. The statistics mean, standard deviation and t-test were used in analyzing the data and testing of the hypotheses. The findings shows that:- Students with low mathematics aversion performed better when taught by the guided discovery method, while Expository method has upper hand under high mathematics version. In order to make the students perform at their best, mathematics teachers and

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Operational Definition of Terms

Academic Performance: The outcome of students'dealing with their studies and how they cope with or accomplish different tasks given to them by their teachers.

Attitude: A personal feeling, thought and predisposition to behave or respond in some particular matter.

Aversion: A strong feeling of dislike exhibited by some students towards mathematics.

Expository Method: An instructional method of teaching that deals with planning the lesson describes, informs and explains whatever is to be learned. (it is teacher's centered).

Guided Discovery method: An instructional method of teaching for teacher to acts as a guide to enable students gets useful information to what is to be discovered in a topic. It is student center.

Interest: An engine room (power or quality) that moves the students to go extra mile in a given task.

Psychometric: A branch of psychology which deal, with the measurement of mental traits capacity and processes.

Retention: Hold and retain the concepts taught or learnt in a course of study.

LIST OF ABBREVATIONS

F.C.T	Federal Capital Territory.
HMAGD	High Mathematics Aversion Students taught by Guided Discovery Method
HMAE	High Mathematics Aversion Students taught by Expository Method
LMAGD	Low Mathematics Aversion Students taught under Guided Discovery Method
LMAE	Low Mathematics Aversion Students taught under Expository
MARS	Mathematics Aversion Ratting Scale
MAT	Mathematics Achievement Test
SSSII	Senior Secondary School II

CHAPTER ONE

THE PROBLEM

1.1 Background to the Study

In this era of technological quest and high attainment in modernization, no nation can afford to allow her teaming population to shy away from mathematically related sciences, Obiefuna (2005). This is because technological development is hinged on strong mathematics foundation. It is therefore no longer conventional fact that mathematics and mathematical sciences are indispensable. The issue at hand is which method can change the attitude of the learners and attract their interest towards mathematics and mathematical sciences.

Mathematical sciences in this context are those school subjects like Mathematics, Chemistry and Physics. At the tertiary institutions of learning, all science courses that usually involve mathematical calculations are included under the topic mathematical sciences. According to Okunade (2000) one may ask the question why mathematics should be taught in schools. Mathematics as a discipline has many advantages for human beings some of which are:-

1. Utilitarian: - In almost all human activities, both in academic pursuits or professional training and practice, mathematics is an effective tool for realizing results. Onogu (2002), said it is engineering language through which insights are presented to analyze and synthesize engineering problems. This made the subject to be taught from lowest to the highest levels of knowledge that the child's ability can allow.

2. Social activities: - Mathematics is used in the area of social activities like birth/ death control, census, marketing, and a host of others.
3. Cultural activities: - Human beings right from inception express their cultural heritage by means of figures and signs using mathematics. It could be said that its study originated from cultural activities, like Egyptian's irrigation plots, pyramids and a host of others.
4. Aesthetic: - Ogbodu (2004), Observed that, Men derive pleasure and joy in beautiful mathematical designs found in their domain, the beautification also takes its origin from mathematics that are used in art, architecture and textiles.

As a result of its uses,Fatius (2000), said that, the world is becoming more mathematical,while Makarfi (2001), commented that the role mathematics played in social, economic, technological and industrial development of any nation cannot be over emphasized. In line with this, Olumase (2004), stressed on the need for strong mathematical foundation among the youth. Mathematics as explained by Audu (2005), is the queen of all sciences, because it is the tool for all disciplines since no scientific advancement (practical applications and approach) could be achieved without it. Kajuru (2005), emphasize on the impacts mathematics make on all aspects oflife. The usefulness is therefore extended to the field of physical sciences, technology, social and business sciences. Besides these numerous advantages, Nigerian Students seem to approach the subject with coldness and no sense of zeal Njku (2004).

Every nation has set goals for the education of her citizens. The national policy on education spells out government's ways of attaining those goals through education. One of the goals set for secondary education in Nigeria after leaving the school is to

contribute to national development through technological manpower training. In demonstrating the resolve of government towards the provision of qualitative education at secondary schools level, the national policy of education stressed on the need for all teachers in secondary schools to undergo training in the methods and techniques deof teaching.

According to Bello (2001) with the advancement in the socio-economic and technological field, life of the individual is becoming more and more complex with a lot of problems, which the individuals and society have to face in the near future. Therefore, the role of the school becomes increasingly important in developing scientific attitudes in students so that they will be able to solve their problems independently and adjust well in the future complex society. The students need mathematics to develop the scientific thinking and aptitude, which is synonymous to mathematical thinking. Odeyemi (2005) asserts that, if thinking is a way of improving understanding and extending control over the environment, mathematical thinking uses particular means to do this. Therefore, the need to have good methods of teaching the operations processes and dynamics of mathematics cannot be over emphasized.

According to Ojoloye (2005) students are ill equipped from secondary schools to handle mathematics problems, because there are poorly taught. Ahmed (2002), said, therefore, it is important that mathematics educators should work closely with the secondary school teachers in finding better alternative methods of instruction and discuss what should be included in the mathematics programmes. Hence thepurpose of this study was to find out instructional method, which will suit students, especially those having mathematics aversion. He further stated that due to poor teaching methods and lack of

qualified mathematics teachers and public prejudices against mathematics, students view mathematics with apprehension. Therefore the search for a better instructional method that should reduce such apprehension and aversion in students cannot be over emphasized.

According to Agosto (2000), the learning difficulties among students which one observes as a teacher of mathematics raises many other questions that one might seek an answer from theories and methods of teaching. For example, although reflection on our own experience should suggest to us that learning cannot be achieved in a hurry, Elaime, & Johnson, (2002), havethis to say, that some students appear to learn slowly, some make very rapid progress and few even make outstanding progress given the opportunity to learn at their rate rather than the class rate. Therefore, it is only possible to accelerate the learning of mathematics for the majority of students when one uses the appropriate instructional method for each type of students.Individual differences are very significant in many spheres of human activity. Some of us are barred from particular subject because of physical characteristics, like being too small, too heavy or having poor sight. Bolaji (1995), in discussing mathematicians drew attention to great differences in the kind of mathematical aptitude, which individuals have displayed. He further explained that, in the classroom, it might be that different learning environment and different styles are needed for different students. Therefore any acceptable theory or method, which enables us to understand individual differences among our students, would be very valuable.

As has been suggested by Agosto (2000), the learning environment might be an important factor in promoting and understanding mathematics. It might therefore be seen that the richer (encourage) the environment, the more efficient the learning. Hence, what

constitutes a rich environment is a subject which is basically a creation of a human mind and in which the aim is to enable abstract arguments to take place through manipulation of symbols, appropriate learning techniques, learning materials and most of all understanding the needs of students within the rich environment.

The theory of meaningful learning proposed by Ausubel (1980) was a general theory and was not specific to mathematics alone. He states that meaningful learning is a process through which new knowledge is absorbed by connecting it to some existing relevant aspect of the individual's knowledge structure. Achuonye & Ajoku (2003), viewed it that if there are no relevant concepts already within the mind to which knowledge could be linked, the new knowledge would have to be learnt by rote and stored in an arbitrary and disconnected manner. Offoma (2003), said, if a new knowledge was assimilated within the existing knowledge structure as a related unit, and appropriate modification of prior knowledge took place, the result is meaningful learning. It is therefore not necessary for all, or perhaps even much knowledge to be acquired by process of discovery method. According to Akudolu (2002), Good expository knowledge teaching could ensure that new knowledge should be relevant to existing ideas, and this might not only be more economical (in terms of time) than discovery, it might be more effective in terms of length and breath of teaching. Therefore if one could really ascertain what the students already knew, who they were (with or without aversion), one would then know how and what to teach them.

Apart from the introduction of new contents and the proposal for better organization of mathematics curricula, the dominant themes of revisionists is emphasizing on understanding, students' involvement and discovery learning. McCain (2000). Inview this, Onukaogu (20002), said, since mathematics aversion has been found

to be related to mathematics achievement, and also discovery approach is an important method for improving students' performance, then finding out the relationship between mathematics aversion and this method and how it affects mathematics achievement becomes very important to kill down the assumption student may have toward mathematics.

1.2 Statement of the Problem

It is the researcher's observation and experience over the past 20 years of teaching that students seem to assume that mathematics has no relevance in day to day'S living. For this purpose those doing well in it at lower level of education, suddenly decline on getting to higher level of studies. A teacher came in contact with 11 year old girl while teaching in a secondary school. The girl asked him, what he intended to further his education with? And the teacher replied "mathematics". On hearing this, she shouted "mathematics!" The acclamation did not just come to her, but resulted from the aversion she has for mathematics. It is possible that this aversion was created in her by the parents, peer groups, or poor handling of the subject by her teacher. That might have given her the impression that mathematics is not a subject to further with. The aversion affected the girl's performance from her usual 2^{nd} or 3^{rd} position in mathematics class, but found her-self in position 15^{th} and above. The researcher believed that, "Many students fail mathematics not because they cannot make it, but because of aversion". While this is hampering the success of the students, it will be very unfortunate for potential mathematicians to refuse practicing mathematics.

Odeymi (2005) said that many students failed mathematics examination as a result of negative attitude towards mathematics, the results obtained in mathematics by students in both schools and public examinations as pointed out by Emah (2005), is so alarming. Obanya (2002), said that the attitudes exhibited by many people especially students and adults in the society towards mathematics need special attention for the young developing nation desirous to practicing scientific technology and industrial developments.

Studies have showed that high achievement in mathematics is related to low mathematics aversion level and low achievement in mathematics is related to high mathematics aversion level for secondary school student as observed byBello (2001). However, the researcher observed that both students with high and low aversion level are taught by the same methods of teaching. This therefore, led the researcher to feel that there is need to find out an instructional method suitable to students with mathematics aversion, which can assist them in overcoming such aversion in mathematics and to come out with the suitable method this study attempted to find out: This study investigate into the effect of guided discovery method on mathematics achievement of high and low averted secondary school students, thus, the study out to identifIied the method that would best achieve the aim of mathematical science teaching, improve performance, retention ability and also enhancing positive attitude towards mathematics at secondary schools level, irrespective of the age level of students.

1.3 Objectives of the Study

The objectives of this study were to:

- examine the mean performances of secondary school students taught with guided discovery methods and those taught with expository.
- compare the academic performance of secondary school students with low mathematics aversion taught with guided discovery method and those taught with expository method.
- examine the academic performance of the secondary school students with high mathematical aversion taught with guided discovery method and those taught with expository method.

1.4 Research Questions

The study attempted the following research questions.

- What is the difference between the mean performance of secondary school students taught with guided discovery methods and those taught with expository method?
- What is the difference between the academic performances of secondary school students with low mathematical aversion taught with guided discovery method and those taught with expository method?
- What is the difference between the academic performance of secondary school students with high mathematical Aversion taught with guided discovery method and those taught with expository method?

1.5 Research Hypotheses

In order to achieve the objectives of this study the following hypotheses were formulated and tested:-

$H_{01:}$ There is no significant difference between the mean score of secondary school students taught with Guided discovery method and those taught expository method.

$H_{02:}$ There is no significant difference between the mean score of secondary school students with low mathematics aversion taught with Guided discovery and those taught with expository method.

$H_{03:}$ There is no significant difference between the mean score of secondary school students with high mathematics aversion taught with guided discovery method and those taught with expository method.

1.6 Significance of the Study

Although the new national policy on education in Nigeria has greatly laid emphasis on mathematics education and other science subjects, as suggested by FRN (1981), found in Uwah, (2005).Aversion on mathematics education at secondary school level is yet to receive special attention, Mbakwem (2005). In line with this,the study provide mathematics educators and curriculum planners with the instructional method that will aid them in planning the mathematics programme in future, which will go along way in reducing aversion of mathematics.

This study was significant, since the result of the study furnished mathematics educator and curriculum planers with information that will help them plan and predict the

outcome of their curriculum when implementing. In view of the above, therefore, the study provided solution(s) to the problem(s) of understanding mathematics face by students haven high and low mathematics aversion. The study provides mathematics teacher and educators with insight into the proper understanding of their students and the type of instructional methods to use in order to obtain optimum performance in mathematics. Such a study was also significant since it enabled teachers to create a suitable and conducive atmosphere in the class for effective teaching and learning.

The study is beneficial to mathematics teachers in secondary schools in developing an improved plan for averting the aversion among students in their various secondary schools, therefore it is significant. This study is also significant, since it serve as a useful guide to guidance counselors and parents, in helping the students to avert the aversion in the field of mathematics. However, the results of this study throw more light on the existing aversion problems in mathematics. It is also believed that the result of the findings will make a modest contribution to the learning of mathematics in our secondary schools.

Essien (2004), said, Aversion level is a factor that can be consider while predicting mathematics achievement. Hence this study is significant since it aimed at finding instructional methods that are relevant to the aversion level of students, which can also help mathematics educators to predict the mathematics achievement of students. Abiola (2007), said that, all is not well with the teaching of mathematics in secondary schools as a result Akubue (2003), pointed out that many students today are bewildered by mathematics. Makarfi (2001), ascertainthat Great aversion has also been expressed by government, parent, employers and teachers about the fact that large numbers of students,

after secondary school course are unable to perform simple mathematics operation needed in their every day live. Therefore, if a way (method) can be found to make mathematics more interesting and easy for student to understand, it will reduce the aversion level in the subject thus helping the students perform better in this era of technological development. Hence this study is significant.

The continuity of knowledge acquired to be significance to the students after leaving school. So, this study is significant, since it produce a blue print of instructional method, which is to be used by teacher to provide the continue significance mathematics needs. Finally, it is hoped that the study will prove a good basis for further research.

1.7 Scope/delimitation of the Study

The scope of this study was delimited to Kwali and Bwari Area Council of Federal Capital Territory Abuja; the investigation was conducted on SSII mathematics students, from some selected government senior secondary schools. GSS Kwali, GDSS Yangoji, GGSS Dutse-Sangwari and GDSS Bwari were used as representative examples. The finding obtained was generalized to cover schools not selected. The researcher limited his investigation to two out of six Area Councils of Federal Capital Territory Abuja since the state operates a common admission policy and make use of the same curriculum for the schools.

Due to time frame, the researcher limited his finding to the use of two out of many instruments which are mathematics achievement test and mathematics aversion rating scale. Due to financial constrain the researcher limited his finding to Discovery method.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter dealt with the review of related literature by renowned scholars on problems militating against the effective teaching of mathematics and how to tackle such problems like aversion to achieve more functional teaching and learning of mathematics, what previous researchers of the topics have in relation to the present study. Therefore the significant roles of instructional methods and mathematical aversion to student's achievement literature, were reviewed under the following sub-headings:

2.2 Theoretical Framework

2.3 Conceptual Framework

2.4 Concept of Aversion in Mathematics Teaching.

2.5 Sources of Mathematics Aversion in Secondary School.

2.6 Effects of Aversion on Learning Mathematics in Secondary School.

2.7 Methods of Teaching Mathematics in Senior Secondary Schools.

2.8 Mathematics Aversion, Instructional Methods and Achievement.

2.9 Implication of Literature Reviewed for the Study.

2.2 Theoretical Framework

Deep structural changes are needed in the ways that societies manage their economic, social and environmental affairs. Hard choices are needed to move from talk to action to bring about changes among the developing nations. Udo (2010) viewed Discovery learning as method of inquiry-based instruction; that, it is better for the learners to discover facts and relationships for themselves. The theory is utilized in the creation of instructional environments. As it is with other field of leaning, discovery relies on the general theory of learning for the development of its instructional environment. Since

technology has recognized how we live, how we communicate, and how we teach, Fox (2003).

Theoretically, this research work on the effect of guided discovery method on mathematics achievement on low and high averted secondary school students in FCT is based on the theory of guided discovery in learning. This theory is attributed to Bruner (1967) he viewed knowledge to be internalized by the learner through the process of accommodation and assimilation. That a child comes from a home and mingled with peer group that may not be interested in mathematics. When opportunity is given to them to construct things on their own, it may withdraw their averted mind. Fox (2003) believed that students construct their own reality or at least interpret it base on their perceptions and experience, so an individual's knowledge is a function of one's prior experiences, mental structures and beliefs that are used to interpret objective and events.

2.2.1 Constructivism and Learning

Fox (2003), state that knowledge is constructed from experience and learning is a personal interpretation of the world. It is an active process in that meaning is developed on the bases of experience and conceptual growth comes from negotiation of meaning, the sharing of multiple perspectives and the changing of our internal representations comes through collaborative learning. Learning should be situated in realistic setting, testing should be integrated with the task and not in a separate activity.

Learner constructs their own knowledge. Students are encouraged to be creative in searching for the actual result. Nwosu (2003) stated that with the constructivist model of instruction, students redefine, recognize, elaborate and change their initial concepts through interaction within themselves and their environment.

2.2.2. Conceptual Framework

Harbor-Peters (2001) took Aversion to be an acquired behavior that prevents one from perceiving concepts in such a way that they may be applied in solving novel problems; that it educes the efficiency and efficacy of any instruction. Afangideh (2005), said that, any factor that stands between an instruction and concept assimilation by a student, constitutes aversion, and must be diagnosed and treated quickly before handling any other thing, if effective learning must take place. Discovery learning is an inquiry-based, constructivist learning that takes place in problem solving situations were the learner draws on his or her own past experience and existing knowledge to discover facts, the relationships and new truth to be learnt. Students interact with the world by exploring and manipulating objects, wrestling with questions and controversies, or experiments. As a result, student may be more likely to remember concepts and knowledge discovered on their own (in contrast to a transmission model). Model that are base upon discovery learning like guided discovery, problem based learning, simulation-based learning, case-base learning, and incidental learning, among others.

Proponents of this theory believed that the basic tools for discovery learning in mathematics must:- Encourage active engagement, Promote motivation, Promote autonomy, create responsibility/independence, Develop creativity/problem solving skills, and Tailor learning experience.

2.3 Concept of Aversion in Mathematics Teaching.

Aversion as defined in the American Heritage Dictionary (2005), in ask.com is the withdrawal of ones attention from what he/she should do through divers' opinion that may arise from peers, parents or teacher due to the fact that they are deficiency in those area. Bing.Com (2010) explained aversion as a strong feeling of dislike of somebody or something that goes along with hatred, loathing, distaste and antipathy. Houghton Mifflin. All rights reservedInhttp://www.ask.com (2005),took aversion to be a fixed, intense dislike; repugnance or the avoidance of a thing, situation, or behavior because it has been associated with an unpleasant or painful stimulus. It is also an act of turning away or averting. Lassa (2005) took Aversion to be an acquired behavior that prevents one from perceiving concepts in such a way that they may be applied in solving novel problems; that it educes the efficiency and efficacy of any instruction. That, any factor that stands between an instruction and concept assimilation by a student, constitutes aversion, and must be diagnosed and treated quickly before handling any other thing, if effective learning must take place. Adetula (2005), view aversion to be problem and attitude emanated from parents towards their children. Student, because the father, mother or peer group are deficient in mathematics may develop hatred for it. Some parents, as a result of their inability to study mathematics, some as a result of not being able to have better job opportunities or latter end up in classroom may discourage their child. It goes beyond that as earlier explained in chapter one. It has so many branches of activities you can think off.Mbakwem and Mkpa (2003), referred to mathematics as a discipline that encourages curiosity, promote critical reasoning and active participation of learner. These objectives require instructional strategies that are activity base.

Audu (2001), In his presidential address said, in the era of technology quest and high attainment in modernization, no nation can allow his teaming population to shy away from mathematically related sciences. Rahaman (2002), in his support said that technology improves learning process. Adamu (2001), took information technology as a useful delivery vehicle, to the right person, at the right manner and in the right place. Audu (2000), pointed out that information technological development is hinged on strong mathematics foundation. It is therefore not contend-able, that mathematics and mathematics sciences are indispensable. Badmus (2002) said that the effective and attitudinal variables that have been found to predict mathematics related behavior includes confidence in learning mathematics, Badmus (2005) explained the need to pass to the students the willingness to apply scientific habits to a wide range of social content which includes multidimensional perspective about sciences and its relationship to other field of studies. Eniayeju, (2005),emphasize on the nation's expectation of science's contribution to life.She further suggests the need to link between science literacy and national economy. Cooney (2002) in agreement said that it should also be between quality of life and social emancipation. Harbor-Peters (2005), said that science is embedded in, and influenced by the society and culture because science knowledge is socially constructed. Etuk (2005)Believed that the level of scientific cultural belief of students was scientifically high inspite (sic) the scientific knowledge they acquire at their level of education. For this reason, Ali (2000) suggests that the focus of scientific literacy should be on utilization of scientific knowledge for the benefit of the individuals

Odili (2005), explained learning to be a change of human disposal or capability that can be retained which is not ascribable to the process of growth, but can be described

as the development of new knowledge, skills or attributes as individual undergoing learning interact with information and the environment such as the learning strategies or methods, the media and the physical facilities. Udoh (2002) said that self estimated mathematics ability is found to be highly correlated with mathematics aversion and mathematics performance. That mathematics confidence and mathematics aversion have been found to be highly interdependent,

Badmus (2002) Opined that the most important predictors of mathematics achievement when preparation (i.e persistence in mathematics courses and election of future course of mathematics) are controlled by attitudes towards mathematics. Oganwu (2005)said that the meaning of individual learning is coupled with their life experience and contexts that are constructed by the learner not by teacher. The issue at hand is how to change the attitude of students and to attract their interest towards the practicing of mathematics.

Adetul and Ale (2005), suggests that, the extent students may be interested in mathematics class session, may depend on the Lesson's objective. That lesson is designed to provide routine drill or mere memorization of mathematical facts may be less interesting than lesson whose goals are to stimulate thought or intellectual curiosity. Harbor-peter (2001), conducted several studies, on students' attitude and interest towards mathematical science subjects, and concluded that, students manifested negative attitude towards mathematics and positive attitude towards what they called modern science teaching. Obioma (2005), explained that students do not find the study of physics boring like that of mathematics. Odili (2005), opinioned that, students' attitudes and interest are

directly influenced by the personal quality of their teachers and the nature of classroom climate created.

Harbor-Peters (2005), observed students' attitude to mathematical sciences and said, that students developed negative attitudes to mathematical sciences, which they attributed to the students' misconception of sciences. Ale & Adetula (2005), explained that, negative attitude inhabited students' understanding of the content of mathematics. Obodo (2005), said that students with positive attitude are more likely to study mathematics because they enjoys or like it. Because, he gets satisfied with acquiring mathematics ideas, he finds mathematics activities very rewarding. That student may likely work diligently and effectively on a task that they are genuinely interested in. Bature (2006), suggests the need to give students the right opportunity. That if aversion must be eradicated, positive attitude must be built in student been the learner.

What then is attitude and what is interest? Obodo (2005), took attitude to be the way one perceives, the opinion one holds as well as the belief one has about people, things, activities, institutions, policies, administrations and general phenomena. Bature (2006), view attitude as mental and natural state of readiness organized through experiences, exerting a directive or dynamic influence on individual's response to all objects or situations with which it is associated. Adetula & Ale (2005), view interest as the feeling of intentness, concern or curiosity about an object. He said that interest leads individual to make variety of choices with respect to their activities in which he or she engages on.

Harbor-Peters (2001), see attitude and interests to be closely related, that they are just like abstract and concept. But the wider term is attitude, which subsumes interests.

Lawal et at (2005), regarded Interests as attitudes that cause one to seek more activities in a particular area. He said that there are positive attitudes on a selected aspect of activities. On the other hand, there are negative attitudes that force one to refuse an activities offered by a selected aspect of an environment. A child through experience, imitation of admired adult or member of the group may have learnt to like or dislike mathematics.

Gushen (2001), Agued, Attitudes are more than any form of learning. They are transformed through the processes of initiations and may have their origin early in life. Ganiyu, (2005) said, that, some attitude spring from modeling behavior and identification within the peers in latter childhood and adolescence, others may spring up through parent's likeness as the case may be.

Watermeyer (2002), opined that attitudes has both perceptual and effective components. They determined not only what the child sees but how he sees it. A child can acquire certain attitude toward a subject through the influence of their parents, peer group or class teachers, which may lead them to respond to those mode of behavior that are characterized in a particular way of expressing dislike or defense. Badmus (2005) said that attitudes can resist changes once established. It is important to create a desirable attitude in learning mathematics at early stage of learning.

Druger (2002), Said, "Just as we can arrange for our children to acquire a particular information for particular skills, so we can arrange for them to acquire particular attitudes and interests. What is needed is for the teacher to understand the skills"

2.4 Sources of mathematics aversion in secondary school.

Leka (2004), said that, every running has a cause, every cause has an effect. No sickness whitout a symptom. The symptoms of mathematics aversion among student can be seeing from the following sources like: - Parents, peer group and teachers.

2.4.1 Aversion Caused by Parents

Badmus (2005), said that parents exhibits an attitude towards mathematics which they transferred to their children and the children consciously or unconsciously emulate such attitudes and carry them to school. Some of those attitudes that can lead to aversion include:-

1. Aggression: - According to Adido (2002), parents transferring value and aspiration or indoctrination to their children, with the notion that mathematics is difficult or that it is not useful to them with respect to the cause they are going to read. The student will use that as an avenue to start developing negative dispositions to mathematics which is known as primary socialization.
2. Lack of interest: -Hartly & tynjala (2001), said many parents may not be interested in mathematics and kept announcing their past failures to their children which may lead them to disliking the subject because their parents failed it in their time.
3. Lack of benefit: - Effiong & Effiom (2005), pointed out that Some, because of the little knowledge of the benefit they see in the subject, force their children to read other subject they think can give easier money, forgetting that the foundation of those subjects are from mathematics. As Harbor-Peters (2001), rightly said, this experience provides by parents modifies students values, emotions, interest and attitudes towards mathematics.

2.4.2 Aversion Caused by Peer Group

Bature (2006), said that the most widely held belief is that peer group creates aversion among themselves when they discover that certain task is given them tough time. They like to discourage others from doing it; generate fear among themselves as explained by Aja (2001), that peer groups placed a low value on academic achievements. In his explanation, he said that secondary school children, like specific fields in life. Thus Ibok (2002), said that about 25% of the students like to be athletes; the reason asviewed by Umoh (2005), was that athletics bring glory and consequent rewards of increase status to all students. Lindblom et at (2003), said that what this means in effect, is that peer groups have a tendency of influencing their member group from practicing mathematics to other social concern. Such diversions render almost whatever planed for the studentsineffective Ntekim (2005). Akpan (2002), said, many students come to school for the first time with a very high aspiration and do record relatively good results in their early year. Peer group aversion makes them become less academically in succeeding years. As viewed by Audu (2000)**,** the purpose of peer groups may not directly be to affect achievement, instead as pointed out, are form of similar ambition that when formed such peer groups will strive to develop the ambitions that brought them together. When the factor that brought them together are academically oriented, like doing homework, attending classes and also in the habit of keeping late in the library, the influence reinforce one another towards the maintenance of the goals that brought them together through helping one another. Fatius (2000), said their coming together may mean to help one another in the area of their difficulties. That working together as a team make them feel happy in achieving academic goals that brought them together, that they even try to

be competing at times among themselves. These are some of the common features of peer group that are very helpful toward better school learning. Audu (2001), in his own view said that in schools where plan to attend college is high, peer group status as a factor in collage choice considerably increases during the period of schooling. In such case as viewed by Jatau (2002), the peer group puts pressure on students, because of their willingness to belong to the high status groups give more attention to their books in other to succeed and fill belong. Onogu(2002),argued that this could not be so in the era of mathematics, when the factor that leads to formulation of peer groups is characterized by campus, fun, absenting from class and going for parties to alienate individual from his studies. That peer group influence members from the academic goals depending on the combination of their factors which may include the home background and the pressure from parents on students also the general school climate which to a large extent dictates the kind of peer groups that exist in it. Ogbonna (2004) said that such school requires special teachers to work with small group of children of different grade levels in the same classroom. Pridmore (2004) spoke on the need for teacher's assistant, his emphasis was on the need to assess the readiness and negotiate the term for participation of students in the class work.

2.4.3 Aversion Caused by Teachers

Esu (2002), stated that researches have shown that teachers' attitude towards mathematics generate aversion in student, by not capturing their attitude towards the subject. Most mathematics teachers' behavior deviated from the expected normal behavior of teachers. Some mathematics teachers exhibit very strong queer character that

scared many students away from mathematics. Some of the attitudes exhibited by them are:-

1. Creating an impression to students that mathematics is difficult and not everybody practice it, except for those with exceptional qualities like themselves teaching the subject.
2. Some extreme neurotic behavior exhibited by some teachers either in the classroom or outside the classroom.
3. Some behave like mad person which may create another notion in students that mathematics teachers are mad people. This could be as a result of their mode of dressing, not combing their hairs and are hot tempered "not being patient".
4. Proving to be very fast when teaching forgetting that they need to carry the students along in their teaching. Not create time for the work they gave their students and could not also work mathematics in different ways for students to adapt to any of the convenient method. Not given adequate corrections to mathematics assignments and failure to do correction of the assignment given to their student.

Ukeje (2005) said that, "If a medical Doctor makes a mistake a patient may die. If an engineer makes a mistake a bridge or physical structure may collapse, if a lawyer makes a mistake somebody may lose his liberty; but a mistake from teacher makes generations unborn suffer the consequences".By implications of this statement, the mistakes of members of the other professional are overt and transient while the mistakes of a teacher are more debilitating and devastating to the future generation. Aromolaran (2004), Noted that special needs of Education, is education towards meeting the needs of

the learners, so that they can develop to their optimum level and live a meaningful contributive life in the community. In this Obani (2000), said that the need to consider, recognized and respond to, is the diverse needs of the learners.

Makarfi (2001), confirmed, that teachers attitude to mathematics contribute to effective and inefficient teaching and learning of mathematics. Sambo (2005), maintained that teachers exert a lot of influence on good or poor performance of students in mathematics. Uyenuge (2003), opined that the attitude of students towards mathematics some time result from teacher's attitude towards mathematics. Sadiq (2001), agued that among the various factors responsible for students' failure is the poor quality of teacher we have in secondary schools. Ojaleye (2005), said that teachers have been responsive to the Problems of Students in regards to their performance. If a teacher of mathematics feels insecure, dreads and dislikes mathematics, or if he thinks, that mathematics comprises largely learning by rote and devoid of understanding. This can be transmitted to the student. Harbor-Peters (2005), pointed out that interested and enthusiastic teacher of mathematics would transmit his love and understanding of the subject to his students.

Badmus(2002) said that teachers are the significant figures to all students. The way they copy what he says and what he shows, can build and destroy the character of the students. That the way teachers of mathematics address their students either formally or informally matters to them. That when a teacher is professionally relating to students, he is capable of stimulating and motivate them to learn effectively. Fatiu (2000), said that the situation is worsened by the fact that teachers themselves tend to have a very low esteem of themselves and the teaching profession. That is why, Ali (2000), emphasized on the training and retraining of teachers. Eniayeju (2005), said teachers should be

trained to enable them recognize the opportunities and challenges that student might face along the line. Alhassan (2001) pointed out that, lack of adequate training; make it difficult for them to impart the appropriate educational goals to the students. Adetula (2001), confirmed that the difficulties encountered by the teachers in teaching mathematics, depend on the level of professional training. Ojaleye (2005), maintained the need to keep abreast the quality of mathematics teacher with the development of new trends in information technology. Azikiwe (2003), suggested that low morale among teachers as a result of teachers' absence due to administrative procedures, strike actions and delay in payment of salaries and allowances generate aversion among students.

Okebukola (2002), opined that teachers' low productivity in mathematics is as the result of their inability to pass the very subject they teach. As a matter of fact, Kajuru (2005), is of the opinion that mathematics teachers are another factor that trend to instill in the students the fear of mathematics. Many mathematics teachers are math-phobic. Some of these teachers, he said are openly confessing before their students of their hatred towards mathematics. They make **c**ynical statements about mathematics before their students. Liverpool (2002), explained that this group of teachers may not be interested in their job, but are compelled to teach the subject in schools the students have no alternative than to develop a strong mathematical aversion that may affect them in their senior secondary schools. Okoye (1996), pointed out that Orange seeds will never give rise to Apple, so if you want Apple, plant Apple.

Odili (2005) said that, it is an established fact that modeling is a way of learning. Students model their teachers' behavior for effective learning. If student do not like their teachers' behavior and are not willing to model such behavior, they will develop negative

attitude towards the teacher and the subject he teaches. According to Apochafo (2003), it is important for a teacher to change the student attitude and their credibility on him and his subject. Eniayeju (2005), said that science educators know that teaching is most effective when teachers take into account the differences in students. Hannah, (2005), said that the major cause of concern for teachers should be students' lack of interest in showing apathy to the learning of their course.

The teacher's prestige or credibility may likely to influence whether or not the students accept his teaching. Effiong (2002), pointed out that, at this stage it is necessary to determine the adequacy of mathematics teachers in schools. Ganiyu (2005), said that a teacher should be an experienced and a competent person. That the credibility of a teacher could be in terms of his expertness in his educational background, position or age to embark students' belief in him and the validity of what he teaches. Nnachi (2005), said that a teacher, if he must remove aversion, should be approachable, kind, empathic and democratic so as to create Conducive atmosphere for learning. That he must know the needs of individual student establishing motivational relationships.

2.5 **Effect of Aversion on Learning Mathematics in Secondary Schools.**

There seems to be some relationship between the general aversion and mathematics aversion. Ukeje (2005), pointed out, that mathematics aversion exists among many individuals who do not ordinarily suffer from any order tension. Hence even though mathematics aversion is related to other types of aversion, many people who are not generally anxious are anxious about mathematics. Effiong (2002), found out that aversion tends to draw the personal ability to discriminate and to interfere with the learner of new materials more than with the learning of more familiar materials.

According to Anekwe (2005), there are two main types of mathematics problems; Mechanical and word problems. Mechanical problems are computational in nature which involves students knowing how to compute using mathematical operations, while word problems require problem solving ability. She then explained that the state of aversion has been found to impair problem solving ability.

Harbor-Peter (2005), states that aversion is a normal human emotion which is necessary for human development, that a moderate amount of it is necessary to spur multi-nation. However this contradicts the evidence of Harbor-Peters (2001), who state that a negative relationship exists between aversion and mathematics achievement, such that high achievement is related to low aversion level. In a few studies, researchers have attempted to experimentally ascertain whether high aversion impairs less performance. However, according to Obodo (2005), aversion influences performance on affective measures more than on cognitive test.Oganwu (2004),found Mathematics aversion to be strongly related to mathematics confidence, also, Bello (2001) reported that student with high mathematics confidence tend to be low in mathematics aversion and vice-versa, with confidence being a positive manifestation and aversion a negative manifestation.

Adetula (2005) in their study on confidence and mathematics achievement found that student who scored above the mean of a standardized test were grouped into those with high confidence and those with low confidence. In a study by Ukeje (2005), he said that those students with high confidence approach their teachers of mathematics and work more frequently than those with low confidence. It was also found that high confidence students tend to have higher cognitive level of interaction with the teachers than those with low confidence. And in the class examination, it was also found that high confidence

student performed better than the low confidence students. In a cognitive modification programme for reduction of test aversion, Harbor-Peters (2001), noted that the cognitive modification programme significantly reduced the aversion level and increased correspondingly the academic performance of college students. Although in a similar research with regards to cognitive modification referred to as positive retraining, Liverpool (2002) said that," positive retraining and natural instruction had no significant impact on the mathematics anxious student". Thus the result suggests while positive retraining may have emotional input, it is ineffective in improving the mathematics test performance of highly anxious students. It can then be concluded that though cognitive modification can reduce aversion and hence improve achievement in mathematics, there is a need to, in addition to cognitive modification, add or use instructional method which is suitable to the level of aversion in students so as to improve their performance and effectively reduce their aversion.

Another way of reducing aversion according to 0keke (2005) is good planning. He states that good plans lead to efficient performance and confidence which will reduce aversion to its minimum. Therefore, although good plans demand thoroughness and make high demands of teachers, good teachers should be equal to the task, since their motives are to improve their students' performance. Hence the importance of effective instructional method for the mathematics, anxious students cannot be over-emphasized if aversion should be reduced and then improve students' performance in mathematics. Wodi &Odukubo (2005), attests to the fact that teachers need to use activities based instruction strategies because of learners' perception of the universe. From the literature above, it is obvious that aversion has a negative effect on learning generally and on mathematics in

particular. In addition, confidence in mathematics is also related to aversion and students achievement. Therefore, literature related to the two instructional methods, which are used in the study, is hereby reviewed here after. The two methods are used in teaching mathematics in secondary schools.

2.6 Methods of Teaching Mathematics in Secondary Schools.

There are several methods of teaching which teacher of science subjects can use in the classroom to presents scientific facts, information, principles, skills or concepts to students. Some of the methods include: demonstration, discovery, discussion, project, laboratory, individualized, field trip and expository methods to mention but few.

Some of these methods which have their characteristic advantages and disadvantages as narrated by Onota, D. (2003), are specific for some situations and categories of students, while others can generally be apply to all categories of students. For the purpose this study, the relevant teaching method amongst the above listed are discovery and expository methods and would be discussed below.

2.6.1 Guided Discovery Methods

The value of discovery has been the subject of debate and some disagreements among educational psychologists. As explained by Mayer (2003), claimed to have established that guided discovery was the best method (of those used) to promote the learning of certain rules. Constructivist (2004), argued that guided discovery only looked better because of what it had been compared with, usually-rote learning. He went further to claim that there was just no evidence that discovery of any kind was a more effective teaching method than meaningful exposition. Clute (2011), agree that discovery is

important in promoting learning with young children, while & Ausubel on the order hand agreed that active learning methods are more important for younger students than for elder ones. Yet guided discovering is quite popular with some teachers. They believed the students are better motivated by an active approach and perhaps by a challenge, but the teacher may justifiably step in at any time to ensure that the desired end point is reached.

Perhaps the most eloquent defender of learning by discovery is Mayer (2003), who claimed that; first, discovery encouraged a way of learning mathematics by doing mathematics and encouraged development with view that mathematics is a process rather than a finished product. Secondly, in agreement with Yapwi (2005), discovery was seen as intrinsically rewarding for students, so that the teachers using discovery methods should have little needs to use extrinsic form of reward. Thirdly, discovery learning, teaches students the techniques of discovery. Solving problems through discovery develops a style of problem solving or inquiry that serves any task that one may encounter. Finally, discovery learning results in better retention of what is learned because the student has organized his new information and know where (in his own storage system) to find the information when he needs it. Now, these points carry great weight, Practical difficulties were acknowledged namely; that one could wait forever for students to discover, that the curriculum could not be completely open. Some students might even fine their inability to discover extremely discouraging. It is of course up to the teacher to make the kind of adjustment necessary to circumvent these difficulties. Such practical difficulties did not invalidate the case for active learning. Therefore, the effort of trying to use discovery methods will be worthwhile for what is to be achieved.

More recently, in the wake of the Gallenstient report (2004), there have been developments aimed at ensuring that secondary school mathematics curriculum does involve an element of more active learning, which is discovery method. The efficiency or otherwise of discovery method is however under debate. Mayer (2003) has commented upon the issue that "*One cannot compare, say 'discovery teaching' with 'non-discovery teaching……' One can only compare some specific attempts to do discovery teaching, Vs some specific attempt to do 'non-discovery' teaching…* ". Supporters of discovery learning may therefore, to a large extent be accepting a belief, summed up by Hopkins, (2002) that "*I believe this discovery is the best way of exciting our students in mathematics*". He also believes that it is only when students are given chance to think him/her self, that they realize their full potentials.

Without controversy, Udoh (2004), pointed out that student who should be given chance to think for himself must have been exposed to ideas that form his prerequisite knowledge. Without such exposure, he may have no basic knowledge from which his thinking will spring forth. This is to say that expository approach supplement discovery approach. Hence to draw a sharp line of contrast between the two approaches may be more and academic exercise than nature. A study which requiring a comparison of the two approaches requires a substantial amount of case study by the researcher. With this in mind, this important method of teaching mathematics will be used to teach students with mathematics aversion, while its efficacy or otherwise improving their mathematics achievement will be shown. Another important method used in the study is the expository method, the potentials of which are hereby discussed latter.

2.7 Learning Mathematics by Expository Method.

Ali (2000), classification of teaching method, we may define expository teaching as the situation in which the teacher gives both the principle and the problem situations. In contrast to her role in inductive discovery learning, the teacher presents the student with the entire content of what is to be learned in final form. According to Udokang (2002), the students are not required to make any independent discoveries. The usual verbal instruction of the lecture hall exemplifies the expository teaching. It is sometime called Deductive teaching because the teacher often begins with a definition of the concepts or principles, illustrate them, and unfolds their implications. Although expository teaching is a widespread and tradition teaching practice in our schools and colleges, it has attracted very little research said Ebong & Agabi (2005). Hopkins (2002), believed that the reason for the lack of research is that expository teaching has been identified with rote learning. The students presumably can only memorize the lecture by constant review and repetition. Indeed it is possible to present a body of materials so poorly that unless the students commit to rote memory, they have little or no way of remembering it. However, expository teaching can present a rich body of highly related facts, concepts and principles which the students can learn and transfer. To these advantages Okobia (1998), adds that expository teaching is more popular in our schools today because it is more efficient and takes less time than discovery learning. When combined with practice, it is very successful in teaching concepts and principles. Expository teaching, he continued, offers students the opportunity to obtain and organize views of the discipline he is studying because the teacher can organize the field more efficiently for learning than the novice student can. Gallenstein (2004), said that in

discovery learning, the concern to teach the techniques of discovery overrides the concern for learning the unifying principle of a discipline. Chin-Tin (1993) and other adherents of discovery methods contend that discovery method is the best method for transmitting subject matter, problem solving is the primary goal of education, there can be training in the techniques of the discovery; expository teaching is authoritarian; and the discovery methods are unique generators of motivation and self confidence. However, Irvin (2011), countered that the primary purpose of teaching is to present in some systematic way an organized body of knowledge. The organization should be explicit form to the students. He does not believe that you teach creative thinking and critical thinking outside the context of a specific discipline. Adopting a precise, logical, analytical and critical approach, which fosters appreciation of the scientific method in that discipline, he contends, can only teach such thinking.

Both discovery and expository methods are good methods of teaching mathematics as shown above. But, looking at the relationship of these two methods with mathematics aversion and how they affect mathematics achievement will sharpen our focus on the study.

2.8 Mathematical Aversion, Instruction and Achievement.

Lassa (2005), in his studies of the interaction of aversion and instructional strategies found that aversion can have largest effect on learning from instruction in the area of pre-processing. According to him, aversion affects learning during pre-processing stage by interfering in the degree to which external stimulation has been internally registered. He suggested that anxious students divide their attention between the demands

of the task and preoccupied themselves with negative thoughts. He concluded that less anxious students generally perform better than their counterparts.

Mathematics aversion has been found to be related to mathematics achievement, Clute (2011). Studies have also shown that high achievement in mathematics is related to low aversion of students. Harbor-Petters (2001) in her study of factor associated with types of mathematics aversion in secondary schools, states that "mathematics aversion is not an isolated phenomenon; it originates and persists within a complex learning process". That is mathematics aversion is analyzed with the effective and cognitive variables with which it interacts. Clute (1984), in jstors.org (2011), came out with a finding on the relationship between level of mathematics aversion and instructional method to mathematics achievement and has found that students with low aversion tend to do better under discovery method, whereas the students with high mathematics aversion did better under the expository approach. He further explained that a possible explanation of this interaction involves confidence. According to Okeke (2001), Confidence performance in ones ability to learn mathematics is significantly correlated with mathematics achievement. Hence, student with high mathematics confidence perform better on mathematics task. Also, in Clute (2011), mathematics aversion is strongly but negatively related to mathematics confidence. Therefore if one lacks confidence in once ability to perform a mathematical task, it seems reasonable to conclude that there is a lack of respect for or trust in ones own instincts or judgment when it comes to learning mathematics. Thus, instead of trusting his/her own methods of mastering the material, the highly anxious student needs to rely on a well structured, controlled plan for learning; i.e the expository method. Conversely, since most students with low aversion have

mathematics confidence as viewed by Clute (2011), and students having high confidence tend to have more interactions with their teachers concerning mathematics than those low in confidence do. Jenny (2011), said that it therefore seem, reasonable to conclude that an instructional methods that rely on and foster interaction would be more suited to students with low mathematics aversion. That method is the discovery method.

The finding in the studies above show that the two instructional methods, discovery and expository have relationship to the level of mathematics aversion of students. Therefore they will be used in this study in order to find out which one is better suited to students with mathematics aversion and better reduces the aversion level of the students.

2.9 Implications of literature Reviewed

The implication of this study is that there is inverse relationship existing between aversion and mathematics achievement such that high achievements are related to low aversion level. Thus aversion has negative effect on learning generally and on learning mathematics in particular, that, confidence in mathematics is related to aversion in mathematics and also related to achievement in mathematics.

The review indicates the causes of mathematics aversion to teachers' attitude and beliefs, parent and peer group, Memorization and lack of variety in teaching methods, emphasis on exact answer and speed can foster aversion.The review indicates that discovery and expository methods of teaching are among the best methods used in teaching mathematics. Their advantages were highlighted. The implication is that the two methods have research support for improving achievement scores in mathematics that

justifies why the two methods were selected for use in the study. Further more it shows that the two instructional materials have relationship to the level of mathematics aversion of the students;

The review of this study shows that students with low mathematics aversion levels tend to perform more in mathematics when they are being taught by the guided discovery approach. This is in agreement with the finding of McCain (2000) who reported in his study that, students with low mathematics aversion perform better under the discovery approach. In his explanations, most students with low mathematics aversion level have mathematics confidence. And according to Udo (2010a) students with high confidence in mathematics tends to have more interactions with their teachers than those with low confidence do. It is therefore seemed, reasonable to conclude that discovery method which relies on and fosters such interactions would be more suited to students with low mathematics aversion.

Another aspect of the study shows that the method used in teaching students regardless of their aversion level does not significantly affect their level of performance in mathematics achievement test which wasin agreement with the finding of IAARR (2011) who commented on the issue of comparing Discovery and Expository methods. It was said that: "one can not compare say, 'Discovery teaching' with 'non-Discovery teaching……. 'one can only compare some specific attempts to do 'Discovery' teaching, vs some specific attempt to do non-Discovery' teaching……." Means both methods are good methods of teaching. These also wasin line with that of Udo (2010), who stated that discovery is the best method of instruction that gives students real excitement in

mathematics while November (2000), with contrary view said that expository teaching is more efficient and takes less time.

The study shows that the aversion of students does not significantly affect their performance in mathematics, which agrees with that of Puzzlemaker.com (2001) who in the studies of the interaction of anxiety and instructional strategies found that aversion level has effect on learning from instructional method. The implication is that, anxious students divide their attention between demands of the task and pre-occupied themselves with negative thoughts, while less anxious students generally perform better than their counterparts. November (2000) also reported that mathematics aversion is strongly related to mathematics achievement.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The study investigated the effect of guided discovery method on mathematics achievement of low and high averted senior secondary students.The chapter described and discussed the research design, population, sample and sampling techniques, instrumentation, data collection, data analysis and also the pilot study.

3.2 Research Design

A 2 x 2 Quasifactorial design was used for the study to compare the discovery (experimental) with the commonly used expository (control) group. The condition attached to each was high and low level of mathematics aversion among students. The design also determines if students with high and low mathematics aversion would do differently on the two methods. The design of the study is illustrated in the table below

Table 3.1 **Quasi Experimental Two Designs**

Aversion Level	**High**	**Low**
Experimental	$Cell_1$	$Cell_4$
Control	$Cell_2$	$Cell_3$

Keys to Note

$Cell_{1;}$ Students with high aversion under discovery group

$Cell_{2;}$ Students with high aversion under expository group

$Cell_{3;}$ Students with low aversion under discovery group

$Cell_{4;}$ Students with low aversion under expository group

In this design there were four cells, each of which represents a subgroup, for example, (experimental: High and low aversion & control: high and low aversion). The design permitted the researcher to determine if there is a significant overall effect (main effect) for the independent variable through the use of Discovery and Expository methods. The treatment without regard to aversion levels indicates the main effect for treatments, by comparing the means of $cell_1$ and $cell_3$ with $cell_2$ and $cell_4$. The design also permitted the determination whether these two variables interact significantly; such that, students with low aversion do better in guided discovery condition, in this case, the subject in $cell_3$ would have a higher average score than those in $cell_1$ and the subjects in $cell_2$ would do better than those in $cell_4$.A pretest was administered before the treatment in the form of a Mathematics Achievement Test (MAT) and Mathematics Aversion Rating Scales (MARS) to determine the equivalence of the control and the experimental group. The experimental group was exposed to the treatment of learning by instructional strategy while control group were exposed to the expository instructional method. After the treatment, a post-test was administered to both the experimental and the control group to determine if there was any improvement in their academic performance.

3.3 **Population of the study**

The population for this study comprises of all Senior Secondary II students in the Federal Capital Territory Abuja. There are six Area councils in the Federal Capital Territory Abuja, with about fifty five (55) Senior Secondary Schools having population of SSII to be about 15435 as shown below:

Table 3.2:**Population of Senior Seconday School II in Federal Capital Territory**

Area Council: Number Of Schs	**Population**
Abaji 4	1328
Bwari;11	2844
G/Lada 8	3097
Kuje 6	1599
Kwali4	817
Municipal 225750	
Total 5515435	

3.4 Sample and Sampling Procedure

At the first stage of sampling, from the six area councils, two area councils were randomly selected through the use of ballot. Investigation from the ministry of education revealed that there are a total number of 14 Government senior secondary schools, 2 Unity Schools and 8 private Senior Secondary Schools in the selected Area councils - these comprise of day secondary schools, single and co-educational (Boys and Girls) institutions, bringing the total number of senior secondary schools in the two Area Councils to twenty four (24). In this study, only the state public schools were considered. This is due to their common socio-economic backgrounds, admission policy, staffing and availability of teaching materials and equally to make the comparisons easy and possible since the schools are funded by the Government of Federal Capital Territory.

At the second stage of sampling, four (two from each Area council) of the senior secondary schools were randomly sampled out of the twenty four (24) secondary schools

in the selected two Area councils of the Federal Capital Territory. These include: Government senior secondary school kwali, Government Day senior secondary school Yangoji, Government Girls Senior Secondary school Dutse Sagwari and Government Day Senior Secondary School Bwari.

At the third stage of sampling, two classes of SS II students were randomly selected from each school making a total of eight classes in all. The first four classes, from each School formed the experimental group, while the remaining four classes, formed the control group. The Eight classes with the population of 177 were then subjected to Mathematics aversion rating scale and Mathematics Achievement test in order to separate them into those with high and low mathematics aversion levels, also to know their levels of mathematics achievement. On the heels of the foregoing, students in each of the two levels of mathematics aversion were also treated. Below is table of samples size of the sampling procedure.

Table 3.3Sample of Students According to Levels of Aversion.

AVER. LEVEL	No. of Studs under Disc	No. of Studs under Expos	Total
HIGH	46	49**80**	
LOW	42	4082	
TOTAL	**8889177**		

3.5 Instrumentation

Two instruments were used in this study for data collection namely mathematics achievement test (MAT) and mathematics aversion rating scales (MARS)

3.5.1 **Mathematics Achievement Test (MAT)**

The mathematics achievement test consisted of set of sixty (60) multiple choice items designed to reveal the level of students understanding of the selected concepts in mathematics.

The sixty (60) multiple choice items consisted of five response option, one of which is the correct answer while the remaining four serve as distracters. The test items were in conformity with Bloom's (1956) taxonomy of the cognitive domain, i.e knowledge, comprehension, application, analysis, synthesis and evaluation. The first twenty (30) of the MAT was used as a pretest to determine the equivalence of the control and experimental groups and the remaining twenty (30) of MAT was used as posttest to compare the groups for significant difference after the treatment and also to determine the level of retention of concepts taught in mathematics. See appendix i

Mathematics achievement test (MAT) was administered on the subjects by the research assistants and collected after twenty five minutes. While the control group has access to the test for an equal time, after which they were stopped. A marking scheme was used to score the responses to the MAT. A correct response was awarded one mark while any wrong response attracts a zero mark. The total obtainable mark was twenty (20). The result of the test was later multiplied by three (3) to make it over hundred (100). The details of the mathematics achievement test are shown in appendices Ia and Ib respectively.

3.5.1.1 Validity of the Mathematics Achievement Test (MAT)

For the purpose of this study, experts in mathematics education and measurement were used to carry out the validation of the instruments. The validators chosen include two experts in mathematics education with PhD qualification from the department of science education, Ahmadu Bello University (ABU), Zaria and the teachers teaching the classes of the senior secondary schools of the affected school in FCT Abuja. The team also includes two experts in test and measurement. The test items examined by the experts were: Content validation, appropriateness of the items, clarity of the statements in the instrument, to ascertain whether the test items are related to concepts in SSII syllabus and to give suggestions and criticisms that would assist towards improving the quality of the test items. At the end of the validation, the first thirty (30) items approved were used as shown in appendix Ia and Ib.

3.5.1.2 Reliability of the Mathematics Achievement Test

The reliability co-efficient of a test refers to the consistency with which the test repeatedly measure what it assumed measuring. After repeated use, if aside from a small margin of measurement error, the results obtained from a test are not different from each other, then such a test is said to be reliable (Sambo, 2005). The reliable of a test can be tested by any of the following methods

Split-Half Reliability, Test Retest Reliability and Parallel form Reliability. For the purpose of this study, a test retest form of reliability method of analysis using the spearson product moment correlation coefficient statistics was used to determine the reliability of the mathematics achievement test (MAT) through pilot study. The same test

was administered on two different occasion at two weeks interval as recommended by Tuckman (1975) the scores from the two administrations was correlated as an estimate of the reliability of the test Sambo (2005a). The reliability of the test therefore is at 0.62 which is at 5 percent that is it is (0.05)level of significant.

3.4.2 Mathematics Aversion Rating Scales (MARS)

The second instrument referred to as Mathematics aversion rating scales (MARS) it was developed by the Richardson and Suinn (1937) and was used by the researcher for administration on the subjects with a view of generating responses on the attitudinal aspect of the study. The instrument consists of a total of twenty items. The questionnaire was constructed based on the Likert type five point scale of strongly agree (AG) Agree (A) Undecided (U) Disagree (D) & strongly Disagree (SD). The responses were assigned weights of 5; 4; 3; 2 & 1 respectively for favorable statements (Olaitan & Nweoke 1988). MARS was administered as a pretest and post-test to the control and expository groups. This is to observe if there is any significance change in attitude based on the treatment experienced. The response decide the degree of aversion arouse by ticking any of the five point categories ranging from strongly agree (5) to strongly disagree (1), made available in the MARS instrument. The respondent who favors the highest score has low aversion.

3.4.2.1 Validity of the Mathematics Aversion Rating Scales

The mathematics aversion rating scales was validated by two senior mathematics educators, two senior sociologists and a senior language expert. Feedback from these experts led to the reframing and expunging of ambiguous, inappropriate attitudinal statements from the instrument. A questionnaire with a total of twenty five (25) items

was initially presented to the team of experts for face validation but only twenty (20) items were eventually retained and used for data collection see appendix iii

3.4.2.2 Reliability of the Mathematics Aversion Rating Scales (MARS)

To test the reliability of the instrument, pilot test was conducted, from the result of the pilot study; the researcher used Kuder Richardson formula (2014). The instrument was found to have a coefficient of 0. 62 which is at 5 percent (0.05) level of significance.

3.4.3 Pilot Testing of the Instruments

A pilot study was conducted in government senior secondary school Kwali in FCT Abuja for two weeks. Two classes of SSS II Students were randomly selected for the study. The main objective for the pilot study was to ascertain:

1. The Pretest to determine the equivalent of the ability level of the experimental group and control group subjects before treatment administration.
2. The Reliability testing of mathematics achievement test (MAT)
3. The Reliability testing of mathematics aversion rating scale (MARS)

The pilot study provided information that ascertains:

1. The practicability of the study
2. The equality in ability of the group studied
3. The appropriateness of the instrument that was used and
4. The duration of the test item administration.

3.4.4 Treatment.

The treatment start with writing of teaching guides like lesson plan and lesson notes for teaching guided discovery strategy. The content was developed according to the SS II mathematics curriculum containing sets of objectives specifically outlined to the teachers, clear direction and kind of expected specific outcomes required from each topic. Again, the teaching guides were encompassing a lot of suggestions, examples and counter examples that teachers follow in their presentation of lessons. For instance, the guided discovery approach emphasize on asking leading questions on the specific tasks presented before the students by leading /guiding them until they discover the solution as in Appendix v. Two broad topics were used for the purpose of this study which includes world problems and geometry. The daily lesson plans was given to mathematics educators for face validation. Some items picked from Kajuru (1995), was used, to modify the lesson notes on guided discovery.

3.5 Teacher Inter-Related Scales

The teacher inter-related scale of Bolaji, (1995), was used. The 20 Items scale was meant to rate teacher's adherence to the following characteristics; Teachers' knowledge of the topics used, Teachers' ability to follow the lesson plan, Students' interaction and control and Method of asking and answering questions see appendix iii. Experts validated the instrument and their comments, suggestions and additions were fully incorporated.

3.5.1 Research Assistants Workshop

A mini workshop for the research assistants for the project was conducted. Eight teachers were used in all. All of them were mathematics teachers in senior secondary

schools and of the same qualification with teaching experience not less than two years. The main objective of the workshop was to discuss the topics to be taught for the duration as specified in the senior secondary instructional materials.

3.6 Procedures for Administration of the Instrument

In this study, two out of four classes of SS II, that is, SS IIA, IIB, IIC and IID in the selected schools were randomly chosen. The mathematics aversion rating scale and mathematics Achievement test was administered to the eight classes in order to separate them into those with high and low mathematical aversion level, and their level of mathematical knowledge. Any score in the mathematics aversion Rating scale from 60% and above, has low aversion level, from 0 - 39% has high aversion level while others are neutral. For the purpose of this study, students within each of the two levels of mathematics aversion were randomly assigned to the two treatments (discovery and expository methods), thus, formed four subgroups with each subgroup forming a cell.

The treatment of Mathematics Achievement Test (MAT) and Mathematics Aversion Rating Scale (MARS) was administered to both the experimental and controlled groups for duration of 8 weeks. The score obtained from these tests formed the data of the study. The statistical mean, standard deviation and t-test were used in analyzing the data and testing the hypotheses. To ensure answers to research questions and testing of null-hypothesis; four main instruments were used. The first instrument was made up of the manual materials for guided discovery shown in appendix iv. This was the main instrument of the study. The second instrument was the academic achievement test items shown in appendix i, aimed at assessing the performance of both the experimental and control groups before and after the teaching. The third instrument was the mathematics

aversion rating scale details are provided in appendix ii, it was used to assess the student's level of mathematics aversion at the beginning as well as at the end of the teaching. The fourth was the inter-rater agreement scale of the actual teaching behavior which was used to assess the extent of teacher's compliance with the prescribed instructional strategies in the guided discovering method. These behavior manifestations were rated through classroom observation. Two raters as well as the researcher simultaneously rate the same teacher (research assistant). The teacher raters were trained for two weeks to monitor and discuss the development of the instructional materials and determine whether there are difficulties in their implementation.

3.7 Procedure for Data Analysis

The scores obtained in mathematics achievement Test and mathematics aversion rating scales form or serve as the main data for the study. These data were compiled and analyzed using the statistical mean, standard deviation and the t-test in the testing of the Null hypotheses 1 to 3.

CHAPTER FOUR

RESULTS, ANALYSES AND DISCUSSIONS

4.1: Introduction

Nations has purpose for the education of her citizens. The national policy on education spells out government's ways of attaining those purposes through education. The study produce ways of handling students of secondary schools in Nigeria so as to contribute to national development through technological manpower training.

In line with this, this chapter produced the result and analysis of data collected for the study. It gives general description of the data, hypothesis-by-hypothesis testing, analysis and interpretation of findings. Statistical techniques, such as the means score, standard deviations and the t-test were used. All hypotheses were tested at 0.05 level of significance.

4.2 Data Presentation

A modified Fennema-Sherman mathematics aversion rating scales was distributed to the selected SS II students as in appendix ii, and was collected as shown in appendix viia. The students in each of the mathematics aversion level were tested for mathematics aversion rating scales (MARS) (pre-test),207 students were tested, with 95 having high aversion, 82 having low aversion and 30 students neutral among the selected students. No student in the high aversion level scored above 39%, and also no student in the low aversion category scored below 60% marks. The neutral students fell between 40% - 59%. The high and low aversion students were subjected to discovery and expository treatments,aspresented in Table 4.1below.

Table 4.1: **The Distribution of Students into their various level of Aversion**

Score Range	Fre. of High Aver	Neutral	Fre. of Low Aver.
95.5	-	-	8
85.5	-	-	14
75.5	-	-	26
65.5	-	-	34
55.5	-	16	-
45.5	-	14	-
35.5	46	-	-
25.5	38	-	-
15.5	11	-	-
Total	**95**	**30**	**82**

Table 4.2: below indicates the frequency scores of the high and low aversion groups. Altogether there were 177 students out of 207, 95 of them have high aversion and 82 of them have low aversion.The students in each selected schools were further divided into class A and B for treatment.

Table 4.2: **Distribution of Score of the High and Low Mathematics Aversion Rating Scale (**MARS).

Sc. Ranges	Freq. of H. Aversion	Freq. of L Aver
95.5	-	8
85.5	-	14
75.5	-	26
65.5	-	34
55.5	-	-
45.5	-	-
35.5	46	-
25.5	38	-
15.5	11	-
Total	**95**	**82**

Table 4.3 shows that forty six (46) high mathematics aversion students and forty two (42) low mathematics aversion students from the selected schools were treated by guided discovery approach, while forty nine (49) high mathematics aversion students and forty (40), low mathematics aversion students from the selected schools were taught under expository approach. The result from each school was collected and analyzed as shown in

appendix viii.The data obtained in the study for high and low aversion students, are shown in the Tables below. Graphs (Ogive curve) were used to describe some of the results in the tables.

Table 4.3: **Distribution of Students into Various Subgroups (cells) for Treatment.**

Aversion. Level	Discv.	Exposit	Total
High	46	49	**95**
Low	42	40	**82**
Total	**88**	**89**	**177**

Table 4.4 shows the frequency scores of the averted students on the mathematics achievement test under discovery method. There are 88 students in this group; the range of marks scored is 70 with a mean score of 59.82 and the standard deviation of 16.22.

Table 4.4: **Frequency Distribution Scores of Averted Students on Mathematics Achievement Test under Guided Discovery Method.**

Score Range	Frequency
95.5	2
85.5	8
75.5	13
65.5	18
55.5	23
45.5	14
35.5	6
25.5	4
Total	**88**

Fig. 4.1shows that majority of students are above the average marks, indicating the effectiveness of guided discovery method on students with aversion under the discovery approach.

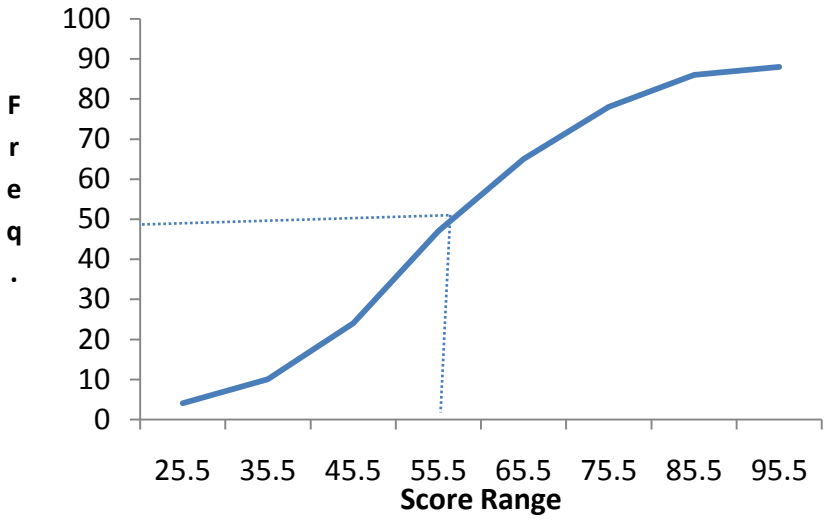

Fig 4. 1:**Frequency polygon of scores of averted students on achievement Test under Discovery Method.**

Table 4.5 shows the frequency scores of the averted students on the mathematics achievement Test under Expository Method. There are 89 students in this group; the range of marks scored is 60 with a mean score of 53.14 and the standard deviation of 14.54.

Table 4.5:**Frequency Distribution Score of Aversion Students on Mathematics Achievement Test under Expository Method.**

Score Range	Frequency
85.5	4
75.5	7
65.5	13
55.5	27
45.5	22
35.5	10
25.5	6
Total	**89**

Fig. 4.2shows average performance of students thought under expository approach.

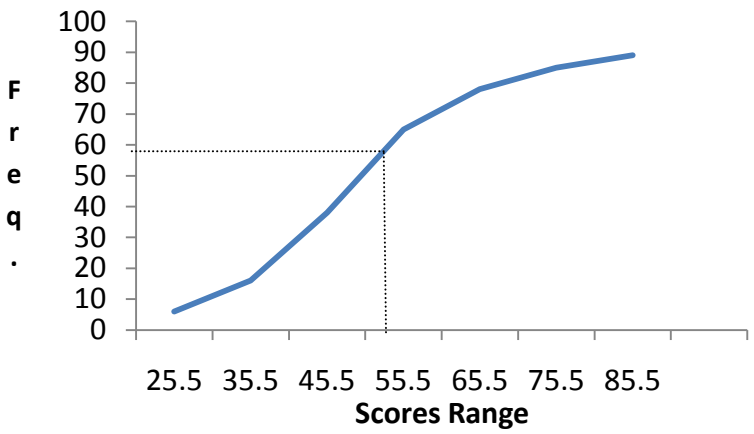

Fig 4.2: **Frequency polygon of scores of averted students on achievement Test, taught under expository approach.**

Table 4.6 showed the frequency of scores of the high aversion students on the mathematics achievement Test. There are 46 students in this group; the range of marks scored is 60 with a mean score of 39.2 and the standard deviation of 12.22.

Table 4.6 **Frequency Distribution Score of High Aversion Students on Mathematics Achievement Test under Guided Discovery Method.**

Score Range	Frequency
75.5	1
65.5	1
55.5	2
45.5	20
35.5	12
25.5	6
15.5	4
Total	**46**

Fig. 4.3shows that majority of the students scored below 40 marks, indicating that students with high aversion perform less under the discovery approach.

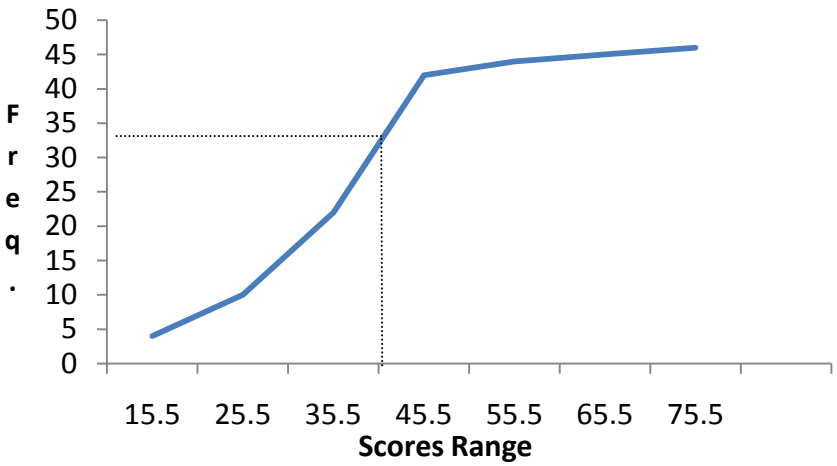

Fig 4.3: **Frequency polygon of scores of high averted students on achievement Test under Discovery Method.**

Table 4.7 shows the frequency distribution of scores of high aversion students taught by expository method on the mathematics achievement test. There are a total of 49 students, the range of marks scored is 50 their mean score is 56.11 and the standard deviation of 14.20.

Table 4.7 **Frequency Distribution Score of High Mathematics Aversion Students on Mathematics Achievement Test under Expository Method.**

Scores Range	Frequency
85.5	3
75.5	5
65.5	9
55.5	14
45.5	15
35.5	3
Total	**49**

Fig 4.4: showed high achievement in mathematics achievement test by students with high mathematics aversion under expository approach.

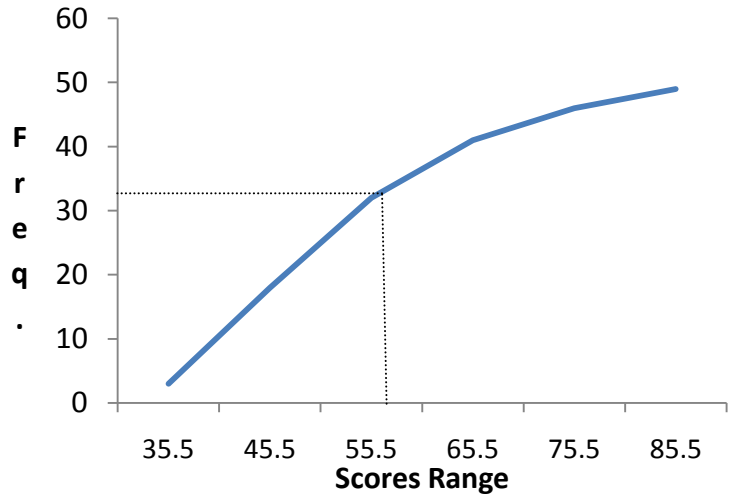

Fig 4.4:**Frequency Polygon of Scores of High Averted Students on Achievement Test, under Expository Approach.**

Table 4.8 showed the frequency distribution of low mathematics aversion students under the discovery approach scores on mathematics achievement test. There are a total of 42 students, the range of marks scored is 50 and the mean score is 71.45 and the standard deviation is 11.35.

Table 4.8F**requency Distribution Scores of Low Averted Students under Discovery Method on Mathematics Achievement Test.**

Scores	Frequency
95.5	2
85.5	7
75.5	12
65.5	16
55.5	3
45.5	2
Total	**42**

Fig 4.5: showed that almost all the students scored above 50 marks. This indicates high achievement in the test by low mathematics aversion students under guided discovery method.

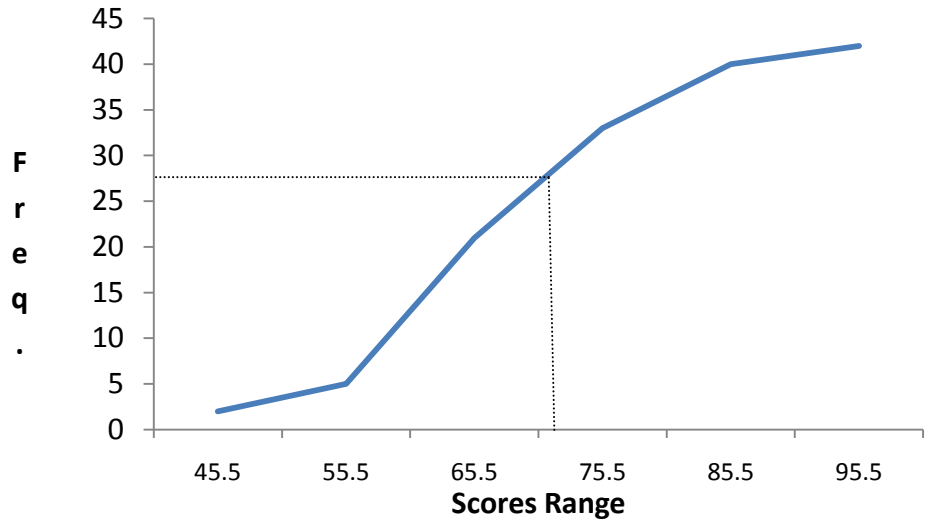

Fig 4.5: **Frequency Polygon of Low Averted Students under Discovery Method Scores on Mathematics Achievement Test.**

Table 4.9 showed the frequency distribution of scores of low aversion students taught by expository method on the mathematics achievement test. There are a total of 40 students, the range of marks scored is 50, and their mean score is 39.5 and the standard deviation of 14.11.

Table 4.9 **Frequency Distribution Score of Low Aversion Students on Mathematics Achievement Test under Expository Method.**

Scores Range	Frequency
75.5	1
65.5	2
55.5	4
45.5	13
35.5	9
25.5	7
15.5	4
Total	**40**

Fig 4.6:**Illustrated an Almost Even Spread of Scores of Students with Low Mathematics Aversion under the Expository Method.**

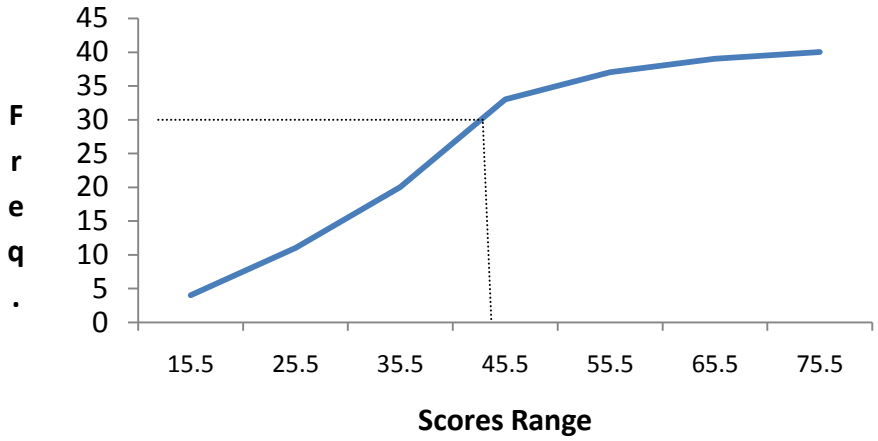

Fig 4.6: **Frequency Polygon of Low Aversion Students under Expository Method Scores on Mathematics Achievement Test.**

Table 4.10 showed the summary of four group means on mathematics achievement test at the end of the study.

Table 4.10Summary of the Four Groups means Scores on Mathematics Achievement Test.

Aversion Level	HighLow	**Mean**	
Discovery	39.2	71.45	**110.65**
Expository 56.11	39.5	**95.61**	
Mean	**95.31**	**110.95**	

Table 4.11showed the summary of the four group distribution of students to their various aversion levels after administering the Mathematics Aversion Rating Scale (MARS) at the end of the study.

Table 4.11**Summary Distribution of Students into their Various Aversion Levels at the end of Treatment.**

Aversion Level	HighLow	**Mean**
Discove 46	42	**88**
Expos 49	40	**89**
Total9582177		

4.3 Hypotheses Testing

There are three null hypotheses tested. The t-test analysis was used in testing the hypotheses.

4.3.1 Null Hypotheses 1

There is no significant difference between the mean performance of students taught with Guided discovery method and those taught expository method.

To test Null hypothesis 1, t-test statistics was used. The summary of the computations is contained in table 4.12. The study showed that there is significance difference in mathematics performance of students with mathematics aversion taught by discovery method and those taught by the expository method at alpha level of 0.05. The students taught by the discovery method have a mean score of 59.82 with a standard deviation of 16.22 as against their colleague under the expository with a mean score of 53.14 and standard deviation of 14.54. The computed calculated t-value was found to be 2.88, the critical t-value was found to be 1.645. Thus, the calculated t-value is greater than the critical t-value. Therefore the difference is significant. Thus the null hypothesis was rejected. It could therefore be concluded that there is significant difference between

mathematics performance of mathematics aversion students taught under guided discovery method and those taught under the expository method in favor of discovery.

Table 4.12: **The Summary of T-test Analysis on Difference between Aversion Students Taught under Discovering Method and those Taught under Expository Method.**

Group	N	$\bar{X}$	SD	DF	SE	T_{Cal}	T_{Cri}	P-value.
EXPERIMENTAL	88	59.82	16.22					
	177	2.32	2.88	1.645	0.05			
CONTROL	89	53.14	14.54					

4.3.2 Null Hypotheses 2

There is no significant difference between the mean performance of students with low mathematics aversion taught with Guided discovery method and those taught with expository method.

To test Null hypothesis 2, t-test statistics was used. The summary of the computations is contained in table 4.13. The mean score for the low aversion students under the discovery method is 71.45 with a standard deviation of 11.35, while the mean score of those with low aversion under the expository method is 39.50 with a standard deviation of 14.11. The computed t-value was found to be 11.26 at alpha level of 0.05, the critical t-value was found to be 1.645. Thus, the calculated t-value is greater than the critical t-value. Hence the difference is significant. Thus the null hypothesis was rejected. It could therefore be concluded that there is significant difference between the mathematics performance of students with low mathematics aversion taught by guided

Discovery method and those with low aversion taught by the Expository method in favor of guided discovery.

Table 4.13: **The Summary of T-test Analysis on Difference between Low Aversion under Discovery (LMAGD) and Low Aversion under Expository (LMAE)**

Group	N	$\bar{X}$	SD	DF	SE	T_{Cal}	T_{Cri}	P-value
EXPERIMENTAL	42	71.45	11.35					
				80	2.84	11.2	1.645	0.05
CONTROL	40	39.50	14.11					

4.3.3: Null Hypotheses3

There is no significant difference between the mean performance of students with high mathematics aversion taught with guided discovery method and those taught with expository method.

To test Null Hypothesis 3 t-test statistics was used. The summaries of the computation were contained in table 4.14 the mean score for the high aversion students under discovery method is 39.20 with a standard deviation of 12.22 while the high aversion students under expository group has a mean of 56.11 and standard deviation of 14.20. The computed calculated t-value was found to be 6.23 at alpha level of 0.05, the critical t-value was found to be 1.645. Thus, the calculated t-value is greater than the critical t-value. Therefore the difference is significant. Thus, the null hypothesis was rejected. It could therefore be concluded that there is a significant difference between mathematics performance of students with high mathematics aversion under guided discovery method and those under the expository method in favor of expository.

Table 4.14:**The Summary of T-test Analysis on Difference between High Aversion Students Taught under Discovering (HMAGD) and High aversion Students Taught under Expository (HMAE).**

Group	N	$\bar{X}$	SD	DF	SE	T_{Cal}	T_{Cri}	P-value
EXPERIMENTAL	46	39.2	12.22					
	93	2.71	6.23	1.645	0.05			
CONTOL	49	56.11	14.20					

4.4: **Summary of the major findings**

The study investigatedinto the effect of guided discovery method on mathematics achievement of high and low averted secondary school students. the study identify the method that would best achieve the aim of mathematical science teaching that will improve performance, retention ability and can enhancing positive attitude towards mathematics at secondary schools level, irrespective of the age level of the student.

The study reviewed that, there is significance difference in mathematics performance of Low aversion Students taught by discovery method and those taught by the expository method at alpha level of 0.05, though the mean performance are closely related, students taught under discovery have a higher mean score of 59.82 as against their colleague under the expository with a mean of 53.14, showing that discovery method has upper hand in teachingsenior secondary school students with aversion.

The study reviewed that, there is a significance difference in the mathematics performance of the low aversion secondary school students under discovery method and those under expository method. The low aversion students under guided discovery method perform better with a mean score of 71. 45, as against low averted secondary

school students under expository method with a mean score of 39.50, showing that discovery method is more effective in teaching students with low aversion.

The findings of this study reviewed that,the difference in mean performance of the high averted students taught by Guided Discovery method and those taught under Expository approach is significant at 0.05 alpha levels. The result shows that high averted students perform better under expository method with a mean score of 56. 11 as against 39.20 for high averted students under guided discovery approach.

4.5 Discussion

This section presents explanation for the finding of this study,by comparing the chapter with existing information of the earlier work as follow:

The difference in the mean performance of students with low mathematics aversion and those with high mathematics aversion was significant.The study stands to agree that, discovery learning resultbetter because studentsretained what was learned and will be able to produce it latter, this is in agreement withUdo (2010) who states that discovery is the best method of instruction that gives students real excitement in mathematics, sincetheycan organized their new information and know where (in their own storage system) to find them when needed. Now, these points carry great weight, since learner constructs their own knowledge in agreement with Nwosu (2003) statement that, with the constructivist model of instruction, students redefine, recognize, elaborate and change their initial concepts through interaction within themselves and their environment.

Secondly, students with high mathematics aversion perform better in mathematics achievement test when taught by expository method. This means that the highly anxious students understand and appreciate mathematics more under a well structured, controlled plan for learning. This finding agrees with the finding of McCain (2000), who in his investigation on finding the relationship between levels of mathematics achievement has found that student with high mathematics aversion tend to do better under expository method. Also Achimgu (2009) in his study reported that, because the highly anxious student lack respect for or trust in his own instincts or judgment when it comes to learning mathematics, he need to rely on a well-structured, controlled plan for his learning through expository method.

Finally, the two methods are good. That is to say that expository approach supplements discovery approach. Hence to draw a sharp line of contrast between the two approaches may be more and academic exercise than nature. A study which requires a comparison of the two approaches requires a substantial amount of case study by the researcher. With this in mind, this important method of teaching mathematics should be used to teach students with mathematics aversion.Going by the analysis of the finding, discovery method is not a commonly used method by many teachers. The finding came out with this opinion that since the method can compete with the commonly used method, it is an easy way of removing aversion in the mind of the students agreeing with Hopkins (2002), who believed that it is only when students are given chance to be involve in thinking that they forget their averted mind.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction:

The study investigated into effect of guided discovery method in teaching students with low or high mathematics aversion. It examined the academic performance of high and low averted students in mathematics and the relationship between guided discovery and expository. In this chapter, we shall discussthe summary of the measure findings and Conclusion. Recommendation are also made on how to carry out further studies on the effect of guided discovery methods on mathematics achievement of low and high averted students in senior secondary schools.

5.2 Summary

This study investigated the effect of guided discovery method on mathematics achievement of high and low averted secondary school students, thus the study was out to identify the method that would best achieve the aim of mathematical science teaching, improve performance, retention ability and also enhancing positive attitude towards mathematics at secondary schools level, irrespective of the age level of the student. Thus it was out to:

1. examine the mean performances of secondary school students taught with guided discovery methods and those taught with expository.

2. compare the academic performance of secondary school students' with low mathematics aversion taught with guided discovery method and those taught with expository method.
3. examine the academic performance of the secondary school students with high mathematical aversion taught with guided discovery method and those taught with expository method.

The students selected for the study were SS II students from GSSS kwali, GDSSS Yangoji, GGSSS Dutse Sagwari and GDSSS Bwari, all in Kwali and Bwari Area Councils of Federal Capital Teritory. The schools were randomly selected from the 24 senior secondary schools in the two selected area councils. A representative random sample of 207 students was used, using Morgan and Krejcie (1970) sampling distribution table. A modified Fennena-Sherman (1977) mathematics aversion rating scale (MARS) was used to identify students with high and low mathematics aversion. Students within each of the two level of aversion were randomly assigned to treatment of guided discovery and expository method, thus forming four groups. After treatment for 8 weeks, the result was analyzed using the statistical mean, standard deviation and t-test. The findings were as following:-

Low mathematics aversion students taught by guided discovery approach performed better than those under expository method. Hence, the null hypothesis of no significance difference between the mathematics performance of low aversion students under guided discovery and those under the expository methods was rejected.

High mathematics aversion students perform better under expository approach. Therefore the null hypothesis of no significance difference in mathematics performance of high aversion students under discovery and those under the expository methods was rejected.

Generally, the method used in teaching the students regardless of their aversion level does not significantly affect their performance in mathematics. Though a look at the mean performance shows that the groups under guided discovery perform better with a mean score 110.65 than their colleagues under expository with a mean score of 95.61. It is fully agreed that when full attentions are giving to guided discovery it will yield more result.

5.3 Conclusion

The study indicated that aversion is an acquired behavior that prevents one from perceiving concepts in such a way that they may be applied in solving novel problems; that it educes the efficiency and efficacy of any instruction. Any factor that stands between an instruction and concept assimilation by a student, constitutes aversion, and must be diagnosed and treated quickly before handling any the subject, if effective learning must take place.

Study shows that, student remember concepts and discovered knowledge on their own (in contrast to a transmission model). That is, Model that are base upon discovery learning like guided discovery, problem based learning, simulation-based learning, case-base learning, and incidental learning, among others. Proponents of this theory believed that the basic tools for discovery learning in mathematics should: - Encourage active engagement, Promote motivation, Promote autonomy, responsibility/independence, Develop

creativity/problem solving skills, and Tailor learning experience. It is believed that knowledge is internalized by the learner through the process of accommodation and assimilation that students construct their own reality or at least interpreted it base on their perceptions and experience within their environment.

The finding of this study reveals that students with high mathematics aversion perform better in mathematics achievement test when taught by expository method. This means that the highly anxious students understand and appreciate mathematics more under a well structured, controlled plan for learning. This finding agree with the finding of McCain (2000), who in his investigation on finding the relationship between level of mathematics achievement has found that student with high mathematics aversion tend to do better under expository method. Also Achimgu (2009) in his study reported that, because the highly anxious student lack respect for or trust in his own instincts or judgment when it comes to learning mathematics, he need to rely on a well-structured, controlled plan for his learning i.e. the expository method

5.4. Recommendations

To this effect mathematics teachers and educators are advised to try as much as possible find out the aversion level of their students and apply these methods accordingly in order to make the students perform at their best. This can be best achieved if mathematics classes were grouped according to student's aversion level, so that mathematics teacher knows the type of approach he will use to teach each class. It is a difficult task, but for the sake of improvement in the performance of students in mathematics we have to adopt the change.

Using the appropriate method can also reduce the aversion level of students. Therefore teachers must be ready to change their attitudes of refusing change and adopt the strategies that outfit a particular student. They should also change their attitudes both towards the subject and the students in other to bring the students closer to mathematics.

Finally, Government, school boards and mathematics educators should come together and organize regular workshops on these instructional strategies for senior secondary school teachers. This will go along way in familiarizing the teachers with the approaches and methods of identifying student's aversion levels. Mathematics aversion rating scales and others should also be discussed in the workshop. In the light of the finding of this study; the following recommendations for further researches are made by the researcher.

1. A similar research should be conducted using different sample, different topic in the instructional material and duration.
2. If the results of the similar study are the same with this study, then widen the scope of the investigation by including other variables like gender, age, rural and urban.A

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Appendix ia

Mathematics Achievement Test (MAT) 1

1 The sides of a triangle are 5cm, 6cm and 7cm. the longest side of a similar triangle is 21cm. find the length of the other sides and the ratio of the two areas.

(a) 15cm, 10cm, 1 ,9 (b) 15cm, 18cm, 1,9 (c)15cm, 18cm, 1,3 (d) 24cm, 30cm 1,6 (e) 2m, 3m

2 For what value of x is the fraction $\frac{x^2-3x+2}{4x+13}$ A $\frac{4}{5}$ B $\frac{13}{12}$ C $\frac{7}{6}$ D $\frac{6}{3}$ E $\frac{9}{4}$

3 a man 1.83m tall, stands at a distance of 1c5.8m away from the base of a tower. He discovers that the angle of elevation from the top of the tower is 63^o. Calculate the height of the tower. (a) 18cm (b) 30cm (c) 30.9m (d) 90cm (e) 80cm

4 The sum of two numbers is 105 their product is 2736, find the numbers (a) 24 and 21 (b) 48 and 57 (c) 77 and26 (d) 77 and 32 (e) 23 and 45

5 The angle of depression from the top of a building of a height 30m of a stationary car is 41^o. Find the distance between the car and the top of the building. (a) 4.50cm (b) 4.33cm (c) 5.00cm (d) 45.7m (e) 4.33cm

6 Lawn is 35m, while the area is $60m^2$find the breadth of the lawn. (a) 6 or 10 (b) 3 or8 (c) 3 or 6 (d) 3 or 5 (e) 2 or 1

7 A man 37years old and his child's age is 8 years, how many years ago was the product of their age 96 years? (a) 5 years (b) 4 years (c) 3 years (d) 2years (e) 22 years

8 If asked to construct an angle 45^o you will have to: (a) Use your ruler, pencil and protractor. (b) Draw any triangle and measure 45^o (c) Use your protractor only (d) Use your compasses to construct an angle 90^o and bisect it. (e) Non of the above

9 Find a number which, when added to its square make 90. (a) 4 or 9 (b) 9 or -10 (c) 19 or 6 (d) 9or 8 (e) 3 or 9

10 the radius of a circle is 10cm. the length of a chord of the circle is 16cm. calculate the distance of the chord from the center of the circle. (a) 6cm (b) 5cm (c) 7cm (d) 8cm(e) 3cm

11 what is the number such that as that when 5/6 of it is subtracted from $3\frac{1}{2}$ the result is the same as when 2/3 of it is added to it. A1 B,5 C,3 D,5 E7

12 Consider this example, the average cost of a number of pencils is 50k, if all the pencils cost #20.00, find the total number of pencils. A 40 B 65 C 34 D 29 E 78

13 Consider another example for students If the average weight is 30kg, find the number of the boys

A29 B65 C34 D40 E78

14 A chord of length 24cm is 13cm from the center of the circle. Calculate the radius of the circle.

(a) 6cm (b) 5cm (c) 3cm (d) 17.69 cm (e) 9cm

15 Find the total surface area of cylindrical tank whose base diameter is 14cm and its hight is 28cm (a) 1528cm (b) 1640cm (c) 1540cm (d) 1520cm (e) 1965cm

16 A cone has a base radius of 6cm and height 9cm. calculate its total surface area cm2. (a) 164.5cm (b) 159.5cm (c) 317.2 cm^2 (d) 58cm (e) 88cm

17 Find the area figure bellow (take $\prod = 22/7$)

(a) 164.5cm (b) 159.5cm (c) 49cm (d) 19cm (e) 58cm.

18 Express the following statement as algebraic equations "the result of taking 2 from n and multiplying the answer by 4 is the same as multiplying n by 3 and taking away 5.

(a) 4(n-2) = 5(n-3) (b) 4(n-2) = 3n-5 (c) 4(n-2) = 5 – 3n (d) 4(2-n) = 2n (e) 4(2- n) = 3(n-5). (e) 3n

19 Find the product of $\frac{1}{7}$ and the sum of $\frac{3}{5}$ and $1\frac{1}{2}$ A, $\frac{3}{10}$ B,$\frac{3}{12}$ C, $\frac{3}{13}$ D,$\frac{5}{10}$ E$\frac{7}{33}$

20 Find the positive difference between the sum of 1.6 and 2 and the product of 7 and 0.4
A, 3.4 B. 2.5 C. 6.6 D.0.8 E 2.6

21 Solve the equation 4(3-5n) - 7(5-4n) + 3 = 0

(a) 5/2 (b) 3/5 (c) 3/7 (d) ¾ (e) -3

22 Change the expression into word 20 – (3 + 9)

(a) Subtract the sum of 3 and 9 from 20 (b) Add the product of 3 and 9 to 20

(c) Subtract 20 from the sum of 3 and 9 (d) Add the sum of 3 and 9 to 20

(e) Find the sum of 20, 3 and 9.

23 for n equals to 2x number greater than n is

(a) ax – 15. (b) 2x. (c) 2x – 15 (d) 2x+15 (e) 15

24 The perimeter of a rectangle is 20cm. if the breadth of the rectangle is 2cm, its area is:
(a) 16cm (b) 18cm (c) 20cm (d) 32cm (e) 40cm

25 Labaran has x kobo, kunle has 15 less than Laraba. Together the number of kobo they have is: (a) x-15 (b) 2x (c) 2x – 15 (d) 2x +15 (e) 15

26 In a class containing 32 students, a student can do either Government or History or both. If 16 students do Government 18 do History and 3 do none of the subject, find how many do both. A, 6 B, 9 C, 4 D,8 E 5

27 In the family of eight, one-eight of the members are very tall, and one-quarter of them are very short. The rest are of average in height. How many are of average heights in that family? A, 32. 6 B, 39.5 C, 43.5 D,18.5 E 14.5

28 Giventhat log 2 =0.30103 and log3 = 0.47712 calculate with out table log5 a 0.79898 b 0.98897 c 0.69897 d 0.86979 e 0.79867

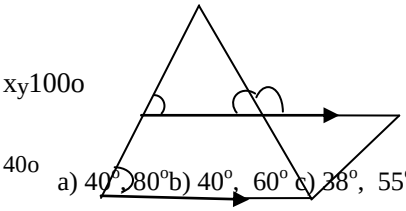
29 Evaluate log3 6.84 to (2dp) a 2.5 b 1.75 c 4.62 d 9.32 e 4.34

30 Evaluate $(2\sqrt{3} - 4)(2\sqrt{3} + 4)$ a -4 b 4 c 16 d 12 e -12

Appendix ib

Mathematics Achievement Test (MAT) 2

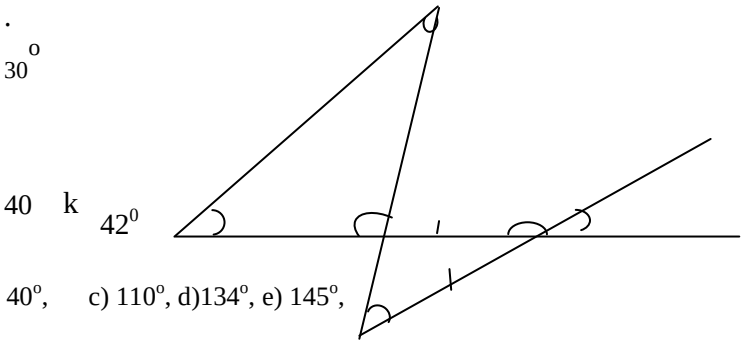
31. Find x and y from the following, give reasons for your steps.



a) 40^o, 80^o b) 40^o, 60^o c) 38^o, 55^o d) 34^o, 89^o e) 45^o, 23^o

32. Find the angles marked with letters in the following diagram

.



a) 40^o, b) 40^o, c) 110^o, d) 134^o, e) 145^o,

23 when 48 is divided by the sum of 2 and n. if the result is 3. What is the n?

(a) 3 (b) 5 (c) 7 (d) -7 (e) 30

34 When 48 are divided by the sum of 5 and a certain number is 3. What is the number?
(a) 11 (b) 14 (c) 26 (d) 15 (e) 30

35 I thought of a number and subtract 5 from it, I then divide 72 by the result. If my answer is 4, what number did I think of?

(a) 23 (b) 32 (c) 42 (d) 20 (e) 22

36 The sum of four consecutive number is 58, Find the numbers? what are the numbers?
a. 13, 14, 17, 18 b. 26, 27, 28, 29 c. 6, 7, 8, 9 d. 13, 14, 15, 16 e 3, 4, 5, 6

37 The sum of 12 and 9 attract a. 65 b.45 c 21 d.43 e.21

38 Ojo bought 12 oranges from the market. His Daddy plucked 14 more Oranges for him from the garden, how many Oranges does Ojo now have?
A, 34 Oranges B. 45 Oranges C. 62 Oranges D. 78 Oranges E 26 Oranges.

39 Ggiven the difference between 8 and another number is 17. Find the possible value, for the number. A, 34 B. 25 C. 62 D. 78 E 26 .

40 A brother is 3 years older than his sister, 5 years ago; the ratio of their ages was 4:3. Their present ages are?(a) 17 years and 13 years (b) 14 years and 12 years (c) 17 years and 8 years (d) 8years and 17 years (e)17 year and 7 years

41 find one ninth of the difference between 256 and 13 (a) 72 (b) 27 (c) 40 (d) 70 (e) 23

42 If 14 men can cultivate 42 acres of land in 18 weeks, how many weeks will it take 21men working at the same rate to cultivate 56 acres of land?

(a) 16weeks (b) 70weeks (c) 63weeks (d) 73 eeks (e) 80weeks

43 The sum of three consecutive integers is 147. What are the integers?

(a) 48, 49, 50 (b) 40, 50, 59 (c) 48, 50, 51 (d) 39, 40, 70 (e) 49, 50, 50

44 Find the first three consecutive even integers if the sum is 420.

(a) 138 (b) 42 (c) 40 (d) 400 (e) 4

45 The sums of four consecutive integers 102, hat are the integers

(a) 24, 25, 26, 27 (b) 20, 21, 22, 23, (c) 23, 24, 25, 26 (d) 24, 26, 28, 30 (e) 21, 22, 23,

46 What is the largest of three consecutive even integers if their sum is 727

(a) 26 (b) 7 (c) 70 (d) 36 (e) 72

47 A car travels 120 km at a certain average speed. If the journey takes 21/2hr. what was this average speed?

(a) 48 km/hr (b) 38 km/hr (c) 40kmhr (d) 50km/hr (e) 58km/hr

48 A car travels foe 15 km in city at a certain speed. Outside the city it travel 72km at twice its former speed. If the total travels time is 1hr.8mins. What was the average speed in the city?

(a) 45km/h (b) 55km/h (c) 35km/h (d) 50km/h (e) 62km/h

49 One third of a number added to four-fifths of itself is equal to 17 find the number.
A, 34 B. 25 C. 62 D. 78 E 26

50 A man is four times as old as his son. In four years time he will be three times as old. How old are they? A, 34 years B. 25 years C. 62 years D. 78 years E 32 years.

51 Solve the equation 1/5 – x = 1/x – 3: (a) 1 (b) -2 (c) 0 (d) 4 (e) 2

A man is x years older than his son. The sum of their ages is 65years. If his son is 16 years old. Find x

(a) 49years (b) 32years (c) 12years (d) 33years (e) 20years

52 If sin q = 12/15 finds q: (a) 12/9 (b) 12/3 (c) 15/9 (d) 5/13

53 In angle ABC, A = 54 ^{o}, B = 67^{o} a = 13.9m find b and c. (a) b. 11m c. 16m (b) b.11cm c. 6.5cm (c) b. 11cm c. 7cm (d) b. 15.8m c. 14.7m (e) b. 11m c. 31m

54 If sin Q = 12/13, find cos Q: (a) 5/13 (b) 23/34 (c) 3/13 (d) 13/5 (e) 10/5

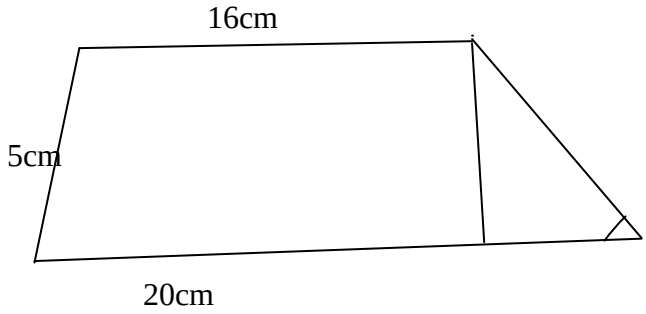
55 The bearing of A from B is 124 what is the bearing of B from A

(a) 124^{o} (b) 126^{o} (c) 304^{o} (d) 36^{o} (e) 156^{o}

56 A wire long goes from the top of an 8-meter pole to a point on a vertical wall 12m above the ground. What is the angle between the wire and the wall? (a)45 (b) 73 (c) 74 (d) -73 (e) -74

57 A car travel 120km along a straight road, which is inclined at 10^{o} to the horizontal. Calculate the vertical distance through which the car rises. (a) 19.4m (b)9.5m (c) 17.0m (d) 20.9m (e) 20.5m

58 Find the area of the trapezium ABCD bellow



(a) 40cm^{2} (b) 64cm^{2} (c) 45cm^{2} (d) 80cm^{2} (e) 90cm^{2}

59 Find the product of the 11 and the positive difference between 4 and 10A, 34 B. 25 C. 66 D. 78 E 26

60 Find the sum of .9 and the product of 1.7 and 3 A,4 B. 25 C. 62 D.78 E 6

Appendix II

Mathematics Aversion Rating Scale. (MARS)

Introduction: Each of the statement on this scale expresses a feeling towards mathematics. You are to indicate on a five –point scale, the extent of

agreement between the feeling expressed in each statement and your own personal feelings. The points are:

Strong Disagree: SD; Disagree: D; Undecided: U; Agree: A; Strongly Agree: SA

Draw a circle around the latter or letters given the indication of how you agree or disagree

		SD	D	U	A	SA
1	I am not good in mathematics.					
2	I see mathematics as a subject I will rarely use					
3	I am usually not at ease in a mathematics class.					
4	It is always important to get exactly answer to mathematics.					
5	My reading mates made me to get tied easily in mathematics.					
6	I will need mathematics for my future work,					
7	I don't think I could do advance mathematics.					
8	For some reason even though I study very well, the attitude of my mathematics teacher will discourage me.					
9	My mind goes blank and I am unable to think clearly when doing mathematics.					
10	I was discouraged by my parent on mathematics.					
11	My fellow students find it difficult to relate with me.					
`12	Mathematics has been my worst subject due to rung company.					
13	I think I can handle more questions in mathematics.					
14	Winning a price in mathematics would make me feel unpleasantly conspicuous.					
15	I am not the type to do well in mathematics.					
16	Mathematics does not scare me at all.					
17	There is a magic key in studying mathematics.					
18	Mathematics is by intensively done to get the problem is solved.					
19	Mathematicians work problems quickly in their heads.					
20	Some students have mathematics mind.					
21	I have problems in the area of trigonometry					
22	I have problem in the language of mathematics					
23	I have interst in mathematics but how to manipulate the figure					
24	I hate the involvement of latter					
25	When I am tought mathematics I do forget after some time					
26	My heart cut when ever I heard of examination date					
27	All my closer friends hate mathematics					
28	I hate mathematics when it come to word problem					
29	The most hatred subject I have is mathematics					
30	My teacher made me to develop hatred to mathematics					

Note: the respondent having the highest score has the lowest aversion level.

Appendix iii

Teacher Inter-Related Scales

Name of the Teacher: _____

School:_____

Class: _____ Topic:_____
Date:_____

Instruction: please complete the following by ticking the appropriate column that represents your opinion of teacher using the following 5 points scale of strongly agree (5)m to disagree (1)

		SA	A	U	D	SD
1	Teachers has mastery the subject matter					
2	Demonstrate a kind of understanding that will make him to present the content well					
3	Communicate with a kin of understanding which really shows that he knows what he is teaching.					
4	Knows how to solve problems without making a lot of errors.					
5	Take care of the interest of the students during the lesson.					
6	Make a Clare statement of attainable lesson objectives.					
7	Follow the presentation designed in the lesson.					
8	Handle all the activities to be the carried out during the lessons.					
9	Make use of all the suggestions contained in the manual materials.					
10	Take care of all directions and guideline as contained in the manuals.					
11	Use all the instructions suggested for him.					
12	Answer the student questions with authority.					
13	Listen to all the student questions.					
14	Ask questions in a sequential order i.e from simple to complex tasks.					
15	Skip some challenging questions					
16	Keep the students involve in the lesson in a meaningful manner.					
17	Keep students busy through a lot of activities in the lesson					
18	Design activities that involve students to be in the lessons.					
19	Give a lot of word problems for the students to practice.					
20	Provide innovations that effectively involve students in the lesson.					
21	His is so friendly with his class students					
22	Encourage his to work mathematics easily					
23	Visit students at will					
24	Encourage parents to give their children out for mathematics practice					
25	He always make me to develop interest in mathematics					

26	The idea of solving mathematics problems can easily be collected from him					
27	His dressing admired me					
28	He is very neatness					
29	He is a very hard working					
30	He used practical in solving mathematical problems					
	TOTAL					

Name of the Pater_____

Date

Appendix iva

Guided Discovery Manual Materials

1 Introduction to Geometry

i. Definition of trigonometry
ii. Students to differentiate between plane shapes and solid shapes
iii. Students should list out the shape under plane shapes and solid shapes
iv. Evaluate the lesson/Assignment

2 Types of Angle

I. Students should be asked to draw various vertical and horizontal lines
II. Ask the to join them together
III. Identify the angle
IV. Form various angle
V. Identification of various angles like right-angle acute-angle, obtuse-angle etc
VI. Identification of supplementary and complementary angle
VII. Find the sum of the angles
VIII. Evaluation/Assignment

3 Solving Problems on Angles

I. Students should use their previous lesson to locate angles
II. Use angle to find the value of X and Y
III. Evaluate the lesson/Assignment

Word Problems

4 Solving Sums and Differences

I. Explain consecutive number
II. Students should be aloud to list some example of consecutive numbers
III. Give student some independent works on consecutive number
IV. Solve some problems on word problems
V. Evaluate the lesson/Assignment

5 Word Problem on Product and Quotient of Whole Number

I. The idea of multiplying fraction with whole number using word problems
II. Use of concrete object like human age and height in word problems
III. Evaluation of the lesson/Assignment

6 Combinations of Sum and Difference in Word Problems

I. Students should solve variety of positive difference between products
II. Evaluate the lesson/Assignment

7 Word Problems Involve Fractions

I. Students should be independent use latter to solve expressions
II. The idea of sets
III. The use of fraction in word problems
IV. Use of subtraction of fraction in word problems
V. Evaluate the lesson/Assignment

8 More Problems Involving Simple Algebraic Fractions

I. Idea of the use of latter fraction in word problems
II. Evaluate the lesson/Assignment

9 - 10 Further Word Problems Involving Fractions

I. Translate word problems involving fraction equation as well mathematics statement
II. Solve word problems involving fractions
III. Evaluate the lesson/Assignment

11 Solving Algebraic on Word Problems

I. The idea of fast reasoning
II. Relating the idea with algebraic expression
III. The use of chronological age
IV. Evaluate the lesson/Assignment

12 – 13 Application of Word Problems from Everyday Situations

I. Solving problems from everyday situations
II. Formulating problems from everyday situations
III. Evaluate the lesson/Assignment

Appendix ivb

GUIDED DISCOVERY LESSON PLAN (GDLP)

Lesson 1:

Topic introduction to geometry

Objective at the end of the lesson students should be able to

1. Define the word geometry
2. Differentiate between plane shapes and solid shape
3. List types of plane shapes
4. List types of solid shapes

Previous knowledge: the students are familiar with objects like plane and solid shapes.

Instructional materials: triangles, squares, cone, cylinder, sphere and maggi cubes.

Introduction: the teacher introduces the lesson by asking questions on the previous knowledge of the student that may help them understand the lesson at hand.

Presentations: the teacher presents the lesson with the use of steps.

Step 1: He explains the meaning of geometry

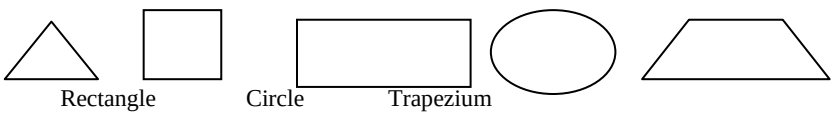
Geometry is an aspect mathematics that deals with the study of different shapes; these shapes could be plain shapes or solid shapes.

Plane shape is a geometrical form such that the straight line that joins any two points on it wholly lies on the surface.

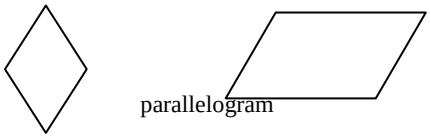
Solid shape on the other hand is bounded by surfaces which may not wholly be represented on a plane surface.

Step ii the teacher presents some instructional materials for the students

to identify as the lesson is going on as follow.

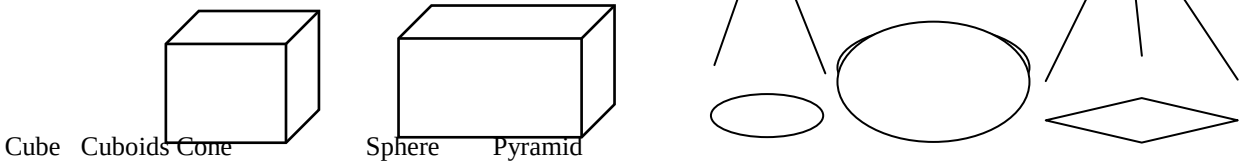


Triangle Square Rectangle Circle Trapezium

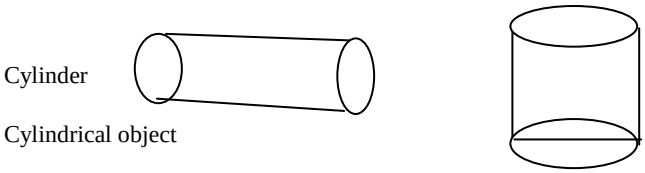


Skit parallelogram

He also presents solid shapes for students to identify as the lesson is going on as follow.



Cube Cuboids Cone Sphere Pyramid



Cylinder

Cylindrical object

Step iii: the students should be asked to differentiate between plane shapes solid shapes.

Evaluation: the teacher evaluates the lesson by asking the students the following questions

1, what is geometry?

2, list four types of plane and solid shape each

3, differentiate between plane shapes and solid shapes

Summary: teacher review the lesson briefly to be sure that students understand the lesson.

Assignment

The teacher gives the following as assignment

I, students were asked to prepared plane shapes and solid shapes from home.

Lesson 2

Topics: - types of angles

Objective: - At the end of the lesson, the students should be able to:

1: list types of angles

2: explain adjacent, corresponding and vertically opposite angles

3: solve problems involving interior angles.

Instructional materials: rope, ruler and mathematical set

Previous Knowledge: students have learnt plane shape and solid shapes

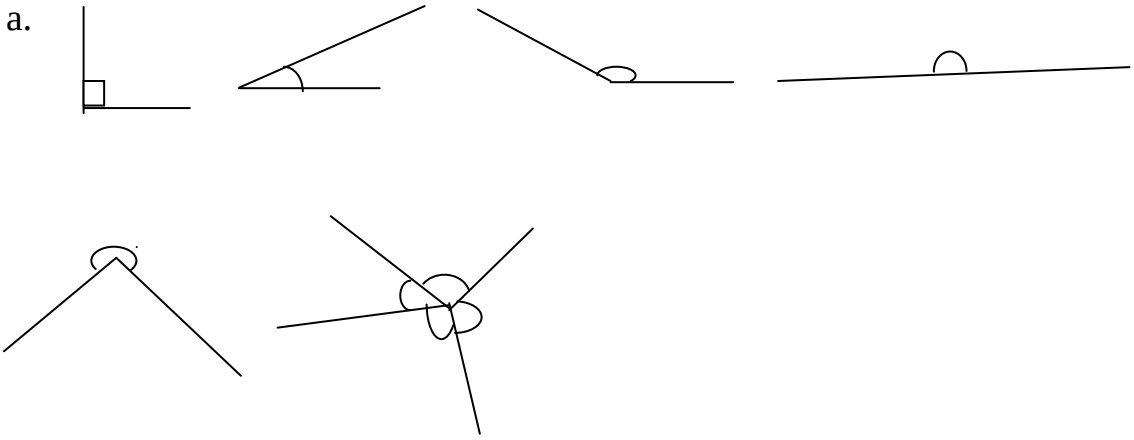
Introduction: briefly revise your last lesson by asking the students some appropriate questions, such as:

i. what is the difference between plane shapes and solid shape?

ii. List two types each

Step I: discus and guide the student on types of angles.

a.



1: angle one is a right angle of size 90^o or a quarter of a revelation.

2: angle number two is an acute angles formed from angle 90^o they are less than 90^o and greater than 0^o.

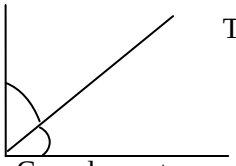
3: angle nO three is an obtuse angle; this angle is greater than 90^o but less than 180^o

4: angle number four is angle on a striate line; it is angle of size $180a^o$.

5: angle number five is an angle of size greater than 180^o and less than 360^o.

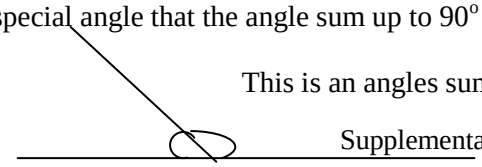
6: the number six angle is an angle at a point. When striate lines meet or intercept at a point an angles are formed angle at a point formed at 360^o he

Step II It is expected of the teacher to guide the students on the area of complementary angle and supplementary angle



This is are special angle that the angle sum up to 90^o

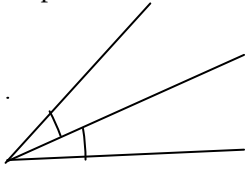
Complementary angle



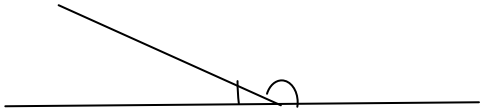
This is an angles summed up to 180^o

Supplementary angle

Step III students should be made known the adjacent of an angle as follow.



Two adjacent have angle have a side common to them.

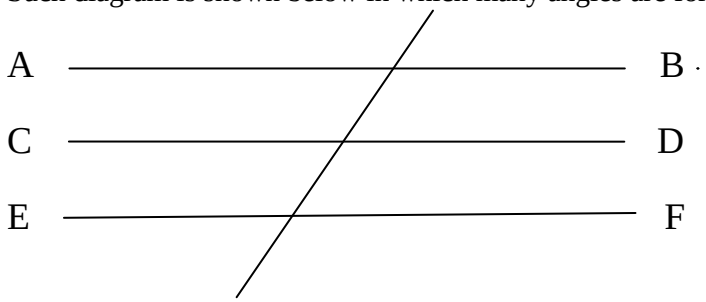


Adjacent angles on a straight line are supplementary that is they added up to $180^{o.}$

Step IV: he guides the students on angle form on a parallel line.

That two or more lines are said to be parallel when they are drawn on the same plane, they will never meet whatever the length of production. Parallel lines on the same surface have the same direction.

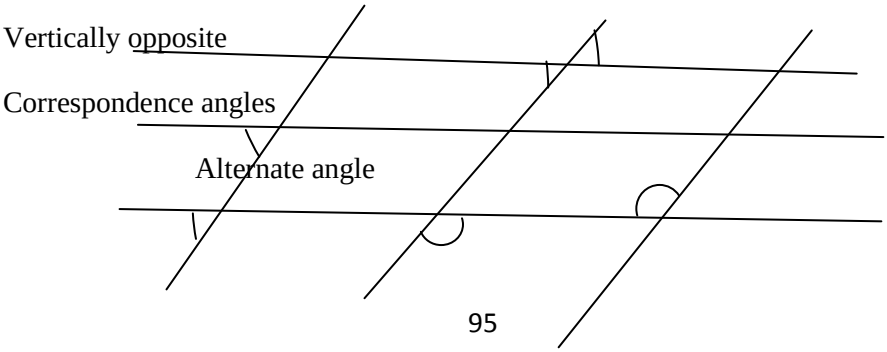
Two or more parallel lines, may have one or more lines drawn across the. Such line(s) are called **transversal**. Thus parallel lines having a transversal running across them are very important in basic geometry. Such diagram is shown below in which many angles are formed.



From the above diagram, line AB, CD and EF are the three parallel lines. The transversal T then cuts across three liners. At the points of intersection of the transversal T with the line AB, CD and EF, angles are formed.

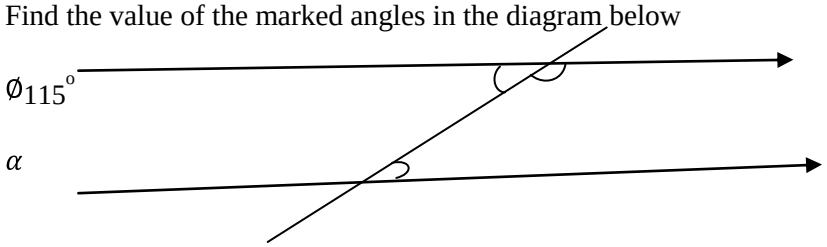
Some terms and relationships are therefore connected with the angles formed on the parallel lines as a result of the transversal cutting across them, which now form 1: corresponding angles alternate angles, and vertically opposite.

Step V: the teacher is expected to explain to the students what corresponding angles, alternate angles and vertical opposite angles are stand for and how they help us work or solve geometric problems.

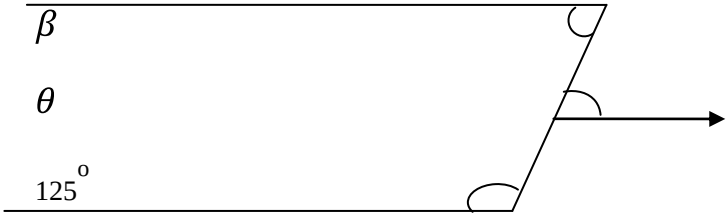


Step VI: he guide the students one examples

Find the value of the marked angles in the diagram below

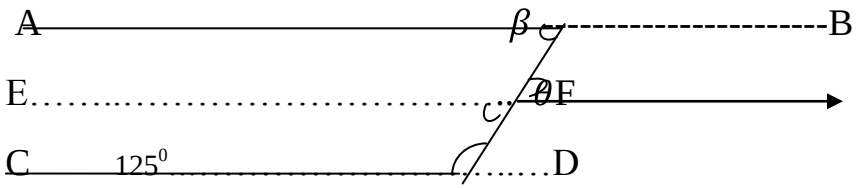


Hint: the students are expected to point out the following
1: angles on straight
2: alternate angles and their result.
He made them to detect the angle formed from the following angles.



Hint: He made the students to think of the following

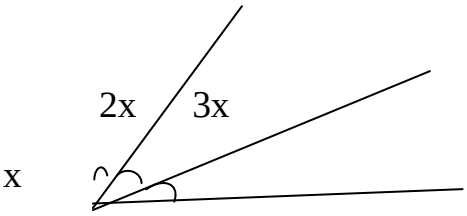
Sketch the angles as follow



2: the students should be able identified angle $< \beta$and $< \theta$ using alternate angle corresponding angles and vertically opposite angle. They should find the sum of interior angle of an angle.

Evaluation: the teacher evaluates the lesson by asking students the following questions to be sure of the students' understanding of the lesson.

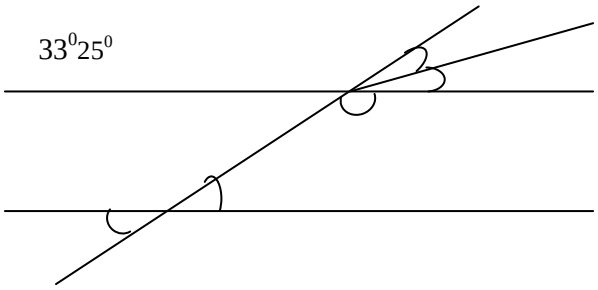
i. The sum of interior angle of a triangle is?
ii. The difference between alternate angle and corresponding angles.
iii. Solve for x in the following angles



Summary: the teacher briefly revises what he has taught so far for the benefit of the weak ones.

Assignment: the teacher asks students to solve the following:-

i.



Find the value of e, f, g.

ii. The difference between -3 and a number is 8. Find the two positive values for the number.

iii. The sum of three consecutive odd integers is 72. What are the numbers?

Lesson III

Topics: - work on angles

Objective: - At the end of the lesson, students should be able to solve problems involving angles.

Previous Knowledge: students have learnt types of angles.

Introduction: briefly revise your last lesson by asking the students some appropriate questions, such as:

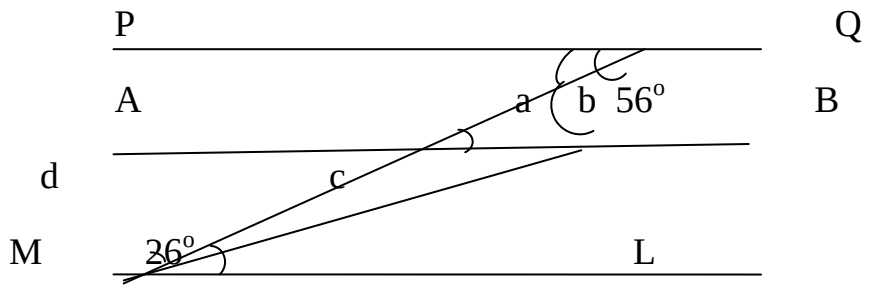
i. Formulate alternate angles on your notebook

ii. Formulate corresponding angles on your note book.

Presentation:

Step I: guides the student to solve the problem involving angles eg.

a. find the marked angles in the following:



Expected solution

Students are expected to point out alternate angle among the angles.eg

$<a$ is alternate to 26^o

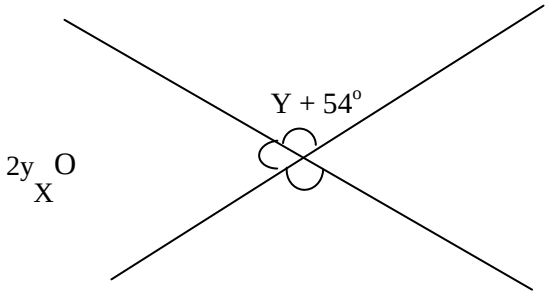
$\therefore <a = 26^o$.

The students are expected to discover that $<b = 58^o - 26^o = 32^o$, (value number on the same angle divided into two).

If $<a = 26^o => <c = <a = 26^o$ (alternate angles)

If $<b = 32^o => <d = <b = 32^o$ (alternate angles)

b: Find x and y from the following.



Solution: The students are expected to identified the angles on a straight line eg

2y, y and 54^o are on a straight line.

$\therefore 2y + y + 54^o = 180^o$

They are expected to collect the like terms as follow:

$2y + y = 180^o - 54^o => 3y = 126^o$

They are expected to make y the subject of the formula

$Y = 126^o/3 = 42^o$

In solving for x, they are expected to give the value of 2y

If $y = 42^o \Rightarrow 2y = 84^o$

For x and 2y being on the same line forming angle 180^o

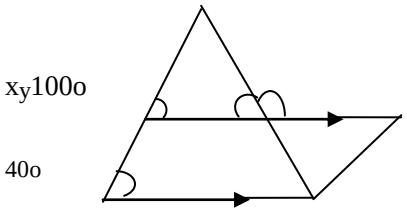
Shows that $x + 2y = 180^o$

Ie $x + 84^o = 180^o \therefore x = 180^o$

The students are likely to be more involve than the teacher. The teacher only guide.

Evaluation: the teacher evaluates the lesson by asking the following questions in order to be sure that they understood the lesson.

i. Find x and y from the following, give reasons for your steps.



ii. Find the angles marked with letters in the following diagram

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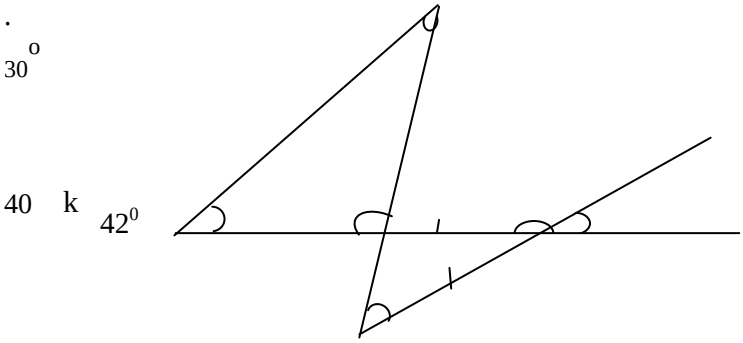


Summary: the teacher briefly summaries what he has done so far for the benefit of the weak one.

Assignment: the teacher asks students to solve the following:-

i. he gave the students works to do from their book pages 146 to 147. Numbers 1 - 5

Lesson IV

Topics: - Word problems in sum and difference

Objective: - At the end of the lesson, the students should be able to solve word problems on sum and difference of whole number.

Previous Knowledge: students have learnt how to translate word problems into numerical expression and vice versa

Introduction: briefly ask students some appropriate questions previous lesson, such as:

i. formulate word problems from the following $\frac{(3+8)-4}{2}$

ii. Translate the following word problem into numerical expressions. Take away fourteen from the product of five and seven,.

Presentation:

Step I: ask the students to solve the problems.

a. the sum of four consecutive number is 58, Find the number?

Ask: What are the numbers? The number must be one ahead each other.

Expected result: Let the numbers be n, n+1, n+2, n+3,

The students discover that:

N + (n+1) + (n+2) + (n+3) = 53

4n + 6 = 58

4n = 58 – 6 =>4n = 52

n= $\frac{52}{4}$

n = 13

Since n = 13, therefore the four consecutive numbers are?

Expected results are: 13, 14, 15 and 16.

b, find the sum of 12 and 9

Ask: what is the sum of 12 and 9?

Then let the sum be n

That is 12 + 9 = n

21 = n

c, Ojo bought 12 oranges from the market. His Daddy plucked 14 more Oranges for him from the garden, how many Oranges does Ojo now have?

Solution: Let the students lead the discussion given a variety ways in solving the problems.

What is the problem? State clearly:

Ojo bought 12 Oranges

Daddy plucked 14 Oranges

Ojo now has (12 + 14) Oranges

Ojo then has 26 oranges.

Ask: could we sum up that, the sum of a set of number is the result obtained when the numbers are added together?

Step II discuss and guide the students to solve problems involving both sum and difference.

a. given: the difference between 8 and another number is 17. Find the possible value, for the number.

Solution: **Expected workings are as follow:**

Assume the other number to be x

X – 8 = 17

Add 8 to both sides =>X – 8 + 8= 17+ 8

i. e x = 17 + 8

x = 25

Alternatively 8 – x = 17

Add x to both sides => 8 – x + x = 17 + x

8 = 17 + x

Take 17 from both sides => 8 – 17 = 17 – 17 + x

∴ x = -9

Thus the number could be:

Expected result 25 or -9

b, Safiya was given 42 groundnuts by her friends. She gave 20 of them to her brother, Faisal. How many groundnuts does Safiya have left?

She has (42 - 20)g/nuts left

She has 22 g/nuts left

The students generalized by saying that the difference between two numbers is the result of subtracting one from the other. It is usual to subtract the smaller number from the larger. This gives a positive difference

Summary: the teacher briefly revises what he has done so far for the benefit of the weak ones.

Evaluation: the teacher evaluates the lesson by asking the following questions in order to be sure that they understood the lesson.

i. The sum of three consecutive numbers is 63. Find the numbers.

ii. The difference between 12.6 and a number is 5.4. Find the two positive value of the number.

Assignment: the teacher asks students to solve the following:-

i. The sum of four odd numbers is 80. Find the numbers.

ii. The difference between -3 and a number is 8. Find the two positive values for the number.

iii. The sum of three consecutive odd integers is 72. What are the numbers?

LessonV

Topics Word problems on product and quotient of whole numbers

Objectives: At the end of the lesson, the students should be able to solve word problems on product and quotient of whole numbers.

Previous Knowledge: The students have already learnt how to solve word problems on sum and difference of whole numbers

Introduction: The teacher introduces the lesson by asking students to solve word problems on sum and difference of whole numbers. For instance, the sum of three consecutive odd numbers is 72. What are the numbers?

Presentation:

Step I One third of number added to four-fifths of itself is equal to 17 find the number.

Solution: Let the students think of the number themselves

The discovered number is x

One third of x = $\frac{x}{3}$

Four fifth of x = $\frac{4x}{5}$

Then the expected work is

$\frac{x}{3} + \frac{4x}{5} = 17$ allow the students to think of the LCM of 3.5 and 1 which is 15.

Let them multiply the equation through by the LCM (15)

$15x \frac{x}{3} + 15 \text{ x } \frac{4x}{5} = 15 \text{ x } 17 = 5x + 12x = 255$

This gives 17x = 255 Divide through by 17

$X = \frac{255}{17} => x = 15$

Step II : give them another example

A man is four times as old as his son. In four years time he will be three times as old. How old are they?

Solution: The students are expected to discover the age of the son to be y. then they are expected to give the father's age to be 4 x y = 4y.

In four years time, their age will be

Father = 4y +4

Son = y + 4

Then 4y + 4 = 3(y + 4)

Expound and collect the like terms.

4y + 4 = 3y + 12 = 4y – 3y = 12 -4 => x = 8

Therefore their ages are now

Sun = y = 8

Father = 4y years = 4x8 years = 32 years.

Evaluation: Yesterday was Mrs. Ojo's birthday. She bought 32 sweet to share equally among her four (4) children. How many did she give each child?

Lead the Students through, by asking leading questions

Such as: How many sweets did Mrs. Ojo buy?

How many children does she have?

She gave each child (32/4) sweets.

The teacher sees that they are able to solve the problem.

Summary: the teacher reviews the entire lesson briefly for all the students' understand.

Assignment: the teacher uses these tests to measure student's ability to discover new ideas

a) If I divide a number by 3, and I remove 12 from the result I got 29 as the answer, what number did I divide by 3?

b) Miriam and Isa have 82 groundnuts between them Isa has 4 more than Miriam. How many has Isa?

The teacher should provide reading, research, or investigations in which ideas are explained independently.

Lesson VI

Topic: The combination of product with sums and differences in word problems.

Objectives the students should be able to solve word problems combining products with sums and differences.

Previous Knowledge: the students have learnt how to solve wold problems with the products and quotient of whole numbers

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

Presentation:

Step I ask students variety of questions such as: Find the positive difference between 31 and the product of 4 and 14

What is the product of 4 and 14?

Product of 4 and 14 = 4 x 14 = 56

What is the difference between 31 and56?

The difference between 31 and 56 = 56 – 31 = 25

Note that the problem is to find the differences between 31 and a product. Therefore, Find the product first (4 x 14). 31 is equivalent to "positive difference between 31 and the product of the 4 and 14".

Step II : give them more examples. Find the product of the 11 and the positive difference between 4 and 10

Ask: what is the positive difference between 4 and 10?

The Positive difference between 4 and 10 => 10 – 4 = 6.

What is the product of 11 and 6?

Product of 11 and 6 = 11 x 6 = 66

Note that the problem is to find the product of 11 and positive differences therefore, find the difference between first

Hence 11 x (10 - 4) is equivalent to the "product of 11 and the positive difference between 4 and 10".

Consider the following example also.

a) Find the sum of .9 and the product of 1.7 and 3

Sum = .9 + (1.7 x 3) 0.9 + 5.1 = 6.0

b) Find the product of $\frac{1}{7}$ and the sum of $\frac{3}{5}$ and $1\frac{1}{2}$

The product = $\frac{1}{7}$ x ($\frac{3}{5}$ + $1\frac{1}{2}$) => $\frac{1}{7}$x ($\frac{3}{5}$ + $\frac{3}{2}$) = `$\frac{1}{7}$ X ($\frac{6}{10}$ + $\frac{15}{10}$)

$= \frac{1}{7} \text{ x } \frac{21}{10} = \frac{3}{10}$

c) Find the positive difference between the sum of 1.6 and 2 and the product of 7 and 0.4

The differences = (1.6 + 2) - (7 x 0.4)

3.6 – 2.8 = 0.8

Teacher stimulated the thinking of the students using dialogues wherever they are solving the above problems on the B.B (chalk board) through questions and hints if possible.

Guesses, conjecture, trail and error will be used to search for ideas and to relate these new ideas to previous concept.

Summary: teacher review briefly the whole lesson to ensure that they have understood the concept.

Assignment:

The teacher then gives them the following work to do.

1) Find the product of 5 and the difference between 15 and 17
2) Find the difference between the product of 0.6 and the sum of 0.6 and 0.4
3) Find the sum of 29, the product of 2 and 9 and the difference between 2 and 9

Lesson VII

Topic word problems involving fractions

Objective: at the end of the lesson the students should be able to solve and simplify word problems involving fractions.

Previous Knowledge: the students have learnt how to add and subtract fractions.

Introduction: the lesson is introduced by dissecting with students the numerical interpretation of word problems using equations and brackets where necessary.

Consider thus: one tenth of the sum of 5 and 8 is the same as $\frac{5+8}{10}$

Given the students to formulate and interpreted word problems as done below

1) Find the sum of x and 4 (ans. Is x + 4)
2) Find one ninth of the difference between the sum of 2 and 7 and number 3 (ans. $\frac{(2+7)-3}{9}$)

Common and familiar examples should be used when teaching common fractions to facilitate understanding.

Presentation:

Step I: consider the following example

a) In a class containing 32 students, a student can do either Government or History or both. If 16 students do Government 18 do History and 3 do none of the subject, find how many do both.

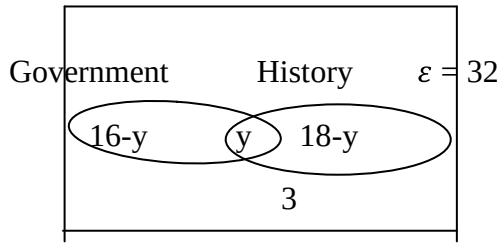
Solution: make the students to reason out the number of the that do both subject

Let the number be y and ∪ = 32

Government n(G) = 16

History n(H) = 18

Neither n(G∪H) = 3



The students are expected to solve the work as follow

n(G) + n(H) + n(G∪H) + 3 = 32

=>16-y + 18-y + y + 3 = 32

37 – y = 32

y = 37 – 32 = 5 => y = 5

b) In the family of eight, one-eight of the members are very tall, and one-quarter of them are very short. The rest are of average in height. How many are of average heights in that family?

Solution: $8(1-1/8 – ¼) = 8(\frac{8-1-2}{8})$

$8(8-3)/8 = 8-3 = 5$

Step II the teacher gives more example such as:

What number is greater than half of 7 and 11?

Solution: let the number be represented by x ask them what is half of 7?

Half of seven is 7/2

∴ x – 7/2 + 7/2 = 11 + 7/2

$X = 11 + 7/2 = \frac{22+7}{2}$

$= \frac{29}{2} = 14\frac{1}{2}$ that is the number is $14\frac{1}{2}$

Another example: what is the number such that as that when 5/6 of it is subtracted from $3\frac{1}{2}$ the result is the same as when 2/3 of it is added to it.

Solution: allow the students to attempt it.

Let the number be x

Then, ask them 5/6 of the number and 2/3 0f the number are what?

The 5/6 of the number and 2/3 of the number is

$\frac{5}{6} \times x$ **And** $\frac{2}{3} \times x$

Then, $3\frac{1}{2} - \frac{5}{6}x = \frac{2}{3}x + x = \frac{5}{2} - \frac{5}{6}x = \frac{2}{3}x + x$

$=> \frac{5}{2} - \frac{2}{3}x + x + \frac{5}{6}x = {}^{5}/_{2} = (\frac{2}{3} + \frac{5}{6})x$

THAT IS $\frac{5}{2} = \frac{(4+6+5)x}{6} = {}^{5}/_{2} = {}^{15x}/_{6}$

$\therefore \quad x = \frac{5}{2} \times \frac{6}{15}$ SHOWS THAT $x = \frac{3}{3} => x = 1$

Therefore the number is one.

Summary: the teacher reviews the lesson once more to help the weak ones.

Assignment: the following is the class activity and assignment.

a) Find one ninth of the difference between 49 and 13 (ans 4)
b) Find one third of the sum of product of 12 and 5.
c) Find one-eight of the sum of 14, 15, and 19.
d) Find the quarter of the difference between 17 and the square of 3
e) Find one third of the difference between 29 and the sum of 11 and 6

Lesson VIII

Topic: more word problems involving simple algebraic fractions

Objective: at the end of the lesson students should be able to solve word problems involving simple algebraic fractions.

Previous Knowledge: the students have learnt how to solve word problems involving fractions

Introduction: Introduces the lesson by considering problems involving algebraic fractions that could be written in the form of statements. For instance the average cost of certain number of books is #250.00. The total cost can be written as #250.00n if n is the number of books

Presentation:

Step I: consider this example, the average cost of a number of pencils is 50k, if all the pencils cost #20.00, find the total number of pencils.

Solution: let the number of pencils be x

Average cost of pencils = $\frac{\#20}{x}$

Convent this to kobo

#20/x = 20/x X 100

Hence $50 = \frac{20\ x\ 100}{x}$

Multiply both sides by x

50x = 2000

Divide both sides by 50

${}^{50x}/_{50} = {}^{2000}/_{50}$

$\therefore \quad x = 40$

There are 40 pencils on the whole

Consider another example for students.

If the average weight is 30kg, find the number of the boys

Solution: let the number of the boys be n

Total weight = 1200kg

Then the average weight = 1200/n

That is 30 = 1200/n

Solve for n we have

30n = 1200

Then, $30n/30 = \frac{120}{30}$ n = 40 there are 40 boys.

The students should be able to deduce that when solving word problems or simple equations involving fractions, the following should be considered.

1). what is the unknown

2). Choose a latter that can represent on known

3). Write the statement into an equation form

4). Solve the problems

Summary: go over the lesson briefly for the weaker ones to understand better.

Assignment:

1). A hunter kills x numbers of bush rats, the total weight of these is 48kg. What is the average weight of the animals in the terms of x (ans 48/x kg)

2). The total cost of a number of school bags is #56.00. Each bag costs #2.00.
a), write one equation connecting the #56.00 and #2.00 and the number of school bags (ans. 56/x = 2)
b), find the number of school bags (ans. 28)

3). a man but a shirt each for his sons at a total cost of #32.00. If the average cost of the shirt is #4.00 how many sons does the man have? (ans. 8)

Lesson IX

Topic: Further word problems involving fraction equations

Objective: at the end of the lesson, students should be able to:
I). translate word problems involving fraction equations as well as mathematical statements,
II). Solve word problem involving fractional operations.

Previous Knowledge: the students have learnt how to solve word problems involving simple algebraic fractions.

Introduction: The teacher introduces the lesson by asking relevant questions on the previous knowledge.

Presentation:

Step I: the teacher informs the students that in this lesson they will consider more difficult problems involving fractional algebraic equations.

Example 1 a certain car covers 10 km at a certain average speed. If this average speed is reduce by 30km/h, the car takes the same amount of time to cover a distance of 6km. find the speed of the car in the first part of the journey.

Solution: the teacher guides the students to identify the key or essential statements in word problems and should be written out on the chalk board, then, their translation into symbolic statements can be done by bit.

Let the speed for the first part = a km/h

∴ The speed for the second part = (a – 30km/h)

Time taken by first car to cover 10km = 10/ah

Time taken by second car to cover 6km = 6km (a - 30)/h

These times are the same, in both journeys

∴ $10/a = 6/(a - 30)$

This equation can now be easily solved as follows

Find the LCM of a and (a - 30)

LCM =a(a - 30)

Multiply both sides by a(a - 30)

(a - 30) x 10 = 6 x a

In expanding we obtain

$10a – 300 = 6a \Rightarrow 10a – 6a = 300$

$4a = 300$

$a = 300/4 \therefore a = 75$km/h

The speed in the first part of the journey is 75km/h

Example II: A boy circled 12km at a certain average speed.

He then increases his speed by 4km/h and takes the same time to travel 15km. find his speed for both parts of the journey.

Solution: the problem is to find the boy's speed. Let his speed for the first part of the journey be v km/h

Then, his speed for the second part of the journey is V + 4km/h

(From the second sentence of the question)

Time taken for the first part = 12/Vh

Time taken for the second part = 15/(V + 4)h

The two times are the same, thus

12/V = 15/(V = 4)

Multiply both sides by their LCM

The LCM = V(V + 4)

12(v + 4) = 15v

12v + 48 = 15v

48 = 15v – 12v = 48 = 3v, v = 16.

His speed for the first part of the journey was 16km/h and for the second part 20km/h

Activities: student should attempt the following.

1) When full, a car's petrol tank holds k liters
After using 15 liters, the remaining petrol is enough for the car to travel 34km.
a) Express the amount of petrol in terms of k (ans. K – 15 liters)
b) Hence express the distance that the car travels in terms on one liter of petrol in terms of k (ans. 344km) k-5
c) If the car travel 80km liter, find the values of k (ans. K = 58)
2) A man ddrives 146km at a certain average speed. He then increases this speed by 9km/h and takes the same time to travels the next 164km. find his speed for the both parts of the journey (asn. 73 km, 82km/h)
3) A man travels 29km on an open road at a certain average speed, in the city, he reduces his average speed by 42km/h and find that it took him the same time to cover 15km. find his average speed.
a) On the open road (ans. 87km/h)
b) In the city (ans. 45km/h)

Summary: The teacher explains to the students that in this lesson they have studied how to solve problems on simple equations involving fractions. The simple equations involve monomial and binomial denominators. He then guides them to conclude that the following steps may be necessary whenever they are solving word problems.
1) Find the LCM of all the denominators
2) Multiply each term in the equation by the LCM
3) Simplify and solve the resulting equations.

Lesson X

Topic: Further word problem involving fractions.
Objective: At the end of the lesson, the students should be able to:
1) Translate word problems involving fractions into mathematical statements
2) Solve word problems involving fractions.

Previous Knowledge: They have learnt how to translate word problems involving fractions
Introduction: The teacher asks relevant question on the previous knowledge.
Presentation:
Step I: the teacher discuss with class when solving problems on this kinds, what do we look for?
Choose a latter to stand for the unknown. Change the statement in question into algebraic expressions. After such discussion with the students, consider these examples.
Example 1: 30 are divided by the sum of three (3) and x, if the result is 5, what is the value of x?
Solution: what is the sum of three and x? The sum of three and x is $3 + x = ?$

What is 30 divide by the sum of 3 and x to give the result to be 5 is $\frac{30}{3+x}$ = 5

Multiply both sides by (3 + x)

(3 + x) x $\frac{30}{3+x}$ = 5(3 + x)

30 = 5(3 + x)

To expended the RHS and solve => 30 = 15 + 5x

Subtract 15from both sides

30 – 15 = 15 + 5x - 15

15 = 5x

Divide both sides by 5 => $\frac{15}{5} = \frac{5x}{5}$

∴ 3 = x => x = 3

Example 2: A boy is 24 years younger than his father and in 2 years time, the sum of their ages will be 40

How old is his father and the son now?

Solution: let the father's age be (x + 2) years, the son (x – 24 + 2) years respective.

But the sum of their ages is 40 years,

Thus: (x + 2) + (x – 24 + 2) = 40

X +2 + x - 24 + 2 = 40

X + x + 2+2 – 24 = 40

2x – 20 = 40 =>2x = 40 + 20 = 2x = 60

2x = 20 => x = 30.

Therefore the father is 30 and the son is (30 - 24) years or 6 years old.

Example 3: A boy is older than his sister by three years, 5 years a go, the ratio of their ages was 4:3. Find their present ages.

Solution: let the boy's age be x and the sister' sage be (x - 3)

Five years ago, the boys age was (x-5) years and the sister was (x-3)-5 i.e (x - 8)

If the ratio of their age is 4:3 then $\frac{x-5}{x-8} = \frac{4}{3}$

The LCM of (x - 8) and 3 = 3(x - 8)

Multiply both sides by the LCM

We have 3(x - 8) x $\frac{x-5}{x-8}$ = 3(x - 8) x $\frac{4}{3}$

Expanding both sides

3x – 15 = 4x – 32

I.e 3x – 15 + 15 = 4x – 32 + 15

i.e 3x = 4x – 17

3x – 4x = 4x – 17 -4x

-x = -17 multiply both sides by -1

-1(-x) = -1(-17) => x = 17 and x – 3 = 14.

So the boy's age is 17 years and his sister's age is 14 years.

The teacher should emphasize this steps involving multiplication by (-1) and discourage students from saying "minus cancel minus"

Example 4: A man is five years old than his wife, 4 years ago the ratio of their age was 7:6. Find their present ages.

Solution: the problem is to find their ages, let the age of the man be y years. Then the age of his wife is y – 5 years. (Form the first sentence of the question)

Then, 4 years ago their ages were as follows

Man's age is (y - 4) years

Wife's age is (y - 4) – 5 => y – 9 years

Thus the ratio of their age 4 years ago was 7:6

Multiply both sides by 6(y -9) being the LCM

$6(y - 4) = 7(y - 9)$

Thus, $6y – 24 = 7y – 63 \Rightarrow 63 – 24 = 7y – 6y$

$39 = y$.

The man's age is 39 years and his wife's age is 34 years.

Summary: the teacher briefly reviews the lesson for proper understanding of the weak ones.

Activities: solve the following word problems.

1) The weight of a man and the son differ by 12kg and are in the ratio of 9:6. Find the weight of each. (ans. Man's weight is 37kg, son's own is 15kg)

2) A woman is 25 years older than the son.
   a) If the son is x years, find the age of the mother.
   b) Find their respective ages if the ratio of their ages 4 years ago was 5:2 (ans. X + 25, b, woman's 452/3 son's 202/3)

3) The difference between the heights of a man and the son is 0.4cm. if the father is taller than the son and the ratio of that height is 4:3. Find the height of the son.

4) A man is thirty years older than his gardener.
   I): If the gardener is x years old, how old is the man. (ans. (30 + x))
   II): Express the age of the man 6years ago in terms of x (ans. (24 + x))
   III): Express the age of the gardener 6years ago in terms of x. (ans: x - 6)
   IV): 6years ago, the ratio of their ages was 5:3. Find their ages. (ans. Man's age is 81, gardener's age is 51).

Lesson XI

Topic: Solving algebraic on word problems

Objective: At the end of the lesson the students should be able to: Solve word problems involving algebraic equations

Previous Knowledge: the students have learnt how to solve word problems involving algebraic fraction.

Introduction: the teacher asks questions from the students, previous knowledge.
Presentation:

Step I: The teacher guide the students through two examples to illustrate word problem can be solved by algebraic method.

Example 1: I think of a number I add 6 to it, the result is ten. What number did I think of?

Solution: Ask the student if the above problem can be express using fewer words? The expected result is, yes, it can be solve using fewer words.

Let the number be x

Add six the result is ten, can be translated into $x + 6 = 10$. Find x.

Example 2: John is six (6) years older than Paul. How old is Paul if John's age is three times Paul's age

Solution: can we reduce the problems? Yes.

Suppose Paul is x years old? Then John is $(x + 6)$ years old. Alsa john is $3x$ years old, then $x + 6 = 3x$

This problem, which is rather difficult to solve by arithmetic methods, is now reduced to a simpler equation. We refer to problems which are best solved by algebraic method as algebraic problems let the students use as many examples as possible, such as:

I): Isa is 3cm taller than Bello, if Bello is x cm tall, then Isa is $(3 + x)$cm tall.

II): peter is three times as tall as Moses. If Moses is x meters tall, then peter is $3x$ meter tall

III): Mairo and Janet together have #42.00. If Mairo has #y then Janet has #$(42 - y)$

IV): Mariam a year old, four years ago her age was $(a - 4)$ yearsm, and so on.

Having had practice in writing expression of certain number in terms of other numbers. Now we shall proceed to solve problems using algebraic method.

Example 1: the sum of two numbers is 24, twice the first plus the second is 26. Find the numbers

Solution: if x is the first number, then $(24 - x)$ is the second number. But twice the fist plus the second is 26.

Thus: $2x + (24 - x) = 26$

$2x + 24 – 24 - x = 26$

$24 – X = 26 – 24 \Rightarrow x = 2$

Therefore the numbers are 2 and $(24 - 2)$ or 22.

Example 2: the product of a certain number and 5 is equal to twice number subtracted from 20. Find the number

Let the number be x?

The product of x and 5 is $5x$

Twice x subtracted from 20 is $20 - 2x$

Thus: $5x = 20 - 2x$

Adding $2x$ to both sides we have

$7x = 20$ divide both side by 7

$X = 20/7 = 2\frac{6}{7}$

Example 3: A rectangular field which is 50 meters wide, requires 260 meters of fencing how long is the field?

Solution: If the field is x meters long, then the total length of the fence around the field is $(x + 50 + x + 50)$m

But, the total length of the fence is 260 meters.

Thus: $x + 50x + 50 = 260$

$2x = 160 \Rightarrow x = 80$.

Therefore, the field is 80 meters long.

Activities: 1) A certain number is less than another by 3. If their difference is 38, find the numbers. Ans, (20, 17).

2): The sum of a number, three times the number, and five times the number is 171. Find the number. Ans(19)

3): I think of a certain number. If I multiply it by 6, add 8 to the product and double the sum, I will get 40 what is the number? Ans. Is (2)

4): the sum of two consecutive even numbers is 54. Find the number. Ans. Is (26, 28)

5): the sum of two consecutive odd numbers is 20. What are the numbers? Ans. Is (103, 105).

Summary: the teacher review the lesson once more to help the weaker ones

Lesson xii

Topic: Application of word problems from everyday situations

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

i): solve word problems from everyday situations.

ii): Formulate word problem from everyday situations

Previous knowledge: the students have learnt how to sole word problems involving equations

Introduction: the teacher asks the students few questions base on the previous knowledge.

Presentation: the teacher presents the lesson in steps.

Step I): the teacher create situation such as: A girls hears that by selling a carton of milk a hawker gains #15.00.

Let the students generate problem or formulate a problem. For example;

Example I problem: if a girl needs #180.00 for her school fees and pocket money for nest term, how many cartons of milk should she sell during the holiday to get the #180.00?

Solution: refer to her #15.00 is gain from selling one carton.

#180.00 is the total gained from selling $\frac{\#180.00}{\#15.00}$ cartons = 12 carton.

Example 2 situation: A boy needs six 80 leaves exercise books, four biro pen two pencils a learner's dictionary for school nest term.

Problem: if 80 Leaves exercise books cost #1:50 each, biro cost 40k each and pencil cost 20k each and learner's dictionary cost #20.00 how much money does the boy needed for all the items?

Solution: 6(#1.5) + 40k(4) + (20kx2) + #20

= #9.00 + #1.60 + 40k + #20

= # 31 ∴ the boy needs #31.00.

Step II Assist and guide the students in creating situations and problems that come up daily in their lives. For example

Example II) situation: cost of living raised by 75%

Problem: last year our family experiences amounted to #400.00 a month. Now the cost of living has rising by 75%. If we wish to maintain the same living standard, how much extra do my parents need every month?

Solution: Extra money require per a month is

75% of #400.00

I,e 75/100 x #400

= 75 x # 4.00 = #300.00.

The family needs extra #300.00 per month

Example 2) situation: mother wants to prepare lunch most of the things she need are at home but she needs to buy 5 cups of rice and 3 cops of beans.

Problem: If the rice cost 75k per cup and beans cost 60k per cup, how much money does she need for five cups of rice and 3 cups of beans?

Solution: 5 x 0.75k + 3 x 0. 60k

#3.75k + #1.80 = #5.55k

Mother needs #5.55k

Activities: the teacher asks the student to formulate word problems for the following every day situation.

1) The cost of rice goes downing by 25%
2) Daddy spends #500.00 every week on petrol.
3) A family has a dog and cat. It cost to feed the dog and cat #5 per day.
4) A man pays his laborers #240 per day
5) Ibrahim spends #15.00 every day on transport to work and back.

Lesson xiii

Topic: Application of word problems from every day situation.

Objective: the students at the end of the lesson should be able to: solve word problems from everyday situation.

Previous Knowledge: The students have learnt how to formulate and solve word problems from everyday situation.

Presentation:

Step 1: the teacher states some problems on the chalk board and asks all the students to discuss and come out with some facts.

Example 1: A motorist drives from point A to point B a distance of 15km in 24 minutes. Where the road is good, he drives at the speed of 45km/h and at 30km/h where the road is rough. Find the number of kilometers of bad or rough road.

Solution: let the x km represent the good road and (15 – x), the bad road.

But, on x km road, the motorist goes at 45km/h

Time taking on x km is $\frac{x}{45}$ km/hours and on (15 - x) km road, he goes at 30km/h

Hence, time taken is (15 - x)/30hours.

A total time taken on 15km road is 24 minutes. $(\frac{24}{60})$ hours = 2/5 hours.

$\therefore$ $\frac{x}{45} + \frac{(15-x)}{30} = \frac{2}{5}$

Bring the students mind to the removal of the denominator through the lowest common multiples. The lowest common multiple of 45,30 and 5 is 90 that is

$\frac{x}{45} + \frac{(15-x)}{30} = \frac{2}{5}$ $\Rightarrow$ 2x + 3(15 - x)= 2 x 18

2x + 45 – 3x = 36 collecting the like terms

45 – 36 = 3x – 2x that is 9 = x

Therefore x = 9.

The rough road is (15 - 9) km = 6km

Step II: the teacher revises all the formulas for finding areas of planes of difficult shapes

If possible write them out on the chalk board for the students. This will enable them to solve and understand the nest problem better.

Example I): square tiles, 30cm, are used to cover a floor. How many tiles are needed for a floor of 4.4m long and 3.8m wide?

Solution: length of room = 4.4m = 4.4 x 100cm = 440cm.

Number of tiles 440/30 = $14\frac{2}{3}$

Thus, 15 liters are needed along each length of the room (the last tiles will be cut).

Width of the room = 3.8m = 3.8 x 100cm = 380cm

Number of tiles = 380/30 = $12\frac{2}{3}$.

Thus, 13 tiles are needed across each width of the room.

The total number of the tiles needed = 15 x 13 = 195.

Example 2): A motorist travels 64km/h at a certain speed. She then decides to increase her speed by 10km/h to enable her to arrive at her destination 72km away on time. If the time taken is the same for both parts of the journey, find

a): Her speed for the first part of the journey

b): Her speed for the second part of the journey

Solution: Let her speed for the first part of the journey be x km/h

Then, Her speed for the second part of the journey is (x + 10) km/h.

She takes $\frac{64}{x}$ km/hour for the first part of the journey and $\frac{72}{x+10}$km/h for the second part of the journey

But, She takes the same time to do each part of the journey.

So, 64/x = 72/(x + 10)

a): 64(x + 10) = 72x

Multiply both sides by the km x(x + 10)

64x + 640 = 72x

72x = 64x + 640

Add (-64x) to both sides

72x – 64x = 64x – 64x + 640

8x = 640 => 8x/8 = 640/8; X = 80

Her speed for the first part of the journey is 80km

b): Her speed for the second part of the journey is (80 + 10)km/h, that is 90km/h.

Example 3: A farmer must deliver 1200 bushels of products to town. He has two loads the larger trucks breaks down, how many trips must the farmer make in the smaller truck if it started after the large truck broke down?

Solution: ask the class the following questions:

How much is carried by the larger truck?

How much is carried by the smaller truck?

How do we solve the problem?

You are ready to choose a variable and solve the problem.

Let t be the number of trip for the smaller truck. In two trips the larger truck delivers 300 bushels.

Therefore 300 + 115t = 1200

115t = 1200 – 300, 115t = 900

T = 900/115 = 7.8

The farmer makes eight trips in the smaller truck after the larger truck broke down.

Summary: briefly revise the lesson for the class.

Activities: let the students attempt the following on their own.

1): A farmer produces 7,315kg of rice from cultivating a certain number of hectares on a piece of farm land and 1,650kg from cultivating twice the

number of hectares on another land. Find the number of hectares the farmer cultivated altogether if the average produce per hectare is 33kg expected ans. Is ($27\frac{1}{6}$)

A distributor must mail 975 cassettes to the same address these cassettes must be shipped in either a large carton (holding 125 cassettes) or a smaller one (holding 75 cassettes). How many small cartons are necessary if there are only five large cartons available? Expected ans. Is (5 small cartons are needed)

3): A motor cyclist travels 48km at a certain speed. He then decides to decrease his speed by 3km/h to travels the remaining 42km. If five km is the same for both parts of the journey, find the speed for the first part of his journey?

4): A rectangular compound, 8.55m long by 5.89m wide is to be paved with the largest possible square tiles, which will fit in exactly. How many tiles will there be? (Hint: express 855 and 589 as products of prime numbers) expected ans. Is (1,395).

Appendix va

The Result of Mathematics Achievement Test Collected for the Study from Selected Schools

GSS KWALI ON G/DISCOVERY: 96, 88, 77, 79, 67, 70, 67, 67, 66, 56, 47, 46, 48, 49, 37, 37, 39, 38, 36, 26, 28, 20, 19

GSS KWALI ON EXPOS: 88, 78, 77, 69, 68, 67, 67, 66, 58, 58, 56, 46, 47, 48, 47, 40, 39, 36, 47, 36, 28, 26, 18, 17

GSS YANGOJI ON G/DISC: 87, 87, 88, 78, 77, 76, 77, 69, 68, 68, 67, 66, 60, 49, 49, 50, 48, 47, 47, 46, 38, 26, 26, 16

GSS YANGOJI ON EXPOSITORY: 79, 78, 66, 67, 67, 56, 58, 58, 58, 46, 47, 47, 49, 48, 46, 46, 38, 26, 27, 19

GGSS D/SANGWARI ON G/DISCOVERY: 86, 79, 78, 76, 76, 69, 68, 68, 56, 49, 48, 47, 47, 46, 48, 47, 36, 37, 28, 19

GGSS D/SANGWARI ON EXPOS: 87, 67, 68, 57, 56, 56, 57, 58, 58, 49, 47, 48, 47, 48, 46, 46, 49, 39, 36, 28, 26, 27, 17

GDSS BWARI ON GUIDED DISCOVERY: 98, 88, 89, 76, 77, 78, 68, 68, 70, 69, 56, 58, 49, 46, 47, 49, 38, 38, 37, 36, 26

GDSS BWARI ON EXPOSITORY: 86, 76, 78, 66, 56, 57, 59, 57, 56, 46, 46, 48, 46, 49, 46, 47, 39, 36, 38, 37, 26, 27

The Result of Mathematics Achievement Test on Averted Students Taught Under Each Method

Score of High Mathematics Aversion Students under Discovery

76, 69, 56, 56, 50, 49, 49, 49, 49, 49, 48, 48, 48, 47, 47, 47, 47, 47, 47, 47,46, 46, 46, 46,39, 38, 38, 38, 38, 37, 37, 37, 37, 36, 36, 36, 28, 28, 26, 26, 26, 26, 20, 19, 19, 16

$\bar{X}$ = 39.2 δ = 12.22. n = 46

Score of Low Mathematics Aversion Students under Discovery

98, 96, 89, 88, 88, 88, 87, 87, 86, 79, 79, 78, 78, 78, 77, 77, 77, 77, 76, 76, 76, 70, 70, 69, 69, 68, 68, 68, 68, 68, 68, 67, 67, 67, 67, 66, 66, 60, 58, 56, 48, 49,

$\bar{X}$ = 56.11 δ = 14.20. n = 49

Score of High Mathematics Aversion Students under expository

88, 87, 86, 79, 78, 78, 77, 76, 69, 68, 67, 67, 67, 67, 66, 66, 66, 59, 58, 58, 58, 58, 57, 56, 56, 57, 57, 57, 56, 56, 56, 49, 49, 49, 48, 48, 47, 47, 46, 46, 46, 46, 48, 46, 37, 36, 36, 28, 26,

$\bar{X}$ = 71.45 δ = 11.35. n = 42

Score of Low Mathematics Aversion Students under expository

78, 67, 68, 58, 58, 58, 56, 49, 48, 48, 47, 47, 47, 47, 47, 46, 46, 46, 46, 46, 40, 39, 39, 39, 38, 38, 37,36, 36, 28, 26, 27, 27, 27, 26, 26, 19, 18, 17, 17

$\bar{X}$ = 39.5 δ = 14.11. n = 40

Summary of Frequency Distribution Score on Mathematics Achievement Test taught under Guided Discovery Method.

The Result Collected School by Schools Separation of the Result Under High And Low

Scores	Freq.	Kw	Ya	DS	Bw
95.5	2	1	-	-	1
85.5	7	1	3	1	2
75.5	13	2	4	4	3
65.5	17	5	5	3	4
55.5	5	1	1	1	2
45.5	22	4	7	7	4
35.5	12	5	1	2	4
25.5	6	2	2	1	1
15.5	4	2	1	1	-
	88	23	24	20	21

Scores	High	Low	Total
95.5		2	2
85.5		7	7
75.5	1	12	13
65.5	1	16	17
55.5	2	3	5
45.5	20	2	22
35.5	12		12
25.5	6		6
15.5	4		4
	46	42	88

Summary of Frequency distribution score on mathematics achievement Test Taught under expository method.

Scores	Freq.	Kw	Ya	DS	Bw
95.5	-	-	-	-	-
85.5	3	1	-	1	1
75.5	6	2	2	-	2
65.5	11	5	3	2	1
55.5	18	3	4	6	5
45.5	26	4	7	8	7
35.5	12	5	1	2	4
25.5	9	2	2	3	2
15.5	4	2	1	1	-
Total	89	24	20	23	22

Scores	High	Low	Total
85.5	3	1	3
75.5	5	2	6
65.5	9	4	11
55.5	14	13	18
45.5	13	9	26
35.5	3	7	12
25.5	2	4	9
15.5	-		4
	49	40	89

Appendix vb

The Collection of Mathematics Achievement Test Result from the Selected Schools

Kwali: 93, 89, 89, 89, 71, 72, 77, 66, 42, 44, 46, 66, 33, 33, 22, 20, 18, 22, 23, 24, 26, 27, 27, 27, 27, 33, 34, 34, 36, 35, 31, 39, 40, 39, 39, 40, 35, 66, 53, 53, 53, 52, 52, 66, 66, 66, 62, 62, 62, 62, 77, 78, 86, 94, 95,

Yangoji: 74, 74, 67, 67, 68, 69, 67, 67, 68, 79, 73, 54, 55, 56, 56, 73, 75, 76, 77, 37, 36, 37, 38, 38, 38, 39, 38, 32, 33, 34, 35, 37, 38, 39, 87, 28, 29, 28, 29, 27, 28, 27, 29, 82, 83, 45, 46, 84, 83, 18

D/Saungwari: 39, 34, 35, 36, 77, 20, 20, 15, 15,75, 75, 77, 66, 70, 45, 46, 47, 48, 70, 62, 62, 63, 63, 61, 33, 35, 36, 37,29, 30, 95, 93, 93, 77, 78, 86, 86,78, 30, 24, 22, 24, 56, 56, 59, 56, 58, 24, 25, 27, 24, 28,

Kwali: 77, 57, 54, 73, 95, 97, 73, 20, 73, 74, 76, 61, 38, 39, 36, 37, 38, 33, 35, 36, 37, 61, 87, 49, 50, 43, 44, 44, 87, 85, 61, 64,20, 64, 27, 28, 29, 24, 25, 26, 27, 26, 25, 21, 65, 65, 20, 19, 66, 69

The Total Summary Scores for Mathematics Achievement Test (MARS).

Scores	**Fre. scores**	**kwali**	**Yangoji**	**D/Sangwari**	**Bwari**
95,5	8	3	-	3	2
85.5	14	4	5	2	3
75.5	26	5	8	7	6
65.5	34	10	7	8	9
55.5	16	5	4	5	2
45.5	14	3	2	4	5
35.5	46	14	15	8	9
25.5	38	9	8	11	10
15.5	11	2	1	4	4
Total	207	55	50	52	50

The Distribution of Students into Their Various Level of Aversion

Sc range	Fre. Of high aver.	Neutral	Fre. Of Low Aver.
95.5	-	-	8
85.5	-	-	14
75.5	-	-	26
65.5	-	-	34
55.5	-	16	-
45.5	-	14	-
35.5	46	-	-
25.5	38	-	-
15.5	11		-
total	95	82	30

Appendix via

The Pre-Test Results Collected For Pilot Study

Table: 3 . 9 The result of the pre-test

S/N	Discovery	Expository
1	42	10
2	34	24
3	74	25
4	45	35
5	62	65
6	40	20
7	83	45
8	60	25
9	33	84
10	64	90
11	24	65
12	72	31
13	10	33
14	85	62
15	66	30
16	33	42
17	90	32
18	53	70
19	65	32
20	25	70
21	57	36
22	35	37
23	34	38
24	35	69
25	56	66
16	59	68
27	63	48
28	49	-
29	58	-

Table:3.10The score range of pre-test

Scores ranges	Frequency for		
	high	neutral	Low
95.5	-	-	2
85.5	-	-	3
75.5	-	-	5
65.5	-	-	9
55.5	-	7	-
45.5	-	9	-
35.5	15	-	-
25.5	6	-	-
15.5	2	-	-
05.5	-	-	-

Table: 3.11**The result range of Pre-test for discovery and expository**

S/No	Discovery		Expository		neu
1	95.5	1	95.5	1	-
2	85.5	2	85.5	1	-
3	75.5	8	75.5	5	-
4	65.5	-	65.5	-	8
5	55.5	-	55.5	-	6
6	45.5	-	45.5	-	2
7	35.5	6	35.5	8	
8	25.5	4	25.5	4	
9	15.5	1	15.5	1	
10	05.5	-	05.5	-	

Table: 3.12 A pre-test for Mathematics Aversion Test and Mathematics Aversion Rating Scales.

Aversion levels	Discovery	Expository	Total
High	10	13	23
Low	12	7	19
Total	22	20	42

Appendix vi b

The Post-Test Results Collected For Pilot Study

Table: 3.13 **The Result of the Post-Test**

No of students	Discovery	Expository
1	74	93
2	70	40
3	35	20
4	37	49
5	46	70
6	65	69
7	54	38
8	51	12
9	80	48
10	90	59
11	85	79
12	32	69
13	33	48
14	56	49
15	84	45
16	39	52
17	58	60
18	53	89
19	29	90
20	82	29
21	40	-
22	20	-

Table: 3.14. **The score range of post test**

Score ranges	Frequency for	
	High	Low
95.5	-	4
85.5	-	5
75.5	-	4
65.5	-	7
55.5	-	9
45.5	5	-
35.5	5	-
25.5	2	-
15.5	-	-
05.5	-	-

Table: **3.15 The result range of Post-test for discovery and expository**

discovery		Expository	
95.5	1	95.5	3
85.5	4	85.5	1
75.5	2	75.5	2
65.5	4	65.5	3
55.5	4	55.5	5
45.5	2	45.5	3
35.5	4	35.5	1
25.5	1	25.5	1
15.5	-	15.5	1
05.5	-	05.5	-

Table: 3.16: A post-test of Mathematics Aversion Test and Mathematics Aversion Rating Scales.

Aversion levels	Discovery	Expository	Total
High	15	14	29
Low	7	6	13
Total	22	20	42