EFFECTS OF CLASS SIZE AND ABILITY LEVELS ON JSS II STUDENTS' PERFORMANCE IN MATHEMATICS IN KADUNA METROPOLIS

BY

Magdalene Addie BASSEY (B.Ed) (ELEM.ED)
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Department of Educational Foundations and Curriculum
Faculty of Education
Ahmadu Bello University, Zaria, Nigeria

SUPERVISORS

DR. A. GUGA

DR (MRS) H.O, YUSUF

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DECLARATION

I declare that this study "Effects of Class Size and Ability Levels on JSS II Students' Performance in Mathematics in Kaduna Metropolis" is an original work of research done by me. To the best of my knowledge, it has never been presented partially or wholly anywhere for the award of higher degree in any form. Information derived from the published and unpublished work of others has been acknowledged in the text.

_____ _____

Magdalene, Addie BASSEY Date

CERTIFICATION

This thesis entitled "**EFFECTS OF CLASS SIZE AND ABILITY LEVELS ON JSS II STUDENTS' PERFORMANCE IN MATHEMATICS IN KADUNA METROPOLIS"** by Magdalene Addie BASSEY, meets the regulations governing the award of the degree of Masters in Education of Ahmadu Bello University, Zaria, it is approved for its contribution to knowledge and literary presentation.

_____ _____

Dr. A. Guga Date
Chairman, Supervisory Committee

_____ _____

Dr. (Mrs) H.O, Yusuf Date
Member, Supervisory Committee

_____ _____

Dr. B. Maina Date
Head of Department

_____ _____

Prof. A.A. Joshua Date
Dean of School of Postgraduate School
Ahmadu Bello University, Zaria

DEDICATION

This work is dedicated to my late grandmother who showed me the way to school, my children, my late husband and lovers of academics.

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Operational Definition of Terms

Ability Level: Grouping of students based on their academic performance.

Academic Achievement: The level of development essentially applied to what an individual and groups have gained from learning outcomes.

Class size: class size is the number of pupils in a class with one teacher.

Effect: This refers to Change that something causes or brings in something else.

Gender: Male or female students (human race).

High Achiever: A student with high level of intelligence and who performs well in test or examination.

Large Class Size: A class of 90 students.

Large Class: A class whose numerical size does not permit the teacher to cope effectively with the demands of individual students.

Low Achiever: These are slow learners who perform poorly in test or examination.

Mathematics: It is the science of numbers shapes spaces, time and the discovery of relationships and patterns in both natural and man-made world.

Medium Achiever: Student of average performance.

Medium Class Size: A class of 40 students.

Small Class Size: A class of 20 students.

Normal Class Size: A class of 35-40 students (NPE, 2004).

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ABSTRACT

The study was undertaken to investigate the "Effects of Class Size and Ability levels on Students' Performance in Mathematics among Junior Secondary School Students in Kaduna Metropolis" to proffer solutions to the problem of poor performance in Mathematics. The study made use of experimental design in which three secondary schools were used with a sample of one hundred and fifty (150) students, ninety (90) students from school I representing large class, forty (40) students from school 2 representing medium class and, twenty (20) students for a small class size. Mathematics Achievement Test (MAT) was used for the students while observation schedule was used for the Mathematics teachers. Three (3) research questions were generated to guide the investigation. Also, three (3) hypotheses were postulated and tested at 0.05 level using Analysis of Variance (ANOVA), T-test and descriptive statistics (Mean and Standard Deviation). The findings revealed that students' performance in Mathematics improved as class size decreased. There was no significant difference in the performance of male and female students irrespective of the class size. The findings also revealed that students in mathematics performed better when taught by teachers who have high qualification and teaching experience. Based on the research findings, it was recommended that stipulated maximum class size of 20-40 in Nigerian schools, be observed, government is to ensure adequate employment of dedicated and qualified Mathematics teachers to teach the subject and tutorial should be encouraged where by students with high ability levels take it upon themselves to instruct their colleagues with low ability levels in Mathematics.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Mathematics has always been regarded as the language of science. It is an important discipline in the training of logical reasoning and it is an important instrument used in attaining practical goals. Concepts in mathematics are useful in solving problems in applied engineering (Andre, 1985). Mathematics has an important role to play in the task of national development. It is an instrument for effecting economical, social, political, scientific and technological changes. In order to achieve these goals of education, the teachers are required to perform their duties efficiently, need to be given controllable and adequate class size of 35 students to teach for effective learning in mathematics, (Balogun, 2002). The history of development of knowledge and much of the development in science and technology has been greatly facilitated by applications of mathematical knowledge and procedures.

The role mathematics plays in the realization of scientific skill is well known that any society that is serious in its quest to develop its technology, must be serious in the teaching and learning of mathematics. Mathematics is always overlooked by many students even when they know that they need it for solution to problems in area of science. They claim that if it was possible not to take mathematics at all, they would have preferred it but would continue their study of science. Hence they put up negative attitude towards the learning of mathematics which consequently appears to affect their performance in the sciences. Because students have already conditioned their minds on the impossibility of learning mathematics, they therefore fail to get a grasp of the subject matter, no matter how hard they persevere (Uhumuavbi and Umoru, 2005). The researcher is of the view that something has to be done to change students' negative attitude towards the learning of mathematics. There is need to arouse the interest of students towards the learning of mathematics.

This study attempts to expose some of the numerous problems facing mathematics that prevents the effective teaching and learning of mathematics in Nigerian secondary schools. The issue of class size is one important area of this study as it relates to teaching/learning of mathematics in junior secondary school level. Alio (2003) attributes students' development of negative attitude towards mathematics teachers to what is called "idiosyncrasy" of mathematics instruction. The usual way some mathematics teachers approach the teaching of mathematics contributes to the students' development of negative attitudes to both the subject and the teachers. Effective and good mathematics performance cannot be possible when students' attitude towards the teachers and the subject is negative.

The need for development of science and technology in this nation will not be successfully achieved without solving the problem of poor performance in mathematics (Betiku, 2002). According to Onu (2003), the usefulness, power and place of mathematics in the field of human endeavor continue to be recognized. In trying to develop science and technology in a nation, mathematics is the key. It is seriously needed to gain access into the world of scientific knowledge and understanding. The importance of mathematics is not a doubt, that is why in the first ordinance enacted by Fredrick Lord Luggard (1914), enforcing western education, Arithmetic, writing and reading were the three areas in which the pioneers of formal education in Nigeria were trained. The need to identify suitable class size by which students, especially with medium and low ability can be made to receive teachers' attention to grasp the content of the subject easily and intelligibly is the focus of this study.

Education (FRN, 2007) recommended an average class size of 30. Anikweze (2004) recommends teachers/pupils ratio to be 1:35 in order to be more effective to, cope with an over-crowded classroom in our schools. The present study considers class size as the total number of students in a class at a given time to a teacher. That is students/teacher ratio of 20 students to a teacher, which constitutes a small class size; 40 students to a teacher as average

class and 90 students to a teacher as a large class. These are to be tested in this study to see the effectiveness. The National Policy on Education (FRN, 2007) recommends an average class size of 40 students to a teacher, but hardly is this attained in Nigerian schools. Duyilemi (2004) observed that in most Nigerian schools what exists in the class ranges from 50 to a large number of 120 students to a teacher in many secondary schools. Oakes (1992) and Lynch (1994) defined ability grouping as dividing students into separate classes of high, average and low achievers, that is classifying students according to their academic performance. This can best deal with individual differences in the classroom. Feldhusen (1992) noted that students of lower and average ability often flourish or become better students when the high ability level students are present and leading to competition. High ability or gifted students are needed in all classrooms in order to stimulate, motivate and inspire other students. Salau (1996) concluded that the achievement profile of high achievers declines as the class size becomes larger. This means that increase in class size tends to reduce the performance of students generally, despite the level.

The researcher is of the view that the use of heterogeneous class could be of more advantage since low and average groups would gain more knowledge from their interactions and sharing with the high achievers whether the class is large or small. The major objective of this study is to determine the adequacy and effectiveness of class size and ability levels on the academic achievement of different group of students in mathematics, when taught with mathematics concepts in junior secondary schools in Kaduna metropolis. This is with the view to establishing what might be considered appropriate class size that will promote teaching and learning in schools. This is then the rationale for this study.

1.2 Statement of the Problem

The objective of secondary school education is to produce high quality students who would be able to face the challenges of the society and prepare them for higher education.

Today, our secondary education is faced with high population of students since the inception of Universal Primary Education in Nigeria. Consequently, there has been high percentage of student's failure in Mathematics.

Many studies have been conducted to find out the causes of this poor performance in Mathematics among secondary school students (Korau, 1988). Reasons ranging from quality of teachers, lack of utilization of instructional materials as a result of shortage of funds, lack of workshops and seminars for Mathematics teachers, over-crowded classrooms, lack of Mathematics textbooks, lack of Mathematics laboratory to mention a few have been advanced. On the part of the students themselves, reasons given range from lack of interest, poor attitude to learning, and effects of peer groups influence and many others (Kemiyele, 1993). These variables make teaching/learning of Mathematics in secondary schools difficult for government to achieve the main stated objectives

1.3 Objectives of the study

The objectives of this study are to:

i. Investigate the relationship between class size and varying ability levels and students' performance in Mathematics in junior secondary schools.

ii. Determine the effects of class size and ability levels on gender-related difference in the performance of students in Mathematics in junior secondary schools.

iii. Determine the relationship between teachers' qualification and students performance in Mathematics in Junior secondary schools.

1.4 Research Questions

In an attempt to come up with relevant findings in this study, the following questions were raised to guide and give focus to the study:

i. What is the relationship between class size, ability levels and students performance in Mathematics in Junior secondary schools?

ii. What is the effect of class size on male and female students with different ability levels and students' performance in Mathematics in junior secondary schools?

iii. What is the relationship between teachers' qualification and students' performance in Mathematics in Junior Secondary Schools?

1.5 Hypotheses

The following hypotheses were postulated and tested at 0.05 level of significance.

$H0_1$: There is no significant relationship between class size and performance of students exposed to various class sizes and ability levels in mathematics.

$H0_2$: Class size does not significantly affect the performance of male and female students exposed to different class sizes and varying ability levels in mathematics.

$H0_3$: Teachers' qualifications have no significant relationship with the students' performance in mathematics in secondary schools in Kaduna metropolis.

1.6 Significance of the study

The findings of this study will hopefully provide the following benefits:

It is hoped that this study would contribute in enhancing the standard of teaching/learning of mathematics in any given class size and the students' ability levels. This study would encourage mathematics teachers particularly in junior secondary schools to acquire skills and appropriate teaching methods so as to encourage interest and comprehension of the principles and concepts taught in any given class size and varying ability levels of the students.

Education planners, mathematics educators and curriculum designers would hopefully benefit from the findings of this study through the evolution of teaching/learning of mathematics in secondary schools with the aim of improving students' performance in any given class size.

This study would provide mathematics teachers with a guide on how to control

various class size at any given time in order to improve students' performance in mathematics.

Education authorities and state ministry of education would be alerted to the extent to which various class size effects can contribute to the achievement of various ability levels in teaching/learning of mathematics in junior secondary schools.

This study would hopefully enable other researchers to identify areas for further studies in relation to the effects of class size and students' ability levels for the improvement of teaching/learning.

The findings would be useful in educational policy making and finding may arouse instructional educational agencies such as Federal Ministry of Education, Facilities or Schools of Education, National Teachers' Institute as well as professional bodies such as Mathematics Association of Nigeria (MAN), Science Teachers Association of Nigeria (STAN) to formulate educational policies which would be useful in implementation of mathematics curriculum.

1.7 Basic Assumptions

This study is guided by the following assumptions:

1. The students used were familiar with the area of staffing, facilities as well as students enrolment.
2. The selected topics were appropriate for the level of subjects used for the study.
3. Most mathematics teachers in the secondary schools do not know how to cope with overcrowded class rooms.
4. Teachers are employed to teach mathematics in secondary schools without considering the effects of class size and ability levels of the students.
5. The teachers cannot give individual attention to the medium (average) and low achievers in schools where mathematics are overcrowded.

1.8 Scope of the Study

This study is basically on the effects of class size and ability levels on students' performance in Mathematics among Junior Secondary School Students in Kaduna Metropolis. The study sought to expose some of the numerous factors responsible for poor performance in Mathematics. It was therefore restricted in its coverage to all J.J.S. two (2) students in the Government Secondary Schools in Kaduna Metropolis with total students' population of three hundred and two thousand, one hundred and sixty-one (302,161) students.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

The aim of this chapter therefore is to present already existing views of people on "the effects of class size and ability levels on students' performance in mathematics among junior secondary school students. For the purpose of easy reference, the chapter has been sequentially arranged and discussed under the following themes:

- Theoretical framework
- Concept of class size
- Academic achievement in mathematics
- Ability levels and effects of class size on students' performance
- Gender and mathematics
- Effects of class size on students' performance
- Influence of teachers' qualification on students' performance in mathematics
- Review of empirical studies
- Implication of literature reviewed on the present study
- Summary.

2.2 Theoretical framework

The theoretical framework of this research lunges on the following theories of learning:

a. Mental development (Odiase, 1992)

b. Theory of cognitive development (Piaget, 1952).

c. Gestalt theory of learning (Odiase, 1992).

d. Reinforcement (Skinner, 1938).

e. Theories of forgetting (Ausubel, 1968)

(a) Theory of Mental Development (Odiase, 1992)

According to Odiase (1992), mental ability is closely related to language ability. As a child grows older, his vocabulary and word usage becomes the best single indicator of his intelligence. Sensory motor ability is the basis of intelligence and other ingredients are ability to perceive situations accurately, to see relations, to remember, to use good judgment and to persist in solving problems. To learn anything, a child must pay attention to what he wants to learn. It also involves exploration of the visual field, fixing eyes successfully on different parts, relating these parts and anticipating phenomenon that are not yet clearly perceived. This study is of the opinion that teachers should be given adequate class size that will enable them to reach individual students' needs, that is, teachers should use the materials that will enable students to easily perceive learning situations in a positive way, especially in teaching mathematics. Overcrowded classrooms will not permit such.

(b) Theory of Cognitive Development (Piaget, 1972)

Piaget (1972) has come to be recognized as a giant of the twentieth century cognition psychology. He distinguished four stages in the development of cognitive ability or intelligence. His concept of stage implies that development takes place in unvarying steps like sequence, regardless of the child's culture or education. According to him, the child begins rudimentary concept formation at the preconceptual stage. The child begins to classify things in certain ways because of their similarities. Piaget further explains that the child's logic rather than being either deductive or inductive is transductive.

This study is of the opinion that in teaching the concepts of weight, height, shapes and sizes in mathematics class, the teacher should be able to present instructional materials that will enable the students to overcome the problems of transductive. This study focuses on the fact that inability of teachers to control large class size in order to utilize the appropriate materials to teach certain concepts in mathematics has contributed to students' poor

performances in the subject.

The next stage of cognitive development that is of importance is the period of intuitive thought. The most striking characteristic of this stage is the child's failure to develop conservation. Conservation is defined as the ability to realize that number, length, substance or area remain constant even though these things may be presented to the child in a number of different ways. For example, a child is shown two containers filled to some level with some water. Next, the content of one container is poured into a tall thinner container. At this stage of development, the child who observed that the first container contained an equal quantity of water will now tend to say that the longer container has more water because the level of water is higher in the container.

According to Montessori, as a teacher, one has to bring oneself very low and clothe oneself with patience before one will be able to successfully teach some of the mathematical concepts to children at this stage. The teacher can utilize these containers in the teaching of mathematics, particularly cylinder, circumference, diameter and area of circle and volume. If positive attitude is not cultivated in the child at this stage, the child will be confused with some concepts in mathematics like volume, perimeter and area of plane and solid shapes. This will go a long way to influence the child's mathematics performance.

This is done for the fact that at this stage, the child cannot mentally reverse cognitive questions. It means that the child cannot mentally pour the water from the longer container back into the shorter one and see that the amount of water is the same in both. For Piaget (1972), conservation is the ability that comes about as a result of the child's cumulative experience with the environment. Teachers can teach the concepts of volume using circular tins or containers as teaching materials to improve the concepts of teaching and learning mathematics.

Piaget's concrete operational stage of cognitive development according to Odiase

(1992) determines the origin of the usage of instructional materials for teaching. Here Piaget explains the ability to deal adequately with classes and variation. The child can arrange things from smallest to largest and vice-versa with number concepts. During this stage, the thought processes are directed towards real events observed by the child. The child can perform rather concrete operations on problems as long as the problems are concrete and not abstract. Utilization of concrete objects in teaching and learning can enhance better understanding.

The educational implication is that as much as possible, all the 'learning' should be related to real life experiences. At this stage, teachers can utilize this theory in teaching mathematics in secondary schools.

At the last stage which is formal operational cognitive development, the child can now deal with hypothetical situations and his thought processes are not tied down exclusively to what is immediate and real, due to the utilization of concrete objects in teaching/learning situations. Thinking at this stage is as logical as it shall ever become. This means that the mental apparatus that a person has is as sophisticated as it shall ever be but the apparatus can be directed toward the solution of a "never ending array of problems" throughout ones life. This is the period in which students can engage in logic solutions to abstract problems which is very necessary to carry out mathematical operations. Teachers in the study area can apply this theory in order to improve the students' understanding and application in mathematics examination for better results. This theory is relevant to this study based on the fact that it was able to reveal how teachers can get the attention of their students through the utilization of instructional materials to teach certain concepts in mathematics. It also emphasized the need for teachers to help the students to persist in problem solving. This is possible in an adequate class size.

(c) **Gestalt Theory of Learning (Odiase E.I, 1992)**

This learning theory was developed by German psychologists Wertheimer, Koffka and Kohler in the early 20th century. Gestalt means configuration, structure and patterning experience. Gestalt insisted that all learning consist of the simple connection of responses to stimuli, without recourse to the existence of ideas or thought process, people attempt to perceive stimuli in an organized whole, not in the disconnected parts.

Some of the characteristics of sensory fields which influence organization in perception as identified by Odiase (1992: 32-52) are:

1. Figure and ground: That the things perceived stands out against a background. The figure may be complex, but the parts in clear perception are always closely patterned to join a unified whole.
2. The stimulus pattern and perceptual organization: The observer establishes the patterning of the visual field and it frequently happens that the character of the stimulus pattern influences or even dictates the way the sensory qualities are organized. The following are important in establishing the patterns made:
    a. Proximity: Patterns which are close together or near to each other tend to be perceived in groups. Teachers can group teaching materials and use them to teach in the class.
    b. Similarity and familiarity: Objects similar in form, shape, color or size tend to be grouped in perception. Familiarity with an object allows a carryover from previous to present experiences. Teachers can utilize related materials in teaching and learning situations since it can facilitate learning. Thus, the teacher can use group method to control a large class. This can improve the students' performance in mathematics.

c. Closure: Missing parts or gaps in information tend to be completed or filled in by the perceiver as individuals strive to reach a satisfactory end state of equilibrium in complete forms. This form helps in quantitative and local reasoning in mathematics learning.

d. Good Continuation: Closely allied to closure is good figures such as circles, squares and lines which tend to remain stable and continue as figure in a way to shift distorted perceptions in the direction of greater symmetry and balance.

According to Kohler in Odiase (1992:14-25), Gestalt psychology in relation to learning is best illustrated in situations in which reconstructing of the field relationships provides sudden solution to problems. Mathematics teachers can utilize these steps in the improvement of students' performance in mathematics.

Teachers need to guide the children to organize their experiences into effective functional patterns through meaningful arrangements and stimulating situations. Teaching should start with the things that are familiar each step or those already taken, facts grouped according to their natural connections. Essential parts should be emphasized, but irrelevant things avoided. Integration of all the divisions, topics of each subject, previews, outlines and review are all that reveale relations between the various parts of a subject and promote the organization of a subject as a whole. Based on the above explanations, appropriate utilization of teacher instructional strategy will play an important role to enhance the students' performance in mathematics.

(d) Reinforcement (Skinner, 1938 in Odiase, 1992)

According to Skinner in Odiase (1992), reinforcement is any stimulus whose presentation or removal increases the probability of a response. Reinforcement is said to occur when pleasant or unpleasant consequence follows a response. Reinforcement can be divided into two main types: positive and negative.

Positive reinforcement: Mukherjee (1972) explained that it is stimulus, the presence of which strengthens the behaviour upon which it is made a contingent. Positive reinforcement is also termed as satisfier. It is any act followed by a state of affairs which the individual does not avoid, and which he often tries to preserve or attain selected and fixed. Teachers can use it in teaching mathematics. It can motivate the learners effectively, if wisely used in teaching and learning situations.

Pleasant consequence constitutes positive reinforcement or rewards. In the school, the reward might be a golden star, or a shield, a nod of approval, or a chance to look at an interesting book. Positive reward of any magnitude has value as a signal to identify "good" responses. Particularly, if it is used in teaching situation, increasing reward may make a task of mathematics attractive so that the students should understand positively.

Students willing to look for approval can enhance understanding of mathematics; but students who have desired to achieve things shall work harder or take tasks that are interesting or promise a concrete reward. Beyond the amount necessary to obtain attractive participation, increases in reward seem not to improve learning and may reduce the learning of whatever does not count towards the reward. It is on this note that the theorists caution against over-use of the positive rewards by the teachers.

Negative reinforcement: This is any stimulus, the withdrawal of which strengthens the behaviour (Mukherjee, 1972:95). Negative reinforcement (coercive stimulation) following a response the teacher seeks to eliminate, has a different effect from non-reinforcement. In teaching/learning mathematics, teachers are to use both positive and negative reinforcement to reward appropriately in order to improve the students' understanding of mathematics and subsequent performances.

Problems affecting reinforcement include:

1. If the class is large, the individual response cannot be adequately reinforced.

2. If the reinforcement does not follow the response it intends to reinforce immediately, the response might not reoccur.

3. The reinforcement must be proportional to the response it intends to strengthen, especially the understanding of mathematics concepts and performance.

4. The teacher might tend to reinforce the response of the best students while neglecting to reinforce the improved performance of the poor ones. This invariably might discourage the less able students. It is on this note that teachers are advised to reward both big and small efforts of the learners in mathematics lessons.

(e) Theories of Forgetting (Ausubel, 1968)

Ausubel (1968) is of the view that if learners should remember all they have learnt, their conscious mind would run riot, and adjustment to new situations would be difficult. This is because new experiences tend to interfere with the old, either directly or indirectly. The theory of interference stipulates that non-reinforcement of an experience displaces that experience with a new one. However, one observes that learning mathematics with appropriate class size and teaching materials will build up appropriate experience. New experience builds on old ones. Teachers can note the essence of repetition, revision and previous knowledge in improving learners' performance in mathematics.

The theory of forgetting operates in the following ways:

i. The theory of retroactive and proactive inhibition: Recall may be retroactive or proactive to circumstance. For instance, when two similar patterns of behavior are learnt simultaneously or successively, at recall of either, there is likely to be a potent competition between them at the conscious level. At recall of the first instructions, the second may interfere (retroactive). At the recall of the second instructions, the first interfers (proactive). This is what happens when a child learns. The utilization of appropriate class size can enhance both concepts. This unconscious anagram is a

confusion of cognitive scheme and it is perhaps responsible for large incidence of forgetting (Odiase, 1992). The teachers of mathematics can utilize the concepts of proactive and retroactive inhibitions to teach mathematics in such a way that it brings improvement upon the performance of the students. The teachers can do this by being given adequate class size and being qualified to teach the subject or make teaching vivid.

ii. Changes in attitudes intersect and cognitive structure: Odiase (1992) and Francis (2003) have the same view that "children will remember things from different angles depending on how at the moment he thinks (were internalized)". If however, the above factors are constant, the learners might continue to remember the experience in its original structure. Teachers that have quality and experience of teaching mathematics can utilize appropriate class size to impart knowledge to learners. Thus he/she will be able to give individual attention. Making the lessons interesting will change negative mathematics learning attitudes to positive attitudes.

iii. Mental set for a given activity: Betiku (2002) supports Odiase (1992) that when the mental set changes between the original learning and the time for recall, recall is more efficient. This is especially so in verbal recall. Thus all learning should have functional utility and should be reinforced from time to time by the teacher. This accounts for the call for the positive utilization of instructional materials in teaching/learning mathematics in an appropriate class size. If a long time elapses before the impact of another experience, mental set shall be displaced, giving way to psychological paramnesia. Appropriate class size given to experienced and qualified mathematics teachers certainly improves upon the students' performances.

iv. Changes in recall situation: A student may not remember a name he learnt previously but when the bearer of the name is physically presented, he may recall. Idialu (1998)

and Ughamadu (1998) are in agreement with the above explanation. They identified the roles that instructional materials can play in learning/teaching of mathematics in secondary schools. This situation mostly applies to factual knowledge where recognition is much more difficult than recall. The theory stipulates that an experience gained in one situation may be incompatible in another situation because of the absence of vital cues. Teachers can make the teaching/learning vivid. This can effectively be done in an appropriate class size.

v. Repression: This is the theory of a protective device used for avoiding anxiety. Students may deliberately forget emotionally disturbing ideas. This happens when a student fails to recall, say an unfavorable propaganda. Metabolic activities in the nervous system play some part in erasing memory trace from the system. Thus if the functioning of the metabolic system is deficient or inefficient, a process of nervous complication sets in making recall difficult; this is in line with Hunter (1996), Bartlett (1932), Kaplesi (2002) and Back (1992). The authors above are of the view that, worries and anxiety can have negative effects on learning from instructions in the area of preprocessing. They agreed that anxious learners divided their attention between the demands of the task and pre-occupied themselves with negative thoughts. Teachers can help them to overcome emotionally disturbing ideas through the wise utilization of repression. Frequent use of the concept of repression is not advisable in teaching and learning situation.

The underlying philosophy of this study lies in the theories of Gestalt theory of learning particularly that of proximity. This emphasises that teachers can group teaching materials and students and teach especially where the class size is large. Teachers need to guide the child to organize his experiences into effective functional patterns through meaningful arrangement and stimulating situation. Teaching should start with the things familiar, each step on those

already taken, facts grouped according to their natural connection. Essentially, parts should be emphasized but irrelevant things should be avoided. Integration of all the divisions and topic of each subjects, previews, outlines and reviews are all revealed relations between the various parts of a subject and promote organization of a subject as a whole. Based on the above explanations, appropriate utilization of teachers' instructional strategy will play an important role to enhance the student's poor performance in mathematics

2.3 The Concept of Class Size

A lot of researchers see the concept of class size in different perspectives and, therefore, seems to have no universal acceptable definition of the term class size in terms of numerical value. For example, class size, according to Florida School Indicators Report (2004) means the number of students meeting in a particular classroom for a class section, engaging in a particular activity. Class size is determined by bringing the total number of students in the classroom and dividing it by the number of teachers assigned to the students (Florida School Indicators, 2004). Lewit and Baker (1997) described class size as an administrative measure typically defined as the number of students assigned to a teacher with the primary responsibility to take charge of given instructions and direction of learning to students. They further stated that available statistics on class size do not properly address the availability, adequacy and type of physical shape used for instruction in the teaching/learning situation. Ward (1990), from the project Student/Teacher Achievement Ratio (STAR) analyzed students' achievement and development in three types of classes:

i. Small class should have 13-17 students to a teacher.

ii. Average class should have 22 - *25* students to a teacher.

iii. Large class should have 25 - 80 students to a teacher, and

iv. Above 80 students to a teacher is considered to be super large class size.

Achilles and Lintz (1991) considered small class size as a teacher handling 13-17

students while Brewer *et al* (1999) considered small class size as one teacher to a maximum of 20 students. Molnar (1998) and Benneth (1999) stated that the students/teacher ratio may be calculated by including all licensed and qualified professionals and then came out with the 15 students to a teacher. Hanushek (1998) and Nevada (1999), described class size as an environment where fewer students (like 15 students) are referred to specialized teacher where he has more time to give sufficient assistance and attention to address the individual demands. The implication of this study is that teachers are having smaller classes, where they have enough time to attend to individual problems of the students.

The National Policy on Education (FME, 2004) stated that educational needs and training facilities should be catered for in order to meet the response of societal needs and which will progressively extend to the satisfaction of individual student's wants and aspiration. In line with this, they feel that the numerical strength of a class should not be more than forty students per teacher on average. Charleston (1994) described large class size as one teacher to fifty students' average. He believed that a teacher with high numerical strength of students will not be permitted to handle the class effectively and adequate attention to individual student will certainly be lacking. That is, individual problems of the students will certainly be buried in a large class.

The mathematics educators are worried with the teaching of mathematics in a large class size and we have seen the prevailing situations in our school environment in Nigeria as that which contains uneven as 1:20 in some rural schools and uneven as 1:80; 1:220 in some urban schools (NERDC, 2002). Mathematics is recognized as an important tool for engineers, scientists, architects and many other professionals. Hence, mathematics is considered as knowledge indispensable to all fields of study. Therefore, it needs to be taught in a good and conducive environment. Thus the need for sizeable classes is prerequisite for effective teaching and learning of mathematics.

It is however unfortunate that in most schools, classes are overcrowded such that effective teaching/learning of mathematics is difficult under this situation, students device poor attitudes towards learning of mathematics and they inevitably leave school having only vague ideas about the importance of mathematical concepts. Wooton (1999:1999) argued that for better teaching of mathematics three things are required:

> "*We need an improved curriculum which will offer students not only the basic mathematical skills but also a deeper understanding of the basic concepts and structure of mathematics. Mathematics programmes must attract and train more of those students who are capable of studying the subject with profit and all help possible must be provided for teachers who are preparing themselves to teach this challenging but interesting course*" (pp 26)

It should be noted that Wooton's suggestions could not materialize without adequate class size put into consideration. This work is to review silent researches into the complex issues of the effects of class size or quality of the teaching/learning, and the performance of students in mathematics. It is going to describe the general attitude of teaching profession towards class size and the performance of students in mathematics.

Many educationists accept as axiomatic that there is maximum class size which determines the quality of learning in the classroom. This assumption generally unsupported by researchers, has been expressed in professional literature and has become one of the criteria of the quality of education for crediting agencies and for the public at large to use in assessment. Peter (2000) opined that despite a long-run debate over the effects of class size differences on educational performance, there is little evidence on the classroom processes that might be involved. The effects of class size differences were examined in relation to socio and behavioral adjustment to school, in terms of two dimensions, that is, attentiveness and peer relations. He based that is was predicted that as class size increases, there would be

more inattentiveness in the class and more signs of difficulties between children in form of rejection, a social, anxious and aggressive behavior and less pro-social behavior. Grissmer (1999) says the effects of class size differences on school children can be considered conceptually in relation to two main aspects of adjustment to school.

First and foremost, adjustment can be seen in terms of academic progress. The acrimonious debate over educational consequences of class size differences has centered on the effectiveness of improving children's academic performance. Secondly, in terms of social and behavioral adjustment though, there are some suggestions of classroom processes connected to class size differences, there is little understanding of classroom processes including social and behavioral factors that might be involved (Grissmer, 1999). It might be expected that in large classes there will be more distractions and with more children bidding for the teacher's attention, they will be more likely to be inattentive and the relationship between the children and teacher may suffer. Cahen (1989) said, "one of the several studies is that in smaller classes, behavior is better and classroom management is easier, problems will be identified and solved faster".

Benneth (1996), in a survey of the views of teachers and others, reports that teachers believe larger classes adversely affect behavior in class. Glass *et al* (1982) formed in their meta-analysis that there were fewer misbehavior in smaller classes. The Scott Committee of N.S.W. emphasized the numerous advantages of reduced class size have been claimed by teaching profession and many adverse corollaries of larger classes have. been stressed, e.g., the larger the class size, the less the active students participation and degree of creative thinking. The less opportunity for students and teachers contact, the more likely it is for teachers' and students' energy morals to be debilitated. The less the opportunity for individualized assignments, the more bookish the programme becomes. The less efficient is implementation of a variety of teaching procedures, the more speech and drama activities are

curtailed. The more mobility is impaired and noise level rises, the greater the concern for and therefore time spent on discipline. The greater the increase in safety problems, the more inflexible the seating arrangements.

Aftreth (1995) quotes the principals observations that in their schools, larger classes have the least effective programmes that the teachers' morale have "an inverse relationship to magnitude of class enrolment", that even in large classes, some outstanding teaching/learning does occur. He also noted that teachers regard an "ideal" class size as fewer than 25, "satisfactory" as 30 students, burdensome as 35 students and real drudgery as 39 or more students. Such opinions are supported by Reisert (1990) who pointed out that students and teachers prefer small classes because teaching is more effective, more personal and attentive and grades are more meaningful. The Scott's Report (1999), gives an example of opinion poll conducted among N.S.W. secondary school inspectors on their views of class size. These support the opinion that class size should be reduced progressively from form I to form VI, although suggested sizes are slightly larger than as might be expected, e.g. from a mean size of 33 with a range of 31 - 35 according to the subject teacher. Krueger (1999) and Whitmore (2001), the students/teacher achievement ratio experiment has been analyzed both in terms of its initial impact on student achievement and in its longer term consequence for academic progress.

Angrist and Lavy (1999) exploited a specific rule of maximum class size in Israel to extract presumably exogenous variation in class size between 20 and 40 students, which may not range most of interest to policy makers in many countries. Case and Deaton (1999) identified class size effect by looking at data on black students in South Africa during apartheid, arguing that the variation in class size for black students was largely exogenous, because the black population at this time had neither freedom of residential choice or control over their school endowment. But the South African school system during apartheid was

obviously unique in its institutional configuration and was characterized by distinct average class size of up to 80 students. Smaller classes exhibit benefit only in countries with relatively low teacher salaries why large classes have negative class size reduction is probably the most popular and most popular and most funded school improvement policy in the United States. In 1996, the California legislature dedicated one billion dollars for a year to class reduction.

The 1999 Federal Budget contained 12 billion dollars to cover 7 years for the same purpose. Class size reductions are, enacted often because they are popular with nearly every constituency interested in schools. Parents like smaller classes because their personal experiences suggest that they themselves give more to each child when they have fewer children to handle or take care of. Even if parents disagree bitterly about educational methods of a school, they can agree that class size reduction is good. Smaller classes give teacher the opportunity to practice more of each parent's favorable educational or teaching methods. Teachers' unions and administrators like small classes for the same reasons parents do, but they may also like smaller classes for reasons that spring from self-interest. Teachers may like smaller class sizes because they reduce the effort that they will expend in order to deliver instructions.

Teachers' unions may also like class size reduction because it increases demand for teachers. Administrators may like class sizes reduced because it increases the size of their domains. As a result of the policy's popularity, the twentieth century has been a period of continuous decline in class size to the point where American elementary schools had an average 18.6 (approximately 19) students per teacher in 1997/1998 school year.

Nevertheless, there are both economic and empirical problems with class size reduction policies. It is conventional to estimate the relationship between educational inputs (like class size) and outputs (achievements) and to call the relationship on education

production function. This nomenclature suggests that inputs transmit systematically into achievement as they do in the production functions of profit-maximizing firms. The analogy is a false one, however, because firms' production functions are not just a result of their ability to turn inputs into outputs. A firm production function is as a result of maximizing an objective (profit) that gives a production possibilities set. It is not obvious that schools have stringent achievement maximization objectives imposed on them as described above, class reduction can fulfill a variety of objectives, not all of which are related to achievement. Thus while class size reduction always afford opportunities for increased investment in each child's learning, it is not obvious that every school takes up such opportunities.

The actual effect of reducing class size will depend on the incentives a school faces. Put it in another way, if a policy maker wants to predict the effect that a proposed class size reduction would have, she should rely on evidence from schools that have faced the incentives that are similar to the incentives that schools would face under the proposed policy. Schwartz (2005) opined that, the vast majority of variation in class size is correlated with determinants of students' achievement. In order to support the above claim, a number of educational researchers such as Fakuade (1983); Balogun (1985); Adepoju (1991); Irovi *et al* (1992); Salau. (1996); Mahmood (1999); Bassey (2002) and Waitutu (2006). They all have attributed students' poor performance in mathematics to large classroom size in our secondary schools. They further listed a number of other factors that can be considered to be responsible for contributory factors to the trend of poor performance of students in mathematics. These include:

i. Work over-load by teachers

ii. Dissatisfaction with the little or no infrastructural materials

iii. Experience or disposition of teachers to use child-centered method of teaching

iv. Lack of initiative on the part of the teachers to improvise – using the locally available materials as an improvisation in the teaching/learning process

v. General teaching skills (subject mastery) by the teacher

vi. Poor perception and negative attitude of students towards mathematics.

vii. Compulsory nature of the subject

viii. Finally, the poor control of candidates' admission due to the introduction of UPE (1979) and UBE (1999) of Obasanjo's administration.

The above factors have also been shown to produce or generate similar effect on students' achievements/performance in a number of researches from various parts of the world, for instance, the work of Yoloye (1994), Ayodele (1999) and Osobonye (2000) in Nigeria. In Britain, similar things were experienced as reported by ^various, researchers namely Blatchford et al (1998), in U.S.A. Costello (1992); Bracey (1995); Ziegler (1997), Gursky (1998), Robbie (1998) and Molnar (1998). It should be noted that the problem is universal and educators are actively involved in seeking to find the effective ways of understanding the problems involved in the issue of class size and their effects on students' performance/achievement. Salau (1996), Kogolla (2005) observed that a number of teaching strategies have been employed to teach mathematics to large groups of heterogeneous students such as child centered and activity based teaching. This is done to involve and draw attention of student(s) to the subject matter in order to perform better. This is achieved through ownership of ideas generated by the student(s) themselves.

Despite the use of various teaching approaches in the attempt to impact knowledge using effective strategies, Waitutu (2006) further reported that slight changes were noted in students' academic performance in mathematics. Erb (1996), Passmroye and Gursky, (1998) examined students' lack of taking or getting responsibility for their own learning in secondary school mathematics and found out that large class size was a major contributor/factor. They

both opined that the engagement and participation in small classes could very well increase the feeling of responsibility that students require to succeed in academic activities.

Hanushek (1998) reviewed of studies available to compare to various school resource, inputs which include class size reductions and students' outcomes and he concluded that reducing class size should not be expected to produce better students' performance and achievement. The analysis of this study showed that the relationship between various schools expenditures including class size reductions are remarkably weak which has led to call for a drastic rethink in the public education policy in U.S.A. The term "class" does not only refer to a single variable. Apart from being the total number of students/pupils in a room at a given period, it also refers to the homogeneity or on the other hand, the heterogeneity of the students in terms of sex, age, socio-economic background, intelligence and ambitions (Ward, 1999). Achilles & Lintz (1991) and Brewer *et al* (1999) defined "small" class size as one with one teacher to 13 -- 26 students.

While Charleston (1994) defines a large class as "one whose number does not permit the teacher to cope effectively irrespective of the students, as long as he cannot cope with the demands and aspirations of the individual student". However, he failed to mention what number of students should be adequate to constitute large class size to the teacher who handles students with varying ability levels, interest and mission with a uniform instructional materials and techniques. In this study, therefore, efforts will be made on how students constitute various class sizes particularly, the large class size situation.

2.4 Academic Achievements in Mathematics

The concept of academic achievement is the level of development essentially applied to what an individual or group has gained from the learning outcomes. Scholfield (2000) sees achievement as a student's relative growth in a given field of study, that makes him to have an in-depth knowledge and skills possessed as a result of instruction that have been

administered either formally or informally. Dike and James (1999) said it is an appraisal of students' educational growth in the three domains. Achino (2000) and Uba (2004) considered achievement to be a level of an individual's educational growth in a test when compared with the scores of others of the same level. Akindehin (1999) and Imo (1997) appraised academic achievement as a student's acquisition of knowledge and the ability to show and demonstrate such positive behavior for a longer period of time. The word achievement, according to Webster's International, is "a result brought about by resolve persistence or endeavour". Marshall (1991) says that academic achievement is the extent to which a person has achieved something, attained given activity, acquired certain skills or information, usually through a planned instruction in the teaching, learning or training process. Inyang (1988) sees academic achievement as how much or what pupils have learnt after teaching/learning period.

Academic achievement essentially applies to what an individual can do or attain in a learning environment within a specific criterion in a given domain with the teacher's guidance in the teaching environment. Collette and Appetite (1984), Johnson and Johnson (1987) have suggested that the students' performance, interest and motivation will be highly increased if each student is assigned a specific role. This is not possible with large class size in our secondary schools today. Empirical support for the effectiveness of assigning roles and responsibilities to students is available in the research work by Richton (1999). He reported that the inability to provide for and to meet the specific challenges and need of individual has been known to show depressed academic performance and achievement. To support this claim of large class, Abdullahi (1996) observed from his studies that effective implementation of the curriculum by the teacher in a large class size is apparently difficult to carry out. According to Titua (2002), large class sizes are significant concern to teachers in schools and also for an increasing number of parents whose children attend such schools. His findings have shown that annual budgets in Nigeria do not accommodate large class sizes

especially with dwindling and inadequate funding in schools.

The private schools take advantage of this to have a reasonable class size which encourages the parents to enroll their children there. They opined that the engagement and participation that small class size bring could very well increase the feelings and affection of responsibility that students require to succeed. Mosteller (1995) asserted that parents like small class size. He opines that reduction from larger class sizes to smaller ones brought about great academic achievement. Walbery (1997) has a different opinion. He commented that some studies conducted in Chicago showed that students in large class sizes had greater academic achievement gain as a result of cooperative learning than those in small class sizes, where no cooperative learning is practiced. Zerigher (1997) in his research of class size asserted that parents strongly believe and prefer that their children learn faster and benefit more in individualized teaching where more attention and awareness are given to them and will translate into higher scores on achievement tests. Robinson and Wittebols (1986), Robinson (1990), Everton *et al* (1990) and Wolf (1994) all agreed that the effects of class size on academic achievement by Educational Researcher Services showed that small classes made great difference in lower levels of education because of self dependence, while there exists increase in academic achievement in higher levels of education as a result of introduction of cooperative or group learning in a large class size.

It should be noted that what happens in the classroom environment does not only depend on how teachers complement their roles but also we need to know how the students perceive and conceptualize their learning and the role of their teachers in the teaching environment. The above researchers cited so far showed that there are still some considerable degrees that class sizes have a significant role in the teaching/learning and academic achievement of students, thus the researcher is promoted to carry out this study in an attempt to find out the best class size according to prevailing situation in any environment.

2.5 Ability Levels and Effects of Class Size on Students' Performance

Ability level is referred to as the practice of dividing students into separate classes of high, medium and lower achievers on ability grouping according to their academic performance (Bolaji, 2008). The findings from Harlen and Malcolm (1997), found that students of all mental abilities were found mixed in the same classroom, they were given the same assignments required and indeed expected to do the same work. Oakes (1992) and Lynch (1994) defined ability grouping as dividing students into separate classes of high, average and low achievers, or ability grouping of students according to their academic performance. Kunku (1989) reported that within class grouping comprising of high, average and low ability groups, they were found to have substantial positive academic effects.

Slavin (2003) concluded that schools can best deal with individual difference in ability by dividing students into sub groups within a heterogeneous class and thereby supported the use of within class ability grouping. He also noted and entertained fears on grouping of gifted learners together and felt that this type of grouping might lower teachers' morale, create differences in instructional quality and also create differences in students' motivation to learn certain materials. Feldhusen (1993) noted that the most common arguments against ability grouping in any form is that the gifted (high ability students) are needed in classroom situations in order to stimulate, motivate, encourage and inspire other students to learn. He further noted that students of lower and average ability often flourish or become better students when the gifted (high ability students) are not present and leading to competition.

Feldhusen and Moon (1992) agreed that grouping students with similar achievement and talent is essential if the desire is to help students achieve at the levels commensurate with their abilities and sustain or increase their motivation to learn a given task. They concluded that schools should consider gifted (high achiever) students before implementing cooperative

learning and heterogeneous grouping, they finally advocated for appropriate grouping, acceleration of instruction, teachers who will create challenging programmes associated with high ability peers, as well as a supportive environment free of negative peer pressures as the ingredients of excellent instructions for high ability learners.

The report of Hoover, Sayler & Feldhusen (1993) which indicates that the high ability or gifted students are needed in all the classrooms in order to stimulate, motivate and inspire other students is adopted in this research study. Also, heterogeneous class is employed on the grounds that the strongest (high ability) students are not over forced and the weakest (low ability) students will gain from sharing with their high ability students in the class. The study will also employ heterogeneous within-class approach where the high ability or gifted students are in the same class and taught with the same teaching method.

Salau (1996) concluded that the achievement profile of high achievers shows a decline as the class size becomes larger. This means that increase in class size tends to reduce the performance of students generally. Medermott (1997) also worked on students of all abilities where a test of general ability was used in small and large classes. The result was essentially identical in all the classes. In line with the work of Slavin (2003), he concluded that high, average and low achievers recorded the same level of achievement in an ability grouped class assignment. Achilles (1992) also reported a decrease in performance of students with different abilities when the class size became larger.

From the various works by different researchers, the result of ability grouping showed that it is one of the most important and controversial issues for schools and classrooms management. It is controversial in the sense that some students mentioned above tend to support grouping according to their ability because it increases students' performance, while other students completely disagreed and feel that there is no significant difference in the performance of students with different abilities. The use of mixed abilities could be more

advantageous since the low and average pupil would gain knowledge from their interaction and sharing with the gifted (high achievers) students. Nwagbo (2002) has further sought for more appropriate and an effective class size that would foster the teaching/learning of mathematics in the senior secondary schools.

The findings of most studies were that if an appropriate class size is known and applied to teaching/learning, it will be more effective and exciting, this will equally enhance teaching/learning. The available or established satisfactory answer as to how class size promotes students' understanding in teaching/learning of students with different abilities. It is against this background that the researcher is worried and sees the need to carry out the study of effects of class size and the different ability levels of students on their academic performance, using the activity method and grouping of students into different ability levels as medium of instruction. This study tends to investigate grouping of students with different abilities so as to find out how class size affects students either positively or negatively in their academic performance and which group will yield greater performance in teaching/learning process.

Teaching was done for six weeks to see if meaningful learning will take place. Post test was administered in order to assess the level of students' academic performance. The various available studies reviewed have not conclusively shown that small class size is linked to improved students learning and high academic performance of students in mathematics in junior secondary school level. In view of this gap, an attempt was made to establish which class size is appropriate for teaching/learning of mathematics. This study is an extension of most of the literature reviewed to serve as a base for the study.

2.5.1 Types of Academic Achievers

There are different types of academic achievers identified by various researchers. Achila (2001), Collia (2002), Anaso (2008) identified three types of achievers as follows:

a. Low achievers (under achievers)

b. Middle achievers (average achievers)

c. High achievers (over achievers)

2.5.1.1 Low Achievers

The under achievers or low achievers, as identified by Hummel and Sprinthal (1965); Ashania (2001) and Anaso (2008) are the group of students who perform poorly in tests, examination and are also easily distracted and are less able to set about their tasks in an organized manner. They further stressed that these students were less able to control their own basic impulses and their destinies. Ayeremo (2001) contended that the low achievers need constant study, evaluation and help so as to reverse their condition. Chachua (2002) identified the problems of the under achievers to be one of the more tragic dilemma in education. Ofonime (2007) also sees the under achievers as students whose academic potentials are judged below class average while their performance is described as poor, not encouraging. Bonnie (2003) is also of the opinion that the problem of the under achievers illustrate per excellence the importance of the motivational variable in academic success. These motivational variables, according to him, include social class difference and educational background of the teachers. Mueller (1988) reported that students that are below average and above average exist.

2.5.1.2 Average Achievers

These are the group of students who, according to Taylor (1992), Eleda (2002), Awe (2003) and Anaso (2008) can only record and average achievement, not because they are not capable of doing better, but partly because they cannot put in extra effort to attain better achievement. They are therefore contented to remain average. For this reason, they content themselves with the classroom learning without trying to reach out to other information.

2.5.1.3 High Achievers

James (1991) has described the high achievers as those students who perform well in tests, assignment and examinations. Collia (2002) refers to those who do not ascribe their fate to luck or to vagaries of chance but rather to their own personal decisions and efforts. Research studies by Coleman *et al* (1966), Resonshine (1980) and Onaso (2008) have further shown that the more important single ingredient in achievement is a feeling of self-directed competence. Ofonime (2007) further described the high achievers as those students whose academic potentials are above the class average and their performance is described as good.

All over the world, students of different abilities are found to be mixed up in the classroom settings, and yet they are exposed to the same treatment in terms of teaching, class work, home work and are required to show the same understanding. Salau (1996) described the achievement profile of the high achievers as being threatened to decline as the class size becomes larger with different individual and little attention is given to them. This implies that the increase in class size tends to drastically reduce the students' performance. Achilles (1991) also noted that with increase in class size, the performance of students become worse because of the work load teachers encountered and little interaction is noted between the teacher and the individual student. Cooper (1989), in his review of evidence, found several studies which showed that pupils in smaller classes attend more and spend more time on task Cahen in Cooper (1989), Carter (1989), Klein (1985), Finn and Achilles (1999) have argued that the benefits of small classes are primarily in terms of increased students' engagement in learning.

Smith *et al* (1989) asserted that there is little systematic research on the effects of class size or large pupil/staff ratio which can adversely affect the quality of relationship among young children. Research on children at nursery school level indicates that less favorable pupil/staff ratio can lead to more negative relationship between two children,

including aggression, anger and teasing. These were found to be of higher level when there is over-crowdedness in pre-primary school settings.

Rubin *et al* (1998) considered the effects of class size on relations between children. It is important to take note of the extensive literature on poor relations, stemming from developmental social psychology. There is evidence that children's early social behavior towards peers is an important predictor of later social and personal adjustments. Parker and Asher (1997) pointed out that the effects of children's pro-social, withdrawn and aggressive behavior towards peers have received most empirical support. Pro-social behavior is an important predictor of children's social adjustment and has been found to relate to the development of friendship. Pate-Bain and Achilles (1992) stated that "it was found that children in smaller classes were more appreciative of each other and showed an increased desire to assist one another".

In the present study, it is hypothesized that as class size decreases, there will be more signs of pro-social behaviour between peers and appreciative of each other in interactions.

The various concepts concerning children's behavior and social relations in class are therefore complex. Measures of classroom behavior, peer relations and social adjustment overlap with each other and need to be conceptualized and measured carefully so that similar but different behaviors are treated separately. Class resulting to high teacher/student ratio is linked to quality of teaching (Ward, 1990). As this requires tackling the issue of sufficient number of qualified teachers to fill the various positions and also provision of adequate facilities to contain the increased number of classrooms. Ward (1990) further pointed out that a class size that does not use more teachers is not a clear class size reduction at all and it is no where clear as effective. In addition, he also noted that in order to achieve maximum impact, class size should be used in conjunction with other strategies. Ward (1999) stated that planned reductions in class size should be accompanied by a review of teaching methods in

order to capitalize on the opportunity to enhance students learning. Fafunwa (1976) reported that student - teacher interaction does not exist in a large class. Albers (1974) held the view that large class does not enhance better utilization of resources. He pointed to the fact that large classes have been found to adversely affect the morale and self esteem of teachers. Johnson and Johnson (1983) on the other hand saw the problem of large class size to be the inability of the teacher to provide the specific needs of the individual student.

The National Education Association (NEA), report (1986) emerged with the following research evidence as a result of their study conducted on class size. Firstly, class size affects students attitudes more significantly than it affects achievement. Secondly, a direct effect of large class size is to lower the morale and increase the stress of teachers. Okebukola (1987) on the other hand considered large class size to be one of the eminent problems arising from enhanced access to higher education. Large classes according to him have led to inadequate teaching and learning materials. Abdullahi (1996) identified large class as a factor that militates against effective curriculum implementation. According to him, large classes in practical terms increase the teacher's work load, creates space problem, increases high level of indiscipline and inhibits the teacher's routine operational practices. This includes difficulties in assessing class work as well as reducing teacher -student interaction. Owuna (1999) reported that the amount of students' participation in a large class is limited. There are some indications that teachers are disturbed for the fact that large classes prevent them from knowing the students well in terms of ability levels, writing ability (fast or slow), social life and so on.

Zeighler (1997) provided some insight into the issues related to class size. He reported that parents believe that their children would benefit more from individual teacher attention, awareness and this would also translate into higher scores on achievement test. This implies that the lower the class size, the higher the academic achievement of students

because of high student - teacher interaction. Ziegler (1997) also reported that the only rationale for investing in more teachers for fewer students is to increase the students' achievement. Glass and Smith (1992) observed that small class sizes can be associated with higher achievement gain. It also leads to higher quality classroom environment, better students attitudes as well as greater satisfaction. From studies of Glass and Smith (1992) on class size, three principal conclusions were drawn:

i. Average student achievement increases as class size decreases.

ii. Group of 15 or fewer than 15 has greater percentage in achievement.

iii. Achievement increases most dramatically when class size drops below 20.

Glass and Smith (1992) further observed that the relationship between class size and achievement is stronger at secondary school level than at primary school level. Geottler-Sopko (1992) provides a summary of relationship of class size and achievement as outlined below:

a. Small class size seems to result in higher achievement among students who are economically disadvantaged.

b. Students with lower academic ability do better in smaller classes.

c. Class size might affect students' attitude more significantly than it affects achievement.

Molnar (1998), Boozer and Maloney (2001) in agreement with earlier studies of Glass and Smith (1992) which reported that reducing class size in schools increases achievement but in a very scale. They compared ten industrialized nations other than the U.S.A and found that students in Australia, Belgium and France did significantly better in large mathematics classes than in small classes.

Okebukola (1994) opined that high enrolment of secondary schools has impeded students' achievement in Biology. Famejurir(1986) in line with Okebukola (1994) agreed that

oversized schools with oversized classes have subsequently led to low academic achievement. On the contrary, Pastella (1997) opined that there was no significant evidence to support the claim that class size affects students' achievement. Kamiyele, (1993) also found that class size makes no significant difference in students' achievement in Physical education, while Talabi (1988) from his studies posited that gradual increase in class size may necessarily lead to low achievement in Geography.

Ferguson (1991) found significant relationships between teacher quality, class size and student achievement when he used data from more than 800 districts representing 2.4 million students. He found that students' achievement fell as the student/teacher ratio increased for every student above 18 to 1 ratio. He also found that measures of teacher's quality (teacher's literacy skills and professional experience) and students' socio-economic status were more strongly related to high students' scores. Angrist and Lavy (1999) cited in Hoxby (2000) illustrate the effects of class size using Israelite schools. He noted that class size varies abruptly and predictably when enrolment is at a multiple of 25. These discontinuities provide identification because of the difference in the underlying population that produces enrolment of 25 versus 26 is very small and therefore should have corresponding small effect on achievement. But the difference in class size of 25 versus 26 is large and should have a significant effect on achievement of reductions in class size as efficacious. The same is true for 50, 51, 75, 76 and so on. Angrist and Levy (1999) further stated that it is useful to estimate the effect of class size only for less-well-off students.

Hoxby (2000) identified the effect of class size on student achievement using longitudinal variation in the population associated with each grade in 649 elementary schools, using variation in class size driven by idiosyncratic variation in the population. She also used discrete jumps in class size that occurred when a small change enrolment triggers a maximum or minimum class rule size. The estimates, according to her, indicate that class

size does not have a statistically significant effect on students' achievement.

The different literature cited above showed that there is no definite conclusion drawn on the effect of class size on achievement. Secondly, the relationship between class size and academic achievement is not well understood. This study is attempting to find out if there is any significant effect of class size and ability levels on students performance in mathematics. Hawkins & Taylor (1992), "within the traditional teaching methods, it is reasonable to assume that a maximum class size limit will exist above which the quality of learning will deteriorate even if this is due to physical condition of learning and seeing". Hawkins & Taylor (1992) once again said, however, this is considered judgment as no research has established with certainty when this limit is reached. Nevertheless, it seems logical to the statement that class size in the traditional classroom or pupils/teacher ratio in the so-called innovations of teaching if not the effectiveness of it. This is probably what motivated the industrial organizations in their drive towards small classes. In the analysis, the research basis underline support on lack of it for small class size, it overlooks the mundane, less exciting issues in classroom, issues such as overcrowding, lack of ventilation etc.

Furthermore, an increase in class size from, say 34 to 42 means that the teacher has eight more assignment to mark, eight more lot of craft materials to distribute, eight more names to check on the roll, eight more accident possible victims to provide against etc. According to Hawkins & Taylor (1992), made the following remarks about the class size and effects; “It is difficult to generalize in a field of research which has been so diversified and contradictory, where serious doubt must be cast upon the validity of many of the research methods and where final results are often dependent upon the researchers' definitions of what represents ‘quality’ or achievement". In view of this he made the following observations:

i. Where achievement in subject areas, especially basic skill is the criterion, small class size has little demonstrable significance as a determinant of improved classroom performance.

ii. Except at critical break down point, reducing class size appears inefficient as a method of improving classroom quality.

iii. Reduction of class size appears to have little effect on teaching behavior, at least in the short term in the classroom.

iv. Increasing class size has an impact on the social learning climate of the classroom. Class size should be manipulated to achieve specific desire on special learning outcome.

v. More important than class size as determined classroom quality assume the self-contained classroom as a determinant of quality, is the style of activities planned in relation to the subject taught.

vi. Supports of class size as a factor determining classroom quality assume the self-contained classroom as the normal teaching unit. With increased innovation in classroom organization the concept of class/one room/one teacher/optimum class size may become more relevant.

Basic mathematical skills with a deeper understanding of the basic concept and structure of mathematics programme must attract and train more of those students who are capable of studying mathematics with interest. And all possible help must be provided for teachers who are preparing themselves to teach this challenging but interesting course. It should be noted that for meaningful learning to take place, effective and enabling environment must be provided through the use of adequate class size. Much research effort in the early twentieth century centered on attempting to determine a relationship between class size and academic achievement as measured by grade, class standing and test results. In the

majority of the study, no reliable relationship were established, probably because little attempt was made to control the indent variables operating within the classroom.

The impact of class size on teacher and pupil behavior has been the concern of a number of researchers who have covered the field from the area of group dynamics to the reaction of teachers to class size reduction. Relevant studies include those of Shane (1996), Oakes (1998) and Kenne and Pugh (2003). Shane (1996) notes, for example, that teacher in small classes tend to invent and adopt new practices, show greater understanding of individuals and use a wider variety of methods. He qualifies this however with the observation that when a teacher's class is reduced in size, it may take up to three years for changes in procedure to be implemented. Kenne and Pugh (2003) acknowledged that although class size seems to be a significant factor affecting the nature of leaning, small class sizes do not bring automatic changes in teachers' behaviour. Most relevant is their comment that many teachers have learned situations of more than 20 pupils i.e. they are capable of capitalizing on deliberately created ideal class size conditions. The review by Glass and Smith (1998), Robinson and Wittebols (1986) and Slavin (2003) summarize classroom-focused studies; these researchers examined "the number of pupils in each classroom, the interactions between the teacher in that classroom and the outcomes that were realized by the pupil in that classroom". It provides that most direct and intensive view of the effect of class size have been vigorous debates for many years about the educational effects of class size difference but even if differences have an impact on pupils. Academic progress has left unanswered important questions about what mediates the effect.

The main worry in Nigerian educational system has been that class sizes at the primary stage are too large and that teaching/learning and children's educational progress can suffer. It is probably true to say that the overwhelming professional judgement is that, other things being equal, smaller classes will enable teachers to provide better quality of

educational experience for students (Blatchford, 1998). Research has concentrated almost exclusively on the effect of class size reduction on academic outcomes. As many others were predominantly interested in the relationship between class size and academic attainment and has little to say about classroom processes that might explain effects found.

Wooton (1999) argued that for better teaching of school mathematics, three things are required:

a. We need enabling environment, which will challenge and assimilate the teaching and learning by the teachers/students.

b. We also need an improved curriculum, which will offer students not for only the basic mathematics skills but also a deeper understanding of the concepts and structure of mathematics.

c. Mathematics programmers must attract and train more of those students who are capable of studying mathematics with interest. And all possible help must be provided for teachers, who are themselves to teach the challenging but interesting course.

It should be noted that for meaningful learning to take place the challenging and enabling environments must be provided through the use of adequate class size. The various authors have highlighted the problems of class size but the extent to which this problem of class size affects achievement is yet to be unfolded. Hence the present study in an attempt to shed more light on these problems and how it affects academic achievement in mathematics.

2.6 Gender and Mathematics Achievement

Gender consideration is essential in teaching/learning environment. Begley (1998) and Holder (1998) indicate that there is very little gap in mathematics between boys and girls at secondary school level. In similar work of Erinleahey and Gwang Guo (2001), it was reported that very little gap of achievement exists between boys and girls at the elementary

level of education in mathematics. Their findings reported that boys tend to progress much more quickly as they become older and advance in academic activities (mathematics) such as cumulatively, associatively, estimation and applying mathematics, the solution to words and practical problems. The researcher has gone through some of the studies that had investigated into gender differences and grouping that constitute the class size and its academic achievement.

Erickson (1994); Rache (1996); Nwagbo (1997); Indolp (1999) and Uhmuavbi *et al* (2003) observed and reported that there is no significant difference in achievement in girls' schools or boys' schools. Harding (1997); Aigbomain (2002) reported from their studies that boys secondary schools perform better than girls' secondary schools in mathematics. Reviewing another research work of Moses (1996), Hatlen (1997), on the effects of grouping students by mixing the sexes in the class size in classroom sitting has shown to bring about conceptualized ideas on notions of proximity/setting and working on the same task/activity. However, the relative performance of students is affected by many variables other than the mix of grouping for instance the class size, ability range, teaching methods and materials, the degree of individual differences and the attitude of the teachers exhibited towards mixed ability teaching and the curriculum content implementation.

Patterson and Povle (2001), suggested in their study, that teachers should make smaller groups or within the class to see the effects of it not only to provide individual differences and their contributions but also to provide avenue for opportunity of maximum participation within the groups. Also in agreement with the work of Stodolsky (1991) and Schmuck (1999) that the scheme for sub-grouping a class into different work groups does not have a decided effect on students motivation and high interaction and social climate in the sharing of ideas; teaching materials and cooperation promote good social climate. All these factors are important determinants of teaching/learning and students' achievement. The sub-

group is defined by Oakes (1986) and Lynch (1994) as the division of academic subject into classes which geared for different levels for students of different ability (high, average and low achievers). Their findings reported that boys tend to progress much more quickly as they become older and advanced in academic activity (Mathematics) such as cumulatively, associatively and applying mathematics the solution of world and practical problems.

This study is aimed at investigating the effect of class size and ability levels on students' performance in mathematics on gender difference to see what the result will be.

2.7 Influence of Teachers' Qualifications on Students' Performance in Mathematics

A teacher according to Urama (2003) is a person in a given community who stands to influence one another through various interactive experiences. In the formal school situation such as western educational system, the professional is otherwise known as the regular classroom teacher who also stands to learn from his/her students anytime (Arifisayo, 1996:26).

For many years educators and researchers have debated which school variables influence students' achievement. As policy makers become more involved in school reform, this question takes on new importance since their many initiatives rely on presumed relationship between various education related factors and learning outcomes.

Darling-Hammond (2009), some researchers have suggested that "schools bring little influence to bear upon a child's achievement that is independent of his background and general social contexts" (Coleman, Campbel, Hobson, McPortlan, Wood, Weinfeld & Yoru, 1966:325).

Other evidence suggests that factors like class size (Glass *et al,* 1982 and Mosteller, 1995), teacher qualifications (Ferguson, 1991), school size (Haller, 1993) and other school variables may play an important role in what students learn. As new standards for student learning have been introduced across the states, greater attention has been given to the role

that teacher's quality plays in students' achievements (National Commission on Teaching and America's Future, 1996; National Education Goals Panel, 1998). While some evidence suggest that better qualified teachers may make a difference for students' learning at the classroom, school, and district levels, there has been little inquiry into the effects on achievement that may be associated with large-scale policies and institutional practices that affect the over-all level of teachers' knowledge and skills in a state or region (Begley and Geeslin, 1972:86-92).

Subject matter knowledge is another variable that one might think could be related to teacher effectiveness. While there is some support for his assumption, the findings are not as strong and consistent as one might suppose. Studies of teachers' scores on the subject matter test of the National Teachers" Examination (NTE) have found no consistent relationship between this measure of subject matter knowledge and teacher performance as measured by students' outcomes (Blackmon & Mackey (1980), Ayers & Quails, (1979), Haney *et al*, (1986); Quirk *et al*, (1973) and Summers & Wolfe (1975).

Teacher quality variables constructed from the schools and staffing survey (SASS) data include the proportion of "well qualified teachers" defined as the proportion holding educational qualification and the equivalent of a major (either an under-graduate major or masters degree) in the field taught. The proportion of teachers who are "fully qualified" includes teachers with standard or regular certification and new teachers on probationary certificates who have completed all requirements for a license except for the completion of the probationary period (usually 2 or 3 years of beginning teaching). The proportion of teachers who are "not full qualified" includes teachers with no certificate and those with provisional, temporary or emergency certification (Darling-Hammond, 1997; Haberman, 1995; Monk, 1994 and Fuller, 1999).

Some recent multivariate studies of students' achievement at the school and district

levels have found substantial influence of teachers' qualifications on what students learn especially when scores in public examinations are included. Ferguson (1991) found that combined measures of teachers' expertise - scores on a licensing examination, masters degrees and experience - accounted for more of the inter-district variation in students' mathematics achievement. Of the teacher qualification variables, the strongest relationship was found for scores on the state licensing examination, a test that measures both basic skills and teaching knowledge.

The effects were so strong and the variations in teacher expertise is so great that after controlling for socio-economic status, the large disparities in achievement between public and private school students were almost entirely accounted for by differences in the qualification of their teachers. (Strauss and Sawyer, 1986) also found out that every additional money spent on more highly qualified teachers netted greater increase in students' achievement than did less instructionally focused uses of school of high school resources.

A study of high school students' performance in mathematics and sciences using data from the National Educational Longitudinal Studies of 1988 (NELS) found that fully qualified teachers have a statistically significant positive impact on students test scores relative to teachers who are not qualified in their subject area, as do teachers who hold degree in mathematics or mathematics education (Goldhaber and Brewer, 1999). Also a more recent Texas study (Fuller, 1999; Fetler, 1999 Greenwald *et a!*, 1996) found that students in districts with greater proportions of licensed teachers were significantly more likely to pass the Texas State Achievement Tests, after controlling for students socio-economic status, school wealth and teachers' experience. In discussing the teachers as the center of the educational system, Ukeje (1991) affirms that no education can rise above its teacher, and no nation can rise above its teachers. On the basis of the above expositions, the teachers' qualification can truly influence students' achievement in mathematics, and students' performance will be more

encouraging if only teachers who are professionally trained should be recruited to teach mathematics in the schools. The untrained teachers already on the job should be compelled to obtain teaching qualification within a given period of time or be relinquished from their jobs, and lastly adequate teaching materials and a manageable class size should be provided to enhance teachers' "efficiency and job satisfaction".

2.8 Empirical Studies

Betiku (2002) carried out a research on factors responsible for performance of students in school mathematics and it suggested remedies. A reliable and validated fourteen-item type questionnaire was administered on 45 undergraduates and 42mathematics. Result showed that factors of poor foundation in secondary school Mathematics are the employment of incompetent teachers in the school system, physiological fear of the subject and large classes. It was recommended among others that:

1. Mathematics laboratories should be established in the school system
2. Results of deliberations of workshops, conferences should be revisited and made open to the mathematics teachers

The reviewed work is closely related to the present study since both focused on the problems of learners poor performances in mathematics. But they differ since the work of Beliku (2002) centered on the general factors responsible for poor performance in mathematics in all levels while the current is limited to the effects of class size and ability levels on the learners' performance in mathematics in Junior secondary school level. More respondents were used and it was experimental in nature.

Ahmed (2009) carried out e research on "Effect of class size and ability levels on performance in mathematics among senior secondary schools in Zaria educational zone. The study tried to examine some factors responsible for poor performance of students in mathematics and recommendations and suggestions were made. Mathematics achievement

test consisted of a set of fifty multiple choice test items which was designed and administered on 180 students in three senior secondary schools and 12 mathematics teachers. Result showed that poor performance in mathematics in senior secondary school are as a result of overcrowded classroom, poor salaries to mathematics teachers, lack of in-service programmes for mathematics teachers, inadequate mathematics teachers e.t.c.

The researchers recommended that allowances should be given to mathematics teachers, apart from the monthly salaries. They should be assisted financially to acquire in service training from time to time. Appropriate teaching aids should be made available for mathematic teachers. Class size of 30 students should be encouraged and supported by government in Nigerian secondary schools for improvement in poor performance of students in mathematics at the senior secondary schools.

The review work is very much related to the present studies since both focused on the problems of learners' poor performance in mathematics. But they differ since the work of Ahmed (2009) is centred on the senior secondary schools in Zaria educational zone. In the current study, less respondents were used and the focus on junior secondary schools in Kaduna metropolis and not Zaria.

Uyagu (2009), also carried out a research on "the effects of utilization of Teachers Instructional materials on students performance in mathematics in senior secondary schools in Zaria". The study tried to examine some factors responsible for poor performance of students in mathematics and recommendations and suggestions were made. Mathematics Achievement (MAT) consisting a set of fifty multiple choice test items in mathematics was designed and administered on 80 students in two secondary schools. Observation schedule was also designed and administered on 9 mathematics teachers. The result showed that poor performance in mathematics in senior secondary was as a result of lack of students' positive attitudes and interest towards mathematics, mathematics textbooks, lack of pre-service

training and lack of mathematics laboratory in secondary schools. Poor utilization of the instructional materials on senior secondary school mathematics classes, teachers qualification and experience, overcrowded classroom were other additional factors.

The researcher recommended that instructional materials should be sourced for and properly utilized for each mathematics topic designed to be taught; government should ensure the adequate employment of dedicated qualified mathematics teachers to teach the subject in all secondary schools in the study area in particular and Nigeria in general. Organization of mathematics "fairs" on utilization of instructional materials at local, state and national levels. The inventive mathematics teachers could be made to describe the processes and principles involved in designing and utilizing such materials.

- Government should make available funds and sponsor the teachers attendance at conference, seminars and workshops on utilization of mathematics instructional materials.
- Suitable source books on utilization of mathematics materials should be made available to all secondary schools.
- Government should be mindful of recommended class size in all levels of secondary schools for effective teaching and learning of mathematics.

The reviewed work is related to the present studies since both focused on the problems of learners' poor performance in mathematics. Both studies used teachers qualification as one of the variables. However, they differ since the work of Uyagu (2009) is centred on the senior secondary schools in Zaria and also on the effective utilization of instructional materials in teaching mathematics to improve student performance in mathematics. She also used two sampled schools in Zaria Local Government Area of Kaduna State while the current study has used three sampled schools in Kaduna metropolis. The former examined the effect of teaching materials on students performance in mathematics while the current examined the effect of class sizes.

Idowu (2010), investigated the influence of home background on students' performance in mathematics in junior secondary schools in Kaduna State.

The study was designed to examine some selected factors through empirical strategy that contribute to poor performance in school mathematics and some remedies were suggested. A reliable and validated thirty-two likert type questionnaire was administered on 300 students and 27 mathematics teachers. Results showed that factors of poor performance in secondary school mathematics may not only be due to the common and obvious factors like methodology, teachers' quality, overcrowded classroom, curriculum but also some subtle factors from the home such as parental support in academic work, socio-economic status of the parents, parental education level, parents occupation and gender difference contribute to poor achievement of studies in school mathematics. It was recommended that:

- Parents should strive to provide for the education and needs of their children in schools, especially the poor, whatever, might be the level of their income.
- Also parents should have a small family size which is manageable with their income, so that students from the poor background would be able to perform equally with those from rich homes.
- Parents should monitor their children's school work and performance and create time for their wards.
- Since parents' level of education was an important factor for determining a child's academic performance, federal and state governments should be directed to improve the literacy level of the populace which can be done through mass literacy campaigns.

This study showed that students from high socio-economic status parents' performed better than those from low socio-economic status parents. The result also showed that the higher educational level of parents, the better the students performance. It furthered showed that parents occupation has a positive impact on the students performance. Again, the higher the

parents' interest and support, the better the performance of the students. In order words, students whose parents at home help in their home work do well in their academic pursuits. It equally showed that gender has influence on students' performance in mathematics. Today in Nigeria schools, there are students of high socio-economic status who perform poorly in school while those from low socio-economic status are doing well contrary to these findings. The reviewed work is closely related to the present study since both examined the problem of learners' poor performance in mathematics. However, the two studies have some differences. The former is about the home background as a factor responsible for poor performance in mathematics while the later is limited to the effects of class size and ability level on student's performance in mathematics. Both studies were done in Kaduna and in junior secondary schools in Kaduna North and metropolis respectively. More respondents and more schools were used and in the former survey the study while the later was experimental in nature. Both studies made use of gender as variable on student's performance in mathematics though the former rejected the null hypothesis while the later accept it. It was noted that poor performance in mathematics was attributable to many factors and some remedies were proposed.

Another study was conducted by Ojo (1987) on the effects of teacher's qualifications on students' performance in mathematics. The result revealed that teacher's qualifications strongly affect performance. He sampled twenty government owned junior secondary schools within Kaduna State and concluded that the schools lacked competent teachers and hence performance was poor. He then recommended that the teachers should be encouraged to further their education. His study further revealed that students' poor performance in mathematics is connected to teachers' failure to cover the prescribed syllabus before the examinations. He also recommended that students should complement the teachers' effort of covering the syllabus by independent study.

The work is related to the present study as both focus on the problem of students' poor performance in mathematics. Both used junior secondary schools in Kaduna state and teachers quality was used as one of the causes of poor performance of students of mathematics. But they differ since the work of Ojo (1987) is focused on teacher qualifications only. In the current study, less respondents were used but both studies were experimental.

The later also identified other factors responsible for poor performance of students in mathematics Recommendations were made in both studies.

2.9 Implication of the Review of Literature to the Present Study

Scholars such as Nolasco and Arthur (1991) contend that the definition of large classes is difficult because teachers who are used to teaching classes of 12 - 14 students might find a group of 20 large depending on the problematic situation they meet in such classes. Moreover, other scholars attempted the definition, such as Olumide *et al* (1996) described a large class as:

> *"One whose numerical strength does not permit the teacher to cope effectively with the demands of the individual student". Holiday (1991) defines a normal classroom situation as a class of less than 30 students. To him, any class that is more than thirty students is a large class. The National Board for Technical Education (NBTE) guidelines for establishing new programmes in polytechnics and similar tertiary institutions in Nigeria (1993) stipulates that "the number of staff shall be determined based on staff/students ratio of 1:20…"(pp. 124)*

In order to bring a kind of cohesion to all these inclusive numbers, in this study, large class is operationally taken to be any number more than 30 students. This brings about the need to justify the large class aspect of this study. Coleman (1998) suggested five criteria for

justifying the study of large classes. This study wants to agree with Coleman (1998) that the study of large class is necessary as it is a common phenomenon in the post primary institutions in Nigeria.

All these arguments seem to be out dated as Bourke (1998) found in a survey of teaching in Melbourne that learners' achievement is not a function of class size. When certain teachers' practices are employed and that of negative correlation, it looks difficult to manage but when the positive practices are employed, he identified such as probing activities, follow up and waiting for students to formulate answers, then it will be interesting.

Andrie (1986) found that the "highest scoring pupils tend to be found in classes of 26 - 35. In another study based in France, which was a survey on "whether learning takes place more effectively in smaller classes" rather than in classes of 16 - 25". This idea is corroborated by Burgess (2002) in an unpublished thesis when he says the teachers of large classes are "fortunate" in that they are forced to confront issues of classroom instruction patterns, curriculum and syllabus design as well as evaluation more seriously than in small class situations. Bolton, in a paper presented at the 22nd Annual TESOL convention in Chicago, concluded that larger classes may be better. "One large class may serve the students and their teachers at least as well as several small ones - perhaps better". The large class, therefore, prepares the teachers for more than just teaching their subjects, they double into areas of teaching and learning in general which are useful to their profession. Large classes are common in Nigerian post primary institutions. They constitute a phenomenon in her education. Ihebuzor (1998), Holliday *et al* (1998), Holliday (1980) and Nolasco and Arthur (1991) have given a character of analysis of what large class is by enumerating its problems which are:

a. Students' negative attitudes to learning new things

b. Discipline problems

c. Students using the mother tongue when asked to work in pairs or groups.

d. Noise making

e. Lack of opportunity for developing individual communication skills.

f. Problems of boredom in teaching and testing as well as teacher domination. (p54).

These problems make it possible to call large classes the art of teaching in an overcrowded or uncomfortable classroom atmosphere. Large classes became more prominent in the Nigerian school system with the introduction of the Universal Free Primary Education in 1955 by the defunct action group government of the old Western Region. During that period, primary school population rose from 456,600 in 1954 to 814, 690 in 1955 (Ministry of Education Western Nigeria, Annual Report 1954 55 forward). The legislative basis for the educational development was the comprehensive law of (1954) no. 6 of 1955). The universal free primary education system (UFPE) of the 50s affected the old western region and Lagos only. It was tried for a while in the East with no success and was later abandoned. It was never tried in the North. The one that affected the whole country was the Universal Primary Education policy of 1976 which made education compulsory and free at all levels. This led to large classes in both the primary and secondary schools. Other measures that led to large class situations in school were the quota system of the federal government to satisfy the multi-lingual nature of the country (Bakoji *et al.*, 1991), indiscriminate admission of students to state-owned secondary schools and the federal government's deliberate policy for all states to admit students from various parts of the country.

In Nigeria, large classes have been largely caused by political decisions and ideologies; the demands of employers and sponsoring agents (notably, federal and state governments) and governmental policies. These are in line with what caused large classes in

some other countries like South Africa (Peachey, 1998) and, Japan, where Costello (1992) reported that large classes came into being as a result of historical explanations and Whiting & Achilles (1995) considered its emergence as a natural phenomena. At tertiary level of education in Nigeria especially the polytechnics, classes started becoming large in the 80s when the federal and state governments wanted more students, to be admitted in order to meet the pressing man power needs of government at all levels. The old idea of higher education for the few gave way to mass education as a result of the nation's economic buoyancy of the 70s which opened up many job avenues without corresponding number of qualified personnel to match these high demands. Just as the classes were getting larger, the economy down-turned, the oil boom became oil doom; schools became worst as teachers left the classrooms for greener pasture. Even in the 90s when resources became scarcer, nothing done to reduce class size.

The structure of classroom has not changed. Students, even in special schools have to carry chairs and tables from their homes to schools. Students in some schools make use of cement blocks to sit on in the classrooms. Some schools have very few classrooms (especially in the villages); some classes are therefore held under the shades of big trees or sit on the windows for lessons. The situation is worse now than ever as some states lay-off teachers who are non-indigenes of such states. The alarming situation in the schools is better explained by Gabriel Dike on the Sunday Times newspaper article of January 7, 1996, captioned "unity schools near collapse" (Gabriel, 1996). The problems were listed on the front page of the paper as:

> *Acute under-funding, low morale of teachers; parents provide chairs, desks; some lack water, light. Library; and resumption date unknown (p26).*

Dike further went on to say that "the nineteen (19) newly established of these sixty five unity schools, which are in newly created states suffer more as they lack the necessary

infrastructure and facilities to adequately cater for the large number of students admitted each year". If special schools, which are established to promote unity and to admit only exceptional students, selected after National Common Entrance Examination, experience dilapidation and negligence of educational facilities and even lack basic teaching aids and infrastructure, the condition of the other schools that are less favored can be imagined. As pointed out earlier in sections 1.3 and 2.6 internationally, large classes are not new especially in countries such as France, Italy and USA (Gibbs and Jenkins, 1992), but resources have not dropped as dramatically as they have in Nigeria. The dwindling economy in Nigeria has led to lack of sufficient personnel and infrastructural facilities to teach in the schools hence, resort to large classes.

The polytechnics attempted to solve some of large class problems by reprogramming some of its courses, redesigning its examination patterns and building more classrooms. The more classrooms built, the more the number of students were. This tallies with Coleman's experiences in Indonesia where many new teachers were employed to solve the problem of large classes, the larger the classes as a result of bureaucratic decisions (Coleman, 1998). All attempts of teachers to force down class size yielded no fruit because of the overriding power of politics on teachers' efforts. Therefore, there isno longer any need to dodge the large class problems, thus a need for a study like this in search for solutions to the problems. Osasuna (1996).

2.10 Summary

The review of literature in this chapter indicated that mathematics is a very important subject, which any nation with positive intention for development in science and technology could not afford to trifle with (Francis 2002).

All over the world and Nigeria in particular, the low academic achievement in mathematics by students has been a major issue and concern to mathematics educators and

educational planners. This has resulted to so many conferences, workshops and seminars by various bodies like Mathematics Association of Nigeria (MAN), Science Teachers' Association of Nigeria (STAN). Recently, the evolution of Strengthening Mathematics and Science Education (SMASH) in Nigeria was born in 2005 by the Federal Ministry of Education in collaboration with Japanese government, to organize in-service training (INSET) for the teachers to improve their competency and strategy in handling the problems of large class size. The problem of poor performance in Mathematics is not a recent issue, the curriculum changes like Entebbe Mathematics of 1963 was called for as a result of poor performance of students.

Literature suggest that the lower the class size, the higher the academic achievement of students because of high student/teacher interaction. Average pupils achievement increase as class size decreases and students with lower academic ability do better in smaller classes.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Introduction

This chapter describes the methodology used in carrying out the research work. The issues discussed are :

Research design, population of the study, sample and sampling, instrumentation, validity of the instrument, procedure for data collection and method of data analysis.

3.2 Research Design

The research design used was quasi experimental type. It involved three schools (groups), schools A (large class size), school B (medium class size) and school C (small class size). The pre-test and post-test were conducted for the three groups. A pre-test was administered on the students in the three groups before the treatment. This was to determine the ability levels of the students.

3.3 Population of the study

The population of this study comprised of all students and teachers in public junior secondary schools in kaduna metropolis. There are twenty-two (22) public secondary schools in kaduna metroplis. The students' population is three hundred and two thousand, one hundred and sixty one (302,161) and two thousand eight hundred and nine (2809) teachers.

The table of population distribution of students and teachers is presented below.

Table 3.1: Population of Students and Teachers in Public Junior Secondary Schools in Kaduna Metropolis

S/N	Name of school	Male Students Population.	Female Students Population	Total Students Population	Population of Male Teachers	Population of Female Teachers	Total Teachers
1	GGSS Badarawa	2301	-	2301	52	20	72
2	GSS Anguwa Sarki	2745	-	2745	59	27	86
3	AMM GGSS A/shana	1548	-	1548	32	14	56
4	GSS A/Rimi	1533	-	1533	12	13	25
5	GGSS kabala costain	-	1110	1110	18	11	29
6	GSS Doka	1241	304	1545	16	14	30

7	GGSSTudunNupawa	-	803	803	16	16	32
8	GGSS Maimuna Gwarzo	1934	-	1934	30	15	45
9	GSS Rigasa	-	1235	1235	31	17	48
10	GGSS Rigasa central	-	1331	1331	21	10	31
11	GGSS Kadi	1203	462	1665	6	6	12
12	GGSS Independence way	561	58	619	22	12	34
13	GGSS Kawo	650	304	954	17	10	27
14	KASSES	589	280	869	17	16	33
15	GGSS A/sarki	967	333	1300	13	18	31
16	GGSS Kadiki	135	740	1875	12	20	37
17	GGSS Doka	1185	200	1385	29	24	53
18	GGSSTudunwada	387	16	403	33	21	54
19	GGSS K/Mashi	302	15	317	17	12	29
20	Umar Idris GGSS T/Buwa	75	1	76	17	9	26
21	GGSS A/Muahazu	900	197	1097	17	6	23
22	MNS GGSS Kabala	573	140	713	21	10	31

From Kaduna ministry of education 2011

3.4 Sample and Sampling Techniquies

From the 22 schools, 3 schools were sampled. They are government girls secondary school (junior) independence way Kaduna, Government Boys' secondary school (junior) Lokoja Road, Kaduna and Government Junior secondary school (GJSS) Kurmin Mashi, kaduna. The choice of the three schools was because they all share common characteristics like student types, academics objectives, educational facilities and education polices. Intact classes of ninety (90) students were used in school A, forty (40) students in school B and twenty (20) students in school C. According to Olayiwola (2007), dealing with intact groups makes it natural. It may not use control group (p65). Table 3.2 below represents a sample distribution of students and teachers as follows:

Table 3.2: Sample Distribution of students and teachers

Table 3.2: Sample Distribution of Students and Teachers

S/N	Sample Schools	Sample	Male	Female	Total

		Students	Teachers	Teachers	
1	GGSS Independence Way	90	3	2	5
2	GBSS (Doka Boys)	40	2	2	4
3	GJSS K/Marshi	20	2	0	2
	Total				**11**

3.5 Instrumentation

The instruments that the researcher used for the collection of data for this study were Mathematics Achievement Test and Obsevation Schedule. The two instruments enabled the researcher to have a face to face contact with the respondents in order to obtain the data required in the course of the study

3.6 Description of instrument

The test covered the syllabus of Junior Secondary School Mathematics mostly JSS two scheme of work.

The test consisted of fifty objective questions covering numbers and numeration, algebraic processes, geometry and numeration, statistics, properties of numbers, number pattern, squares and plane shapes, angles, proportion, ratio and rates. These were given to test the effect of small, average and large class size and ability levels on the performance of students in mathematics in Junior Secondary Schools. Pre-test was administered to the three categories of class sizes (large, average and small class sizes) before teaching the students by the mathematics teachers in different groups of large (90 students) average (40 students) and small (20 students). This was done without prior notice about the test in order to minimize examination malpractice and fear by the students. The test was conducted in the morning when students were not stressed up.

The teachers and researcher jointly supervised the students during the test. Post-test was given to the students after six weeks of teaching by the mathematics teachers and jointly supervised by the teachers and the researcher. The scripts were marked and recorded by the researcher for statistical analysis.

3.7 Checklist / Observation Schedule

In using this instrument, the researcher visited the classes to obtain on-the-spot assessment of class teaching strategies of individual teacher. It was however subdivided into six (6) areas of interest. These included lesson preparation, lesson presentation, classroom management, communication skills, evaluation and teacher's responsibilities. Each item had a structure of what the researcher was interested in looking at and the total score was 100 marks. Marks were allotted to each item used in the observation of teachers and their classes.

Description of Observation Schedule

1. Preparation of lesson notes (10mks)
    a. Statement of objectives (5)
    b. Context (1) logically and sequentially (2) coverage (3)
2. Presentation (55 marks)
    a. Introduction (relevance) - 5
    b. Development of lesson – 5
    c. Mastery of subject matter – 10
    d. Use of chalkboard – 5
    e. Time management – 5
    f. Questioning technique – 5
    g. Use of instructional materials (relevance, adequacy, variety) –
    h. Class participation – 10
    i. Summary, conclusion – 5
3. Class Management (12)
    a. Class control – 5
    b. Class arrangement – 2
    c. Pupils responses – 5

4. Communication Skills (5 marks)
    a. Clarity of voice – 2
    b. Appropriate use of language – 3
5. Evaluation (10 marks)
    a. Suitability of assessment – 5
    b. Attainment of state objectives -5
6. Teachers responsibility (8 marks)
    a. Neatness/dressing – 4
    b. Comportment - 4

The above items indicate how marks were allotted to each item used in the observation of teachers and their classes.

The Mathematics Achievement Test (MAT) consisted of fifty multiple choice questions and five essays. MAT evaluated the effects of class size on the teaching in the three groups of class sizes. The test items were adopted from the multiple choice in Junior Secondary Certificate Examination past questions 2010. The fifty multiple choice test items consisted of four response options of which one is correct, while the three remaining options are good distracters. The students were made to respond to each test item by selecting the correct options and picking the corresponding letter of the correct options. (See Appendix).

3.8 Validity of the instruments.

The observation Schedule used in this study was developed by the researcher, while the MAT test items were adopted from past JSCE question papers. They were vetted by the supervisors and experts in the field of evaluation and measurement in the faculty of Education, Ahmadu Bello University, Zaria. This was to determine the face and content validity of the instruments with the objectives and hypotheses of the study. However, necessary corrections and modifications were

made on the advice of the experts. The corrections they made were effected and the items were reconstructed based on the satisfactory comments of the experts in the field.

3.9 Pilot Study

A pilot study was carried out in Government Secondary School, Riga Chukun (Jnr.) which is not part of the sampled schools. A total of four mathematics teachers were observed and fifteen students were given tests. The purpose of the pilot study was to determine the reliability of the instruments, their level of difficulty and whether they have the power to discriminate over results. The instruments were personally administered by the researcher and scored. This was to give room for final corrections of the MAT items for possible commencement of the field work.

3.10 Reliability of the Instrument

The reliability of the instrument was calculated using split-half method. Afolabi (1993) explains reliability as the consistency and dependability of the instruments to measure what it is intended to measure. Therefore, Pearson Product Moment Correlation Coefficient (PPMC) was adopted to determine the reliability of the instruments.

The reliability score of MAT was 0.82. This indicates that the items were reliable within acceptable limits. It was further confirmed by Murkherjee (1978) that the requirements for internal consistency is an average value of the corelation coefficient, which must be higher than 0.80.

3.11 Procedure for data collection

The researcher administered the instruments to the subjects with the help of assistants. Before moving to the sampled schools, permission was sought from the Ministry of Education, Kaduna through a letter of introduction from the researcher's institution. It involved the administration of test and conducting observations on the selected junior secondary schools. This was carefully administered and likely results were obtained within six (6) weeks.

3.12 Method of data analysis.

The data collected from the study were subjected to statistical analysis. Descriptive statistics were used in analysing the research questions. The first and third hypotheses were analysed using the analysis of variance (ANOVA) while the second hypothesis was analysed using t-test.

CHAPTER FOUR

DATA PRESENTATION AND ANALYSIS

4.1 Introduction

In this chapter, the analysis of data and the results of the study on the effects of class size and ability levels of student's performance in mathematics are presented. The analysis of research question precedes the testing of hypothesis in this chapter. The analysis essentially involved statistically testing of hypotheses using statistical package for Social Sciences (SPSS). The level of significance adopted was 0.05. This level of significance formed the basis for accepting or rejecting each of the null hypotheses stated. The t-test was used particularly to test the second hypothesis, while the analysis of variance (ANOVA) was used to test the other two hypotheses.

4.2 Respondent: Biodata

Schools	Number/class size
GGSS Independence way	90 students
Doka Boys, Lagos street	40 students
GJSS K/Mashi	20 students

4.3 Analysis of Research Questions

The researcher had earlier stated three research questions to guide this study. The answers to the research questions were obtained through the analysis of the MAT and observation schedules used for the three groups.

Research Question 1:

What is the relationship between class size, ability levels of students and their performance in mathematics in Kaduna metropolis?

Table 4.1 reveals the performance of each of the treatment groups representing three different class sizes: large, medium and small.

Table 4.1: Performance of Students in MAT

Schools	Class size	Mean Score	Standard Deviation
GGSS Independence Way	90 Pupils	39.70	8.456
Doka Boys, Lagos Street	40 Pupils	43.988	9.131961
GJSS K/Mashi	20 Pupils	44.080	13.74142

The table above revealed the performance of each of the three schools representing large (90), medium (40) and small size(20) classes. The mean score and standard deviation of the large class size were 39.70 and 8.456 respectively. For the medium class size the mean and standard deviation were 43.988 and 9.132 respectively; while 44.080 and 13.74142 were the mean score and standard deviation, for the small class size. From this result, it can be seen that a better performance was obtained from the small class size than from the large class size. This indicates an inverse relationship between class size and performance, i.e. as one decreases, the other increases.

The relationship between class size and ability levels is shown in Table 4.2.

Table 4.2: Comparison of Performance in Students with Varying Ability Levels in the Three Class Sizes

Ability Levels	Small Class Size		Medium Class Size		Large Class Size	
	Frequency	**Percentage**	**Frequency**	**Percentage**	**Frequency**	**Percentage**
High	3	12	0	0	5	5.9
Medium	16	64	9	22.5	77	90.6
Low	6	24	31	77.5	3	3.5
Total	**25**	**100**	**40**	**100**	**85**	**100**

The table above indicates that the small class size had the higher percentage of students (12 percent) with high ability; the large class group had a lower percentage (5.9 percent) of high ability students. For all class sizes, the medium ability students were predominant. The difference in percentage of high ability students for both large and small class sizes shows that ability level increases as class size decreases.

Research Question 2

What is the effect of class size on the performance of male and female students with different ability levels?

Table 4.3: Comparison of the Performance of Male and Female Students with Different Ability Levels in Three Different Class Sizes

Ability Levels	Small Class		Medium Class		Large Class	
	Male (%)	Female (%)	Male (%)	Female (%)	Male (%)	Female (%)
High	25	0	0	0	7.2	0
Medium	50	75	75	80	83.3	97.6
Low	25	25	25	20	9.5	2.4
Total	**100**	**100**	**100**	**100**	**100**	**100**

The table above reveals the performance of male and female students with varying ability levels in small, medium and large class sizes. Generally, small class size had the highest percentage of students having high ability levels (25%) as compared to the large class size having 7.2%. A closer look at the table reveals that all the students having high ability levels were boys. The girls on the other hand dominated the medium ability level group in small, medium and large class sizes. It can be deducted from this result that boys in small class sizes perform better than girls. Their performances, however reduces as class size increases. It can be concluded, therefore, that increase in class size diminishes the performance of both male and female students with varying ability levels.

Research Question 3

What is the effect of teachers' qualification on the performance of students in mathematics?

The performance of students taught by teachers with different qualifications is shown in table 4.4.

Table 4.4: Comparison of performance of students tutored by teachers with different qualifications

Qualification	Number	Year of Experience	Mean score	Standard deviation
NCE	20	7	7.6	1.932
HND/PGDE	20	4	6.8	1.506
NCE/B.Sc.Ed. (Maths)	20	5	9.1	0.994

As seen in the table, students taught by teachers with NCE/B. Ed. had the highest mean score of 9.1; those taught by teacher with NCE had the second highest score of 7.6; the group taught by teacher with HND/PGDE had a mean score of 6.8. The difference in the mean scores of these groups can be attributed to the superiority per qualification as teachers with NCE/B.Ed. can be said to have had better and qualitative professional training in teaching than others.

4.4 Hypotheses Testing

The results of hypotheses testing are presented in this section.

$H0_1$: There is no significant relationship between class size, ability level of students and their performance in mathematics.

Table 4.5 shows ANOVA of the performance of each of the three class sizes in the Mathematics Achievement Test (MAT).

Table 4.5: Descriptive Statistic of Teachers with Different Qualifications

Qualification	Numbers	Mean Scores	Standard Deviation
1. NCE	5	55.80	3.145
2. B.Sc(Ed)	4	60.50	6.557
3. HND/PGDE	2	51.60	4.241

In an attempt to provide an answer to question 3, an observation schedules was also used for the teachers too. The mean score for the teachers with NCE was 55.80 while the teachers with degrees had mean score of 60.50. The standard deviation for NCE teachers was 3.145 while the mean score of degree teachers was 6.557. This is in agreement with the studies carried out by Ferguson (1991) which had shown that teachers' qualifications have positive effects on student's performance in Mathematics.

Table 4.6 presents ANOVA of the performance of students with varying ability levels.

Table 4.6 ANOVA of performance of students with varying ability levels

Source of variation	Sum of squares	Df	Mean	F-cal	F-ratio	P	decision
Pre-test between groups	6726.946	2	3363.473	124.481	3.070	0.004	Significant difference
Within groups	3971.888	147	27.070				
Total	10698.834	149					
Post-test between groups	9695.111	2	4847.556	137.699	3.070	0.002	Significant difference
Within groups	5174.949	147	35.204				
Total	14870.060	149					

Results from both pre-test and post-test revealed the significant deference between the performances of the students with three ability levels examined in the study (high, medium and low). The table above shows that the calculated f-values for both pre-test and post-test were 124.481 and 137.699 respectively and were both greater than the tabulated f-ratios of 3.07 at 5% level of significance.

4.5 **Descriptive Statistic**

Table 4.7: ANOVA of Performance of Students with Varying Ability Levels

Small Class	**N**	**Mean perf.**	**Std. dev.**	**Std.**
Low medium	9	25,000	.6324	.190
Medium	6	27,9018	1.2611	.275
High	5	31.2727	1.678	.506
Medium				
Low medium	20	21.3501	.725	.061
Medium	14	23.901	.611	.072
High	6	26.350	.620	.910
Large				
Low medium	50	19.4211	.120	.020
Medium	25	22.452	.029	.050
High	15	24.462	.101	.061
Total				

Effect of class size on different ability levels on student's academic performance. The performance in terms of class size varies from class size visa ability levels in terms of performance. In small class size, the performance of students high, medium, low was the highest. Followed by students in medium class size, and least is performance of student, in large class size in the high, medium and low ability levels.

There is significant interaction of class size and ability levels on students performance, the Null hypothesis is therefore rejected.

$H_0$2: Class size has no significant effect on the performance of male and female students in mathematics.

Table 4.8 displays the performance of both male and female students in small, medium and large class sizes.

Table 4.8: t-test of Performance of Male and Female Students in Three Class Sizes

Small Class	N	Mean	SD	SE	Df	t-cal	t-crit
Male	12	47.33	15.19	4.38	22	0.313	2.07
Female	12	41.67	11.34	3.27			
Medium Class	**N**	**Mean**	**SD**	**SE**	**Df**	**t-cal**	**t-crit**
Male	20	38.80	8.22	1.84	38	0.508	2.02
Female	20	40.60	8.80	1.97			
Large Class	**N**	**Mean**	**SD**	**SE**	**Df**	**t-cal**	**t-crit**
Male	42	43.10	10.07	1.55	82	0.440	1.98
Female	42	44.64	8.11	1.25			

The above table compares the performance in post-test of male and female students in small, medium and large classes. The results reveal that for small class size, the calculated t-value 0.313 is less than the critical t-value 2.07 at 5% level of significance with 22 degree of freedom. The null hypothesis is therefore accepted; hence, there is no significant difference between the performances of male and female students in small class. For the medium class, the calculated t-value is 0.508 which is less than the critical t-value 2.02 at 5% level of significance and with 38 degree of freedom. Therefore the null hypothesis holds true. The inference drawn from this is that there is no significant difference between the performances of male and female students in medium class size. Result of the large class size shows a calculated t-value of 0.440 and the critical t-value is 1.98 at 5% level of significance with 82 degree of freedom. Since the calculated value is less than the critical value, the null hypothesis is rejected.

$H_0$3: Teachers' qualifications have no significant effect on the performances of students in mathematics in junior secondary schools in Kaduna metropolis.

The result for the test of the third hypothesis is presented in table 4.9 below:

Table 4.9: ANOVA of Students Taught by Teachers with Different Qualifications

Source of Variation		Sum of Squares	Df	Mean Square	F-cal	F-Ratio	Decision
Pre-Test	Between groups	162.10	3	54.03	11.51	2.84	S
	Within groups	169.00	36	4.69			
	Total	**331.10**	**39**				
Post-Test	Between groups	68.10	3	22.70	8.94	2.84	S
	Within groups	91.40	36	2.54			
	Total	**159.50**	**39**				

From the table above, the calculated f-value for pretest is 11.51 and greater than the f-ratio 2.84 at 5% level of significance. For the post-test, the calculated f-value 8.94 is greater than the f-ratio 2.84 at 5% level of significance. On this basis, the null hypothesis is thus rejected. The inference here is that there is significant difference in the performance of students taught by teachers with different qualifications. Students taught by teachers with degree in mathematics/education performed better in mathematics.

4.6 Major Findings

The findings of the study reveal that;

1. Students' performance in Mathematics improved as class size reduces and students with high ability levels performance better in Mathematics than those with low ability levels.
2. The difference in the performances of male and female students in Mathematics is independent of the class size.
3. Mathematics as a subject becomes more interesting to learn when taught by experienced and qualified teachers and the students' performance improved.

4.7 Discussions

This study was carried out to find out the effect of class size and varying ability levels of students on their performance in mathematics. Three hypotheses were stated in this study. The data based on the scores of the students in M.A.T were analyzed according to the stated null hypotheses and laid down design in chapter three of this work. The findings from the analysis are discussed below:

The performance of students, as indicated by the results, has shown that small class size, with a mean of 44.08, performed significantly better than medium and large classes with mean scores of 39.70 and 43.99 respectively. This evidence suggests that class size significantly affects the performance of students and students' performance tends to improve as class size reduces. This supports reports by Jimoh (2009) who attributed the difference to frequent interaction between teachers and students in small class size which is more significant than interactions between teachers and students in other class sizes. It also supports the findings of Usman (2007) and Kamiyole(1986).

In testing the first hypothesis using ANOVA, it was shown that the pretest calculated f-value 9.02 was greater than the f-ratio 3.07. On this basis, it was concluded that there is significant difference between the performances of students in the three different class sizes. The ANOVA for ability levels revealed a significant difference in the performances of high, medium and low ability students, since the calculated f-value 137.699 is greater than the f-ratio 3.07. This could be as a result of the decline in the level of teacher-student interaction which characterizes large classes. The study further revealed that small class size had a higher percentage (12%) of high ability students than large class size which had only 5%. This agrees with the findings of Jimoh (2009), that the correlation analysis between class size and ability levels showed the Pearson product-moment correlation coefficient (r) to be -0.06. This indicates a weak and negative correlation. This correlation is however not significant at

5% level of significance. On this basis, we therefore reject the null hypothesis. The implication of the negative value of r is that ability level reduces as class size increases and vice-versa confirming the earlier findings by Strong (1974) and Mazareas (1981).

The test of the second hypothesis resulted in calculated t-value of 0.313 and t-critical value of 2.07 for small class. It can be inferred from this that there was no significant difference in the performances of male and female students in the small class size. In the medium class result, the calculated t was 0.508 and critical t was 2.02. Therefore there is no significant difference between the performances of male and female students in medium class size. The result for the large class showed that calculated t was 0.440 and critical t was 1.98 indicating that there is no significant difference between the performance of male students and female students in large class. Thus we arrive at the conclusion that the null hypothesis holds true and is therefore accepted. This finding suggests that there is no difference between the performances of male and female students regardless of the class size.

The findings of Erikson (1994), Rache (1994), Nwagbo (1997), Indo (1999) and Uhmuavbi etal (2003) has made the same conclusion. That there is no significanct difference in achievement in girls' school or boys' school or performance. But the findings of Erinleahey and Guang Guo (2001), show that there is very little gap of achievement between the boys and girls at elementary level of education in mathematics. They reported that boys tend to progress much more quickly as they become older and advanced in academic activity (Mathematics), such as cumulatively, associatively, estimation and applying mathematics, the solution of words and practical problems.

The third hypothesis was also tested using ANOVA and the result showed that the f-calculated was 8.94 and greater than 2.84 at 5% level of significance. This means that there is significant difference in the performances of students taught by teachers with different qualifications. We therefore reject the null hypothesis. This implies that teachers' qualifications and

experience have significant effect on the performance of students. This agrees with the findings of Uyagu (2009), Njoku (2000). Egede (2000) and Otu (1999) which stated that professional competence of teachers was determined by the qualification and experience acquired by the teachers. It is this competence which impacts on the performance of the students in mathematics.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This segment summarizes the effect of class size, ability levels and teachers' qualifications on the performance of students in mathematics in junior secondary schools in Kaduna metropolis. Mathematics is a core subject in secondary schools in Nigeria. It is therefore compulsory at both senior and junior secondary levels of education.

The researcher investigated how students would perform if they were taught in small, medium and large classes such as is obtainable in any average Nigerian school.

The strength of the study therefore, lies on the selection of appropriate class sizes as observed in schools. The researcher tried to find out if by adopting the right class size a better teacher-students interaction can be enhanced and thereby boost students' performance in mathematics. Three objectives, research questions were raised and three hypotheses were formulated and tested in the course of the study. Three secondary schools were randomly selected for the study; one school represented the small class size, another represented the medium class size and the third school represented the large class size.

A pretest MAT was administered to the students. The test was a 50 item test after which there were several intensive teaching sessions during which students were taught the same topics. This was followed by a 50 item post-test to evaluate their performances as indicated in the appendix. The students' scores for both pretest and post-test were recorded. Data gathered from the study were analyzed at 0.05 (5%) level of significance.

Results from the data were collected, analyzed, interpreted and discussed giving rise to the following findings:

1. Students' performances improve immensely in small class size compared to large and medium class sizes.

2. The difference in the performance of male and female students in mathematics is independent of the class size.
3. From the scores of observation schedules used for the teachers, the analyses showed that teachers' qualifications affect the performance of students in mathematics.

5.2 Conclusion

The main focus of this study was to find out the effects of class size and teachers qualification on students' performance in mathematics in junior secondary schools in Kaduna metropolis. The results of the study showed that there existed a significant difference in the performance of students in the three different class sizes. This finding led to the conclusion that small class size is most appropriate for effective teaching/learning of mathematics to take place. Based on the analysis of results in this study, the high rate of poor performance in mathematics observed by several researchers in the years past could be lowered by reducing the population of students in large classes.

5.3 Recommendations

Based on the preceding conclusions, the following recommendations are made in order to address the issue of poor performance in mathematics:

1. Teaching/learning of mathematics can barely be effective in a densely populated class where the teacher cannot very well attend to the students at individual levels to identify their needs and weaknesses. Therefore, educational policy makers should stipulate and enforce maximum class size of 20 - 40 in Nigerian schools.
2. Government should ensure the adequate employment of dedicated and qualified mathematics teachers to teach the subject. The teaching profession should be made attractive for university graduates to practice since this group of teachers appeared to be more competent than their colleagues with lower qualifications. High salary levels,

better working conditions, affordable and comfortable accommodation, benefits and loan schemes would all be suitable incentives that can go a long way to attract university degree holders to pick up interest in teaching as a profession.

3. Already practicing teachers with poor qualifications should be encouraged to pursue higher qualifications so as to improve their competence. Training courses, seminars and conferences should be organized from time to time to identify and meet the training needs of teachers in service.
4. Students' tutorials should be encouraged where by students with high ability levels take it upon themselves to instruct their colleagues having low ability levels in mathematics. Such tutorials can be incorporated into the school time-table. Where this is not feasible, periods outside the school time can be fixed for the tutorials to take place.
5. Students with low ability levels need to align themselves more with their contemporaries who have higher ability levels.

5.5 Suggestions for Further Study

The following are suggestions for further studies:

1. There is the need to replicate the study in Junior secondary schools in other states so that the validity, reliability and scope of generalization made in this study can be broadened.
2. The results obtained in this study are for mathematics. The study can therefore be conducted for other science subjects such as Biology, chemistry and other science-based subjects.
3. A study of this nature can be extended to other levels of education such as primary, senior secondary and tertiary schools in various disciplines as well.
4. The performance of students in mathematics in public and private schools should be

studied in both large and small class sizes in order to find out the difference between them.

5. An assessment of the competence of teachers in mathematics should be conducted in order to assess their handling of the teaching of mathematics and arrange for their capacity building.

REFERENCES

Abdullahi, U. O. (1996). Teachers' opinions about some implementation constraints of the senior secondary school Islamic curriculum in Lagos state.

Achilles, and Lintz (1991). Class size does make a difference. Education leadership.

Achilles, C.M. (1992). Class size does make a difference? Education leadership

Achino, C. (2000). The importance of class motivation to learning Achievement. *Journal of Curriculum Studies*.

Adepoju, J.A. (1991). Factors and problems in the teaching and learning of Mathematics in Nigeria schools, proceeding of the national curriculum conferences organized by the federal ministry of Education, Abuja.

Adetula, L.O. (1998). Teaching and learning of mathematics at junior secondary school" Nigeria Education forum vol No 15

Afolabi, M. (1993). Introduction to research for writing proposal, project and thesis. Zaria: Alpha Publishers.

Aftreth, O.B. (1965). The class size Experiment. Report to the Board of Education. San Diego city schools.

Aguiyi, J. C. (2007). Challenge of class size in teaching/learning of Mathematics and Science in senior secondary schools in Nigeria. SMASE Nigeria In-service teaching (INSET) workshop; Kaduna.

Aigbomian, D. O. (2002). Science for all; Implication for the teacher and National Development. Ambik press Benin city.

Akindehin, F. (1999). Assessment and Evaluation in Education, Ondo: The light of life publications.

Alakpa, S.O. (2007). Resource utilization in a lager class- size for effective Teaching/learning of Mathematics and science. SMASE Nigeria In-service training (INSET) workshop Kaduna.

Albers, P. (1974). Tacking Education Malpractices in Nigeria ,4th Dimension press.

Alio, B. C. (2003). Obstacles to effective secondary school secondary school mathematics education;

the challenges of mathematics education. Multidisciplinary journal of research development NARD Publishers.

Anaso, C.E. (2005), favourable Environmental conditions associated with Nigerian and arid zone

Angrist L. (1999). Maximum class size rule. New evidence from population variation quarterly journal of Economics

Anikweze, C.M. (2004). Achieving improved teacher capacities in Nigeria: impact and policy reforms and social dialogue. May

Arifisayo, C.M. (1993). Promoting S.T.M. Staff Development with Students' Evaluation. A paper presented at the 34th annual conference of STAN in Katsina.

Awe, O.B. (2003) Evaluation strategies in Educational planning and implementation

Ausubel, D. P. (1968). Educational Psychology: a cognitive view. N. Y. Holt Rinebiart and Winston.

Ayeremo, S.O. (2001) "strategies for copying with overcrowded mathematics classroom". STAN Journal of issues on mathematics. Vol. 4, no 1, p. 1-3

Ayers, J. B. and Quails, G. S. (1979). Concurrent and predictive validity of the National Teacher Examination. *Journal of Educational Research;* 73(2) pp.86-92.

Ayodele, A.O. (1999). The effect of discovery method on the academic achievements of students in biology journal of psychological studies.

Back, H. J. (1992). Improving the learning of mathematics printed and found in Britain by Biddies Ltd.

Bakoji, B.T. Akpofure, R.E and N dupu, B.L (1991) "National Standards and quality control in Nigerian Education," the state of education in Nigerian, Lagos: UNESCO office.

Balogun, J.I.(2002). Effects of secondary school teachers job satisfaction on the students' academic achievement in Kogi state of Nigeria M.Ed, thesis ABU Zaria, unpublished.

Balogun, T.A. (1985). Interest in science and technology Education in *Nigeria, journal of the science Teachers association of Nigeria* . 23 (1&2).

Bassey, M.P. (2002). Availability of Resources for the teaching of science subjects in public secondary school. Scale study of some selected secondary school in Ahmosho L.G.A of Lagos state unpublished B.SE Ed university of Lagos

Benneth, N. (1996). Class size in primary schools: perception of head Teachers, chairs of governors, teacher and parents. *British Education Research journal*, 22(1), 33-35.s

Benneth, S. (1999). Class size and academic achievements New Dimensions in Research. University of Wisconsin Madison.

Betiku, P. F. (2002). Factors responsible for poor performance of students in mathematics in schools: suggested remedies. STAN 2002.

Blatchford, P. (1998). Research on class size Effects, a critique of Methods and a way forward international *Journal of Education psychology*.

Bonnie, P.O. (2003) "Teaching and learning Mathematics in secondary schools". Dubuque, Lowa, Wne, Brown Company, P. 28-30

Boozer, M.A and Maloney T. (2001). The effect of class size on the long -run growth in reading Abilities. Health and Development study, Department of economics Yale, university.

Brewer, D.J., Krop C, and Reinhardt R. (1999). Estimating the cost of national class size reduction under different alternatives. *Education Evaluation And Policy Analysis*. 21.(3),197-192.

Cahen, L.S. (1989). Class size and Educational Achievement: A review of methodology with particular reference to study design. *British Educational Research journal*, 24(3),255-268

Chachua, T. (2002); "A review of teachers' effectiveness" Quarterly Review of Education, 13 (93): 315-320

Charleston, K. T. (1994). Cognitive principles of teaching and learning. Ibadan, Spectrum.

Chukwuma, U. (2007). Effective approaches in the teaching and learning mathematics and Science. SMASE Nigeria In-service Training Workshop. Kaduna.

Coleman, J. S. (1998). Public schools, private schools and public interest. The New Nation Benin City Bendel Press.

Collette, A.T. & Chiappetta, E.L. (1984), Science instruction in the middle and Secondary Schools.

Toronto: Times Minor Moshy College publishing.

Collia, T.S. (2002) “concepts of Education achievement”. Educational Research, 19 (3) 2-7

Coleman, J. S.; Campbell, E. Q.; Hobson, C. J.; McPartland, J.; Mood, A. M; Weinfeld, F. D. and York, R. L. (1996). Equality of educational opportunity; Washington DC. US Government Printing Office.

Cooper, H. M. (1989). Does reducing student to teacher ration affect achievement? *Educational Psychologist*, 24(1), 79 - 98. New York: John Wiley.

Costello, P. A. (1992). The effectiveness of class size on achievement. Document Reproductive Service No. 400

Darling-Hammond, L. O. (1997a). Doing what matters most: investing in quality teaching, NY: National Commission of Teaching and America's Future.

Dike, N. and James, T. (1999). The need for standardizing achievement test in science schools. 40th Annual Conference Proceeding of Science Teachers Association of Nigeria.

Duyilene, B.O. (1998). “Community Biology to large classes. The textbook as an organic model for effectiveness” proceeding of the 39th Annual conference of science Teachers Association of Nigeria (STAN), p.128-132

Erb, M. (1996). Increasing students' responsibility for their learning through Multiple Intelligence Activities and cooperative learning. *ERIC Document Reproduction Service*. No. ED 400 - 947.

Eleda, M. (2002), “How over crowdedness affects Mathematics Classes”. Journal of Education Leadership, 55 (20): 49-51

Erickson, D. (1994). "Creating educational resources for classroom use". *Challenge* vol. 13(2). Johannesburg. Ouagga Press.

Everton, S. B. and Gregg, K. (1990). The structure of learning and basic teaching methodologies. Oakland. Cedar Press.

Fafunwa, A.B. (1976). New perspective in Africa education. Lagos. Macmillan and co. Nigeria Limited.

Fakuade, R.A. (1983). An aspect of inability to do Mathematics successfully among Nigerian

secondary school students. A pilot study. *Journal of Science Teachers Association of Nigeria* 22(1).

Famejuru, E. (1986). Cross-cultural stability of Bern sex-role. Inventory comparison of Norms *Nigerian Journal of Counseling and development.*

Federal Ministry of Education (2004). National Policy on Education, Lagos. Federal Gov. Press.

Federal Republic of Nigeria FRN (1998). National policy on Education. Lagos. NERDS Press.

Fergusson, R. F. (1991). Paying for public education. Harvard Journal on Education. Vol. No. 3

Feldhussen, C.J. (1993). "An experimental study of the effective of class size". American Educational Research Journal (AERJ), 17(2): 14-15

Fetler, M. (1999). High school staff characteristics and mathematics test results. *Education Policy Analysis Archives*; 7, 9, (Entire issue). Available online at http://eppa.asu.edu/epaa/v7n9.html

Fin, J. D. and Achilles, C. M. (1999). Tennessee's class size study: findings, implementation, misconceptions. *Educational Evaluation and Policy Analysis,* 21(2) 97 - 109.

Florida School Indicator Report (2004)

Francis, B. G. (2003). Effects of improvised geometrical multiplications on mathematics achievement of secondary schools Delta thesis.

Fuller E. J. (1999). Does teacher certification matter? A comparison of TAAS performance in 1997 between schools with low and high percentages of certified teachers. Austin: Charles A. Dana Center, University of Texas at Austin.

Geothler-Sopko, S. O. (1992). The effect of class size on reading achievements. Tenon Eric Document Reproduction Service.

Glass, G. V; Cahen, L. S.; Smith, M. L. and Filby, N. N. (1982). School class size: Research and Policy, Beverly Hills, CA: SAGE Publications.

Goldhaber, M. and Brewer, D. (1999). Does teacher qualification matter. High school certification status and students achievement. Unpublished manuscript.

Grissmer, D. (1999). Class size effects: Assessing the evidence, its policy implementations and

future research agenda. *Educational Evaluation and Policy Analysis* 21(2), 231 - 248.

Hanushek, E. A. (1998). Teacher/students ratio: the immediate problems of Nigeria's education. Argenta Press, Akure.

Harding, J. (1997). Gender, Science and Technology, where are they now? *Science Education Newsletter* 135(1), 25 - 34.

Hatlen, S. L. (1997). Science education in Australia Camberra: New Era Press.

Hawkins, W. and Taylor, S. (1992). Teachers reactive behavior related to class size and to the teaching of Mathematics, Social Studies and English. Paper presented to the Australian Association for Research in Education and Conference Canberra.

Heberman, M. (1995). Selecting "star" teachers for children. Phi Delta Kappa; 76; 777 781. http://www.dcylar.org/icraf/toolkit/thecipp -evaluationmodel.html

Hoover, L., Sayler P. & feldhussen, J. (1993), "Different behaviour in large size class". USA: Harvard University Press. P 33-36

Hoxby, C. M. (2000). The effects of class size on students' achievement: new evidence from population variation. *The Quarterly Journal of Economics.* Vol. 2(1) 70 - 71.

Hummel, S. & Sprinthral N, (1965), Educational Psychology, New York: McGraw-Hill, Inc

Hunter, J. M. E. (1966). Memory Pelican.

Hythlon, C. M. (1998). The effects of class size on students' achievement: new evidence from population variation. *The Quarterly Journal of Economics.* Nov. (1998), 23(2) 45 - 62.

Idialu, P. (1983). "sex typing". E. M. Hetherington. Handbook of child psychology. New York, Wiley.

Idowu, A.A. (2010). Influence of Home Background on Students' Performance in Mathematics in Junior Secondary Schools in Kaduna State. Unpulbihsed M.Ed Thesis, Ahmadu Bello University, Zaria Nigeria.

Imo, E. U. (1997). Maximizing students achievement in mathematics through multi-grade classroom teaching approach. Proceedings of Science Teachers Association of Nigeria (STAN). Aug. 1997.

Indolp, J. S. (1999). "Class size and Learning Challenges". Selected topics in Educational Instruction. Lagos: University Press. Lagos.

Irowi, M.O. (1992), Rising standards of performances in science Technology and Mathematics Teachers Association of Nigeria. Position paper No. 4

Johnson, D. W. and Johnson, R. T. (1987). Learning together and alone, cooperative, competitive and individualistic learning. 2nd Edition. England Cliffs pre-notice hall.

James, T. (2001) History and Philosophy of Science. Unpublished undergraduate Lecture notes. F.C.E/A.B.U. Zaria

Kamileye, K. M. (1993). Teachers' perception of changes in teaching when they have a small class. *Pea body Journal of Education* 67(1) 108 -122.

Kenne, B. H. and Pugh, W. (2003). Achievement of first graders in class size in semi-industrialized city North of Boston.

Korau, Y. (1988); the construction and validation of Mathematics Achievement Test in Primary 3 in Zaria

Kinku, A. (1989) "mathematics as a universal language" Nigeria Tribune Tuesday 24th January

Kogolla, P. A. (2005). Identify suitable activities in mathematics to achieve the stated objectives in large class size. Third country training manual.

Kogolla, S. A. (2007). Enhancing classroom activities for effective teaching and learning SMASE Nigeria In-service (INSET) Workshop.

Krueger, V.A, (1989),. The psychology of Mathematical abilities in school children, Chicago: University of Chicago Press.

Lewit, E. M. and Baker, L. B. (1997). Class size child mediator. *The future of children financing schools.* Vol. 7 No. 3.

Lynch, S. (1994). Ability grouping and science education reform, policy and research base. *Journal of Research in Science Teaching.* Vol. 3(2).

Mahmood, A. J. (1999). The effects of class size on students' achievement in Biology. *Journal of Science Teachers association of Nigeria.* Vol. 34(122).

Marshall, H. (1998). Class test construction Ibadan: Wisely Publication Company inc. mathematics. http://www.collegeboard.org/ap/math/html.

Maxima, I.J. & Aclajado, P.D. (2002). Value-Oriented Textbooks in College Algebra, Effects on Students Attitude, Anxiety and Achievement in Mathematics: *STAN*.

Mazereas, W. (1981). Achievement of first grades in class size in semi-industrialized city, North of Boston.

Molnar, A. (1998). Smaller classes not vouchers increase students' achievement. Keystone research center, Harrisburg P. A.

Monk, D. H. (1994). Subject matter preparation of secondary mathematics and science teachers and students achievement. *Economics of Education Review*, 13(2); 125- 145.

Moses, P. J. (1996). A study of effects of inter-class grouping on achievements in mathematics. Uni-Lagos.

Mosteller, F. (1995). The Tennessee study of class size in early school grades initiatives for children. American academy of art and science.

Mueller, F. (1988). The Tennesse study of classsize in the early school grades initiatives for children. American academic of art and science

Mukherjee, A. (1972). An investigation of the effects of knowledge or results and personality factor on transfer of learning from the learning of concepts and rules to that of problem solving. Unpublished Ph. D. Thesis, University of London Institute of Education.

National Commission on Teaching and America's Future (NCTAF) (1996). What matters most: Teaching for America's Future. New York: Author.

Nevada, P. S. (1999). Class size child performance the future of children in public schools. New York. Vol.5(3); page 102 - 105.

Nolasco, R. and Arthur, L. (1991). Large classes. Macmillan Publishers Ltd; London

Nwagbo, C. R. (1997). "The effects of two teaching methods on the achievements and attitude in Biology of students of different levels of science literacy. An unpublished PH. D desertion; University of Nigeria, Nsukka.

Nwagbo, C. R. (2002). Level of scientific literacy of secondary school science students; implications for sustainable development in Nigeria. 43rd Annual conference proceedings of the Science Teachers Association.

Oakes, J. (1998). Can tracking research inform practices technical, normative and political considerations. Educational Researcher Delta, Kappan.

Odiase, E. I. (1992). A practical approach to educational psychology and learning theory. Enugu: New Age Publishers.

Ofonime, G.O., (2007), Sex and environment as Factors in Secondary Mathematics Achievement. Unpublished Vol. 3-5

Ojo, J.O. (1987), "Improving mathematics teaching and teachers competency in our schools" *Abucus the journal of mathematics Association of Nigeria (MAN)* Vol. 17, (1). 164-177.

Okebukola, P. A. (1987). Tackling the problems of large class in Biology. An investigation into the effects of cooperative learning techniques. *Journal of Science Teachers Association of Nigeria.*

Olamide, Y.A & Ogunyemi, E.D. (1996). An investigation of cognitive preferences in mathematics achievers in two secondary school. African Journal of Education Resear, Vol. 1, 42-55

Okebukola, P. A. (1994). Cooperative beginning and students' attitudes to laboratory work. Science Teachers association of Nigeria.

Olayiwola, A.O. (2007). *Procedures in Educational Research*. HANIJAM Publications.

Onu, A.D. (2003). Is mathematics the key to science? Zaria Journals of Education studies vol. 5 No 1 & 2

Osobonye, G. T. (2000). Nigerian secondary schools laboratories and the goal of science education. STAN 43rd Annual Conference. August.

Osasuna, M.O. (1996). Effects of two reading approaches on the achievement and attitude of polytechnic students in large classes. Ph.D. Thesis, Ahmadu Bello University, Zaria. Unpublished

Owuna, E. O. (1999). The essentials of qualitative education. Lusaka. Wearers Press.

Parker, J. G. and Asher, S. R. (1987). Peer relations and later personal adjustment. *Psychological*

Bulletin; 102(3); 357 - 389.

Pass-Mroye, B. and Gursky, D. (1998). Small class always paying parents. Times educational supplement. 22 May.

Pastella, M. (1997). The congested classroom: a pilot study. *Journal of Behavioral Research;* 15(2); 60 - 61.

Pate-bain, H. and Achilles, C. M. (1992). Class size makes a difference. *Phi Delta Kappa;* 74(3); 253 - 256.

Peter, B. (2000). Institute of education, University of London, United Kingdom.

Piaget, E. C. (1952). The origin of intelligence in children. N.Y international University Press Inc.

Piaget, J. C. (1972). Intellectual evolution from adolescent to adult. *Human development;* 15(1); 25 - 31.

Quirk, T. J.; Witten, B. J. and Weinberg, S. F. (1973). Review of studies of concurrent and predictive validity of the National Teacher Examinations. Review of Educational Research; 43; 89 - 114.

Rache, M. M. (1996). "Psycho-motive consideration in classroom operation". *Journal of educational cape coast;* Edmonds Incorporation.

Richton, C. (1999). Elements and structure of learning on the effects of class size. London: Arnold.

Robin, K. H. and Ebukowski, W. (1908). Poor interaction relationships and groups, (pp 619 - 700). New York: John Wikey.

Robinson, G. E. (1990). Synthesis of research on the effects of class size. Educational leadership.

Robinson, G. E. and Withebols (1986). Class size research: a related cluster analysis for precision making. Arlington, V. A. Educational Research Services.

Rwat, S.I. (2006). The usefulness of Mathematics in our society.

Salau, M. O. (1996). The effects of class size on the achievement of different ability groups in mathematics. *Journal of Science Teachers Association of Nigeria.* 13(1&2).

Schmuck, T. (1999). The critical perceptions in teaching (3rd edition). Manchester United Press.

Scholfield, H. (2000). Peer model and children's behavioral change. *Review of Educational Research;* 57(2); 47 - 174.

Schwartz, J. (2005). Class size reduction and school climate. American Education Research Journal, California.

Scott, H. W. (1969). Report of the committee appointed to investigate and advise on class sizes and teaching loads in government secondary schools.

Shane, B. A. (1996). "An experimental study of the effects of class size". American Educational Research Journal.

Slavin, E. R. (2003). Achievement effects of ability grouping in secondary schools. The best evidence synthesis. Review of Educational Research.

Smith, A. B. and Millian, M. C. (1989). The effects of improving pre-school teacher/child ratios. *British Journal of Educational Psychology.* 41; 123-138.

Stodolsky, H. (1991). Learning styles and academic achievements. *Educational Psychology;* 26; 217 - 230.

Strong, D. H. (1974). The effect of class size on drop-out rate. Matye Journal.

Talabi, J. R. (1988). Effect of class size learning an approach to the classes a social system. *American Research Journal.* 6; 522 - 542.

Taylor, W. (1981) Teacher Education Encyclopedia Brilannica (15th Edition). Vol. 18, No.2, Chicago

Titua, P. (2002). Psychology and class size; a hand book for teachers. New Jersey Temple Press.

Ugagu, D.B. (2009). Effects of the Utilization of Instructional Material on Students' Performance in Mathematics in Senior Secondary Schools

Uhumadaubi, P.O. & Umaru, G.E. (2005). Relationship between interest in Mathematics and Achievement students. A case study of Auchi Polytechnic. Nigeria Journal of professional Teachers. Vol.1,1

Universal Primary Education Policy of 1976, Lagos.

Waitutu, N. K. (2006). Towards better teaching and learning of mathematics and science, third country training workshop held at CEMASTEA, Kenya.

Waitutu, N. K. and Mwambu, M. K. (2004). Factors that contribute to the poor performance and science, Kenya, teachers college journal published by SMASSE WASCA, Nairobi.

Walbery, H. J. (1997). Predicting class learning, an approach to the class as a social system. American Educational Research Journal.

Ward, E. (1999). Student/teacher achievement ratio (STAR) class size study. Nashville, Tennessee.

Ward, W. H. (1990). A test of the association of class size to students' attitude towards science. *Journal of Research in Science Teaching.* 13:37-42.

Whitemore, J.H. (2001). Construclivision in a college Biology classroom. Effects on content Achievement Cognitive growth; and science attitude of act-risk students unpublished Doctoral dissertation, North-caroline state university Raleigh

Whittington, A.; Bain, H. P. and Achilles, C. M. (1995). Interesting developments on class size. Phi Delta Kappa.

Wolf, R. M. (1994). Evaluation in education. 2nd edition. New York Praeger.

Wooton, S. E. (1999). Central and management of class size. Tata McGraw Hill publishing; New Delhi.

Yoloye, E. A. (1994). Keynote address delivered at STAN annual conference in Katsina state, 15-20 August.

Ziegler, S. (1997). Class size and academic achievement and public policy. Canadian Educational Association.

APPENDIX I
Letter of Introduction

AHMADU BELLO UNIVERSITY, ZARIA
FACULTY OF EDUCATION
(CURRICULUM AND INSTRUCTION SECTION)
MATHEMATICS ACHIEVEMENT TEST (MAT)

I am Magdalene Addie Bassey; a postgraduate student in the Department of Education, A.B.U., Zaria. I am conducting a research work on "effects of class size, varying ability levels and teachers' qualification on students' performance in mathematics in junior secondary schools in Kaduna metropolis. I will appreciate your kind support in writing this test to collect data on the research topic. It is for academic research purpose only. All information supplied shall be treated confidentially and for academic purposes.

Thank you for your assistance.

Appendix II

PRE-TEST

MATHEMATICS ACHIEVEMENT TEST

INSTRUCTION: Choose the correct answer only from the options.

Section A: Number and numerations

1. It has only two factors, itself and 1.
   (a) Fraction [ ] (b) Factor [ ] (c) Prime number [ ] (d) Multiple [ ] (e) Product [ ]
2. Fraction is the number obtained when the ____ divided by the
   (a) Multiple and factor [ ] (b) Number and numeration [ ] (c) FICF and LCM [ ] (d) Numerator and denominator [ ] (e) Digit and factor [ ]
3. Simplify this (-72) x (-9).
   (a) 648 [ ] (b) -846 [ ] (c) 846 [ ] (d) -648 [ ] (e) 64.8 [ ]
4. Round off 14.9028 to 3 dp.
   (a) 14.902 [ ] (b) 14.903 [ ] (c) 14.009 [ ] (d) 14.028 [ ] (e) 14.9[ ]
5. A typist can type 33 words per minute. How many words can she type in 1 hour
   (a) 33 words [ ] (b) 1980 words [ ] (c) 880 words [ ] (d) 1900 words [ ] (e) 3,300 words [ ]

Section B: Algebraic processes

1. Find a, if 3a = 12
   (a)4[ ](b)5[ ](c)6[](d)7[ ] (e) 8 [ ]
2. Expand (5+8x)x
   (a) (5+8x)x [ ] (b) 5x+8x [ ] (c) 5x+8x+2 [ ] (d) $(5+8)x^2$ [ ] (e) $5x^2+8x^2$ [ ]
3. 3(5x-2)llx
   (a) 4x-6=0 [ ] (b) x V_2 [ ] (c) 15x+6 [ ] (d) 4x6 [ ] (e) 1 lx-6 [ ]
4. Solve: 51-3+8x
   (a) x=8 [ ] (b) x=6 (c) x=48 [ ] (d) x=12 [ ] (e) x=7 [ ]
5. Remove brackets and simplify: y (y^3) - 6(y-3)
   (a) y^2 + 18 [ ] (b) y^2 - 6y+ 18 [ ] (c) 6y=24 [ ] (d) y^2-6y+ 15 [] (e)y+6y+18[ ]

Section C: Geometry and Measuration

1. A tin' of milk has the shape of a _
   (a) Cylinder [ ] (b) Triangle [ ] (c) Kite [ ] (d) Pyramid [ ] (e) Square [ ]
2. Which of the following will roll smoothly on every part of its body?
   (a) Cuboids [ ] (b) Pyramid [ ] (c) Sphere [ ] (d) Cube [ ] (e) Square [ ]
3. How many edges has a cube?
   (a)6[ ](b)12[ ](c)8[ ](d)91 [ ] (e) 10 [ ]
4. Each face of a cuboids is the shape of a _
   (a) Square [ ] (b) Triangle [ ] (c) Hexagon [ ] (d) Circle [ ] (e) Rectangle [ ]
5. S^3 is the formula for finding the volume of a _
   (a) Cuboids [ ] (b) Cone [ ] (c) Sphere [ ] (d) Cube [ ] (e) Cylinder [ ]

Section D: Statistics

1. What number does the following represent? ~~IIII~~ ~~IIII~~ ~~IIII~~ ~~IIII~~ I
   (a)21[ ](b)17[ ](c)33[ ](d)41[ ] (e) 19 [ ]
2. Find the average of 22,14,8,6,0
   (a)20[ ](b)30[ ](c)15[ ] (d) 12 [ ] (e) 10 [ ]
3. When the most frequently occurring number is picked, we make use of _
   (a) Mode [ ] (b) Median [ ] (c) Mean [ ] (d) Variance [ ] (e) Range [ ]
4. Find the range of the following set of numbers 35,5,40,82,33,95,44 and 12.
   (a)82[ ](b)12[ ](c)90[ ] (d) 5 [ ] (e) 25 [ ]
5. A farmer has 435 eggs. If he sells all the eggs except 20 eaten by his family and five were broken at $420 each, how much dies the farmer get?
   (a) N5,000 [ ] (b) N7,000 [ ] (c) N6,000 [ ] (d) N10,000 [ ] (e) N8,000 [ ]

Section E: Angles

1. When two straight lines meet at a point, it forms _
   (a) Triangle [ ] (b) An angle [ ] (c) Square [ ] (d) Cube [ ] (e) Parallel [ ]
2. An obtuse angle is an angle which is
   (a) 90° [ ] (b) 180° [ ] (c) between 90° and 180° [ ] (d) 60° [ ] (e) 120° []
3. Find angle x

   (a) 20° [ ] (b) 25° [ ] (c) 30° [ ] (d) 35° [ ] (e) 40° [ ]
4. An angle less than 90° (0° and 90°) is
   (a) Acute [ ] (b) Obtuse [ ] (c) Right [ ] (d) Straight [ ] (e) Reflex [ ]
5. Two parallel lines can also be interpreted as:
   (a) Lines that form this right angles [ ]
   (b) Lines that form angle at a point [ ]
   (c) Lines that cannot meet [ ]
   (d) Lines of intersection [ ]
   (e) Lines of perpendicular [ ]

Section F: Numbers

1. Find the product of 82 and 10
   (a) 92 [ ] (b) 72 [ ] (c) 820 [ ] (d) 8.2 [ ] (e) 182 [ ]
2. The sum of a certain number and 13 is 30, what is the number?
   (a)17[ ](b)27[ ](c)37[ ] (d) 47 [ ] (e) 182 [ ]
3. The sum of three consecutive numbers is 63. Find the numbers.
   (a) 13,14,15 [ ](b) 20,21,22 [ ] (c) 16,17,18 [ ] (d) 30,31,32 [ ]
   (e) 20,23,24 [ ]
4. Find the positive difference between $3\ ^3/4$ and 2 2/3
   (a) 1 % [ ] (b) 1 1/3 [ ] (c) 1 $'/_2$ [ ] (d) 1 1/6 [ ] (e) 1 2/3 [ ]
5. A number is multiplied by itself. The product is 54/9. Find the number.
   (a) 21/3 [ ] (b) 7 [ ] (c) 12/3 [ ] (d) 41./8 [ ] (e) 32/3 [ ]

Section G: Indices

1. Find the value of 8^3
   (a) 480 [ ] (b) 630 [ ] (c) 512 [ ] (d) 488 [ ] (e) 680 [ ]
2. 10^2+3^3 =
   (a) 127 [ ] (b) 72 [ ] (c) 70 [ ] (d) 73 [ ] (e) 127 [ ]
3. 6^3x2^4
   (a) 1,620 [ ] (b) 1,728 [ ] (c) 1,165 [ ] (d) 1,820 [ ] (e) 1,904 [ ]
4. Find the value of $6^4x2^4x3^6x6^5x2^3x3$ and express your answer in index form,
   (a) $6^9x3^6x3x2^3$ [ ] (b) $2^6x3^6x6^9$ [ ] (c) $9^6x2^6x3^7$ [ ] (d) 69x26x37 [ ] (e)$6^4x3^6x2^5$[ ]
5. $12^3/4^4$
   (a) 53/4 [ ] (b) 4.75 [ ] (c) 7.75 [ ] (d) 5.75 [ ] (e) 6.75 [ ]

Section H: Ratio, Rate and Proportion

1. Two sons are aged 19 years and 17 years. 216 cows are shared between them in the ratio of their ages. How many cows does each get?
   (a) 100 and 116 cows [ ] (b) 200 and 16 cows [ ] (c) 114 and 102 cows [ ] (d) 90 and 126 cows [ ] (e) 80 and 136 cows [ ]
2. Two women share 54 eggs in the ratio 2:7. How many eggs does each get?
   (a) 12 and 42 eggs [ ] (b) 20 and 34 eggs [ ] (c) 10 and 44 eggs [ ]
   (d) 24 and 30 eggs [ ] (e) 0 and 54 eggs
3. 7 workers dig a piece of ground in 10 days. For how long would 5 workers take?

(a) 12 days [ ] (b) 13 days [ ] (c) 14 days [ ] (d) 15 days [ ]

4. A bag of rice feeds 15 students for 7 days. How long would the same bag feed 10 students?
   (a) 10 days [ ] (b) 10 Y_2 days [ ] (c) 12 days [ ] (d) 12 Y_2 days [ ]
5. A car factory made 375 cars in 5 days. Find its production rates in cars per day.
   (a) 85 cars [ ] (b) 75 cars [ ] (c) 65 cars [ ] (d) 55 cars [ ] (e) 45 cars [ ]

Section I: Fill in the blank spaces with the correct answer.

1. This is an _____ triangle
2. _____ has only two factors; itself and 1
3. Angles are measured and constructed using a _____
4. Information in numerical form is called _____
5. 7^2 =
6. 721 568 397 is _____ in words.
7. Any number raised to the power of zero has the value of _____
8. 10^3 = _____
9. The sum of the angles of any triangle is _____ degrees.
10. This shape is called _____

Algebra

1. b
2. c
3. a
4. a
5. d

Indices

1. d
2. a
3. b
4. b
5. e

Fraction

1. a
2. b
3. a
4. c
5. e

Ratio rates and proportion

1. c
2. a
3. c
4. b
5. d

Measure of central tendency

1. a
2. b
3. a

Numbers and numerations

1. c
2. d
3. a
4. b

Appendix III
Post-test

Please kindly tick the appropriate answer from the options A-E. do not choose more than an answer to a question.

Algebra

Find the value of x and y, if x=5 and y=4

1. 2x+y (a) 15 (b)14 (c) 17 (d) 18 (e)19
2. 3xy (a)40 (b) 50 (c) 60 (d) 80 (e) 90
3. Solve 6(3x-3y) (a) 18 (b) 32 (c) 22 (d) 30 (e) 42
4. 69 = 5 +8m (a) 8 (b) 9 (c) 10 (d) 11 (e) 12
5. 7n = 49, what is n?

   (a) 16 (b) 12 (c) 11 (d) 7 (e) 8

Fraction

1. Simplify 32/3- 11/3 (a) 2 1/3 (b)31/3 (c) 22/3 (d) 32/3 (e) 21/3
2. Covert 33/4 to decimal (a) 3.5 (b) 3.75 (c) 3.25 (d) 3.1 (e) 3.05
3. 7/10 + 5/12 x 3/5 + 8/9 (a) 1663/2700 (b) 1665/2700 (c) 1266/2700 (d) 1766/2700 (e) 1166/2700
4. 51/3 x ¾ = (a)21/4 (b) 13/3 (c) 5 (d) 12 (e) 4
5. Find the quotient of 42/3 and 12/3

   (a)24/5 (b) 14/5 (c) 31/5 (c) 31/5 (d) 43/5 (e) 21/5

Measure of central tendency

1. What number does the following represent?

   ~~IIII~~ ~~IIII~~ ~~IIII~~ II

(a) 17 (b) 20 (c) 15 (d) 19 (e) 22

2. Find the average of the following numbers n22, 14, 8, 16 and 20 (a)

   15 (b) 16 (c) 17 (d) 18 (e) 19

3. When the most frequently occurred number is picked, we are making use of ___

   (a) Mode (b) median (c) mean (d)variance (e) range

4. Find the range of the following set of numbers 35, 5, 40, 33, 82, 92, 44, and 12

   (a)82 (b)12 (c)90 (d)5 (e) 95

5. A farmer has 425 eggs, if he sells the eggs except 20 eaten by his family and fire that were broken at N20 each, how much does the farmer get?

   (a)N5000 (b) N7000 (c)N6000 (d)N10000 (e)N8000

Angles

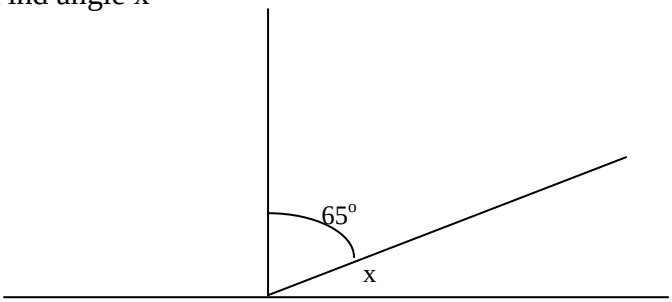
1. When two straight lines meet at a point, it forms

   (a) Triangle (b)an angle (c)a square (d) a cube (e) cylinder

2. An obtuse angle is an angle which is _____

   (a) 90^0 (b) 180^0 (c) between 90^0 and 180^0 (d) 60^0 (e) 120^0

3. Find angle x



   (a) 20^0 (b)25^0 (c) 30^0 (d)35^0 (e)40^0

4. An angle less than 90^0 (0^0-90^0)

   (a) Acute (b) Obtuse (c) Right (d) Straight (e) Reflex

5. Two parallel lines can also be interpreted as:

   a. Lines that form the right angles

   b. Lines that form angle at a point

   c. Lines that cannot meet

   d. Lines of intersection

   e. Lines of perpendicular

Numbers

1. Find the product of 82 and 10

(a) 92 (b027 (c08.2 (d0820 (e)182

2. The sum of a certain number and 13 is 30, what is the number?

(b) 17 (b) 27 (c) 37 (d) 47 (e) 182

3. The sum of the consecutive numbers is 63. Find the numbers. (a) 13, 14, 15 (b) 20, 21, 22 (c) 16, 17, 18 (d) 30, 31, 32 (e) 20, 23, 24

4. Find the positive difference between 33/4 and 22/4

   (a)11/4 (b)11/3 (c)11/2 (d)11/6 (e)12/3

5. A number is multiplied by itself. The product is 54/9. Find the number

   (a) 21/3 (b)7 (c)12/3 (d)41/8 (e)32/3

Indices

1. Find the value of 63

   (a) 408 (b)316 (c)230 (d) 216 (e) 80

2. $10^2 + 3^3$

   (a) 127 (b) 72 (c) 170 (d) 73 (e) 138

3. 63 + 24

   (a) 1620 (b) 3456 (c) 1165 (d) 1728 (e) 4904

4. Find the value of $6^4 \times 2^4 \times 3^6 \times 6^5 \times 3 \times 2^3$ and express in index form. (a) $6^9 \times 3^6 \times 3 \times 2^3$ (b) $2^7 \times 3^7 \times 6^9$ (c) $2^6 \times 3^6 \times 6^9$ (d) $9^6 \times 2^6 \times 3^7$ (e) $6^4 \times 3^6 \times 2^5$

5. $12^3/4^4$ (a) 53/4 (b) 4.75 (c) 7.75 (d) 5.75 (e) 6.75

Ratio, Rate and Proportion

1. Two sons are aged 19 years and 17 years. 216 cows are shared between them in ration of their ages. How many cows does each get?

   (a) 100 and 116 (b) 200 and 16 (c) 114 and 102 (d) 90 and 126 (e) 80 and 136

2. Two women share 54 eggs in the ration2:7 how many eggs does each get?

   (a) 12 and 42 (b) 20 and 34 (c) 10 and 44 (d) 24 and 30 (e) 10 and 54

3. 7 workers can dig a piece of ground in 10 days, for how long would 5 workers take?

(a) 12 days (b) 13 days (c) 14 days (d) 15 days (e) 16 days

4. A bag of rice feeds 15 students for 7 days. How long would the same bag of rice feed 10 students? (a) 10 days (b) 101/2 days (c) 12 days (d) 121/2 days (e) 13 days
5. A car factory made 375 cars in 5 days. Find its production rates in cars per day.

   (a) 85 cars (b) 35 cars (c) 65 cars (d) 75 cars (e) 55 cars

Numbers and numerations

1. It has only two factors, itself and I

   (a) Fraction (b) factor (c) prime number (d) multiple (e) product
2. Fraction is the number obtain when the _____ divided by _____

   (a) Multiple and factor (b) numbers and zeros (c) HCF and LCM (d) numerator and (e) denominator digit and factor
3. Simplify: (-72) x (-9) (a) 648 (b) -846 (c) 846 (d) -648 (e) 64.8
4. Round off 14.9028 to 3 dp

   (a0 14.902 (b) 14.903 (c) 14.009 (d) 14.029 (e) 14.9
5. A typist can type 33 words per minute. How many words can she type in 1 hour?

   (a) 33 words (b) 1980 words (c) 880 words (d) 1900 words (e) 3500 words

Geometry and mensuration

1. A tin of milk has the shape of a _____

   (a) Cylinder (b) triangle (c) kite (d) pyramid (e) square
2. How many edges has a cube?

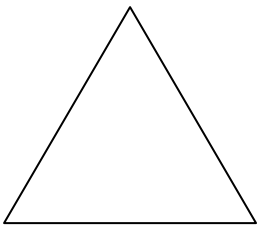
   (a0 6 (b) 8 (c) 12 (d) 14 (e) 10
3. Each face of a cuboid is the shape of a ____

   (a) Square (b) triangle (c) hexagon (d) circle (e) rectangle
4. S3 is the formula for finding the volume of a ____

   (a) Cuboid (b) cone (c) sphere (d) cube (e) circle
5. Example of three-dimensional shape is _____

(a) Square (b) circle (c) cone (d) triangle (e) trapezium

Fill in the blank space with the correct answer

1. 

   This is a ___ triangle
2. Information in numerical form is called_____
3. 7^2 = _____
4. The sum of the angles of any triangle is _____ degrees
5. 

   This shape is called _____

Algebra

6. b
7. c
8. a
9. a
10. d

Fraction

6. a
7. b
8. a
9. c
10. e

Measure of central tendency

6. a
7. b
8. a
9. c
10. e

Indices

6. d
7. a
8. b
9. b
10. e

Ratio rates and proportion

6. c
7. a
8. c
9. b
10. d

Numbers and numerations

6. c
7. d
8. a
9. b
10. b