EFFECTS OF MATHEMATICS TEACHERS' BASIC CONTENT ABILITIES ON THE PERFORMANCEOF SENIOR SECONDARY SCHOOL STUDENTS MATHEMATICS IN KADUNA STATE, NIGERIA

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MARCH, 2015

DECLARATION

I Shittu Mohammed Sani hereby declared that, this thesis Titled ”Effects of Mathematics Teachers’ Basic Content Abilities on the Performance of Senior Secondary School Students Mathematics in Kaduna State, Nigeria” has been written by me and that it is a record of my own research work. It has not been presented in any previous application for a higher degree. All quotations are indicated by quotation marks or indentation and the source of information are specifically acknowledged by means of references.

Shittu Mohammed Sani **Signature** **Date**

CERTIFICATION

This thesis is titled**: "**Effects of Mathematics Teachers' Basic Content Abilities on The Performance of Senior Secondary School Students Mathematics in Kaduna State Nigeria" written by Shittu Mohammed SANI meets the requirements governing the award of the degree of masters in Education (Mathematics Education) of Ahmadu Bello University, Zaria and its contribution to knowledge and literary presentation.

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DEDICATION

This work is dedicated to Almighty Allah, then to my parents, Late Malam Mohammed Sani and Malama Rukayyatu Mohammed Sani then to my family members and friends for praying and encouraging me to finish this work.

ACKNOWLEDMENT

Iam most grateful to Almighty Allah for the opportunity, strength and guidance He gave to me throughout this research work. To Him all praises, honour and glory belongs.

I am very grateful to my two Supervisors: Dr. Mamman Musa and Prof. Y.K. Kajuru for their persistent encouragement, guidance and constructive criticisms to ensure the successful completion of this work. My thanks go to Prof. C. Bolaji, Prof.. Isa A. Usman, Dr. S.B. Olorukoba, Dr. Maruf O. I and Mal. H.I Usman for going through the work and making meaningful corrections and Dr. Abdullahi Dalhatu for his support and encouragement to finish this work. My thanks also go to Dr. Abdullahi Musa, Mal. Adamu Aliyu and Magaji Badamasi for their encouragement to see this work completed.

Finally, my thanks goes to my wives, Rahmatu and Kauthar then my children Khadija, Aishatu, Rukayyatu, Aliyu, Umar and Rabiah for their patience, endurance and moral support during the Study.

ABSTRACT

This research examined the "Effects of Mathematics Teachers' Basic Content Abilities on The Performance of Senior Secondary School Students Mathematics in Kaduna State Nigeria". Four main hypotheses were formulated and tested. The target population was thirty one thousand eight hundred and thirty three (31,833). Simple and stratified random sampling was used in selecting the fifteen (15) schools and the number of male/female students. A total Sample of 348 Students was drawn from fifteen Senior Secondary Schools in Kaduna State. The hypotheses were tested using various statistical techniques such as Means, Standard Deviation , Pearson product moment correlation coefficient and one way Analysis of Variance (ANOVA), to test the significance of difference or relationship if any at $\alpha = 0.05$. The result of this test indicated that the students' performance was poor as only 56 (24.03% of the population) scored the minimum 40% pass mark. Out of these passes, 9 (16.07% of the passes) were female while the remaining 47(83.93% of passes) were male students. The teachers have relatively a fair result which showed that 9 (75% of the teachers) scoring above the minimum 40% pass mark while 3(25% of the teachers) scoring below 40% pass mark. Some of the results from hypotheses tested on the five content domains were as follows: There is no significant relationship between teachers and the students mean score of the basic ability in the content domain and also there is no significant difference in the mean performance among SSIII students in the various content areas of the senior secondary school curriculum.

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Abbreviations

CESSM - Curriculum and Evaluation Standard for School Mathematics.

EYNRP - Early Years Numeracy Project.

IAEA - International Association for Educational Assessment

MAPTECOK – Mathematics Performance Test in the Content knowledge

MAN - Mathematics Association of Nigeria.

M.O.E - Ministry of Education.

NABTEB - National Business and Technical Education Board.

NACOME- National Advisory Committee on Mathematics Education

NAEP - National Assessment of Education Progress.

NSCM - National Council of Supervisors of Mathematics.

NCTM - National Council of Teachers of Mathematics.

NECO - National Examination Council.

NPE - National Policy on Education.

NSSE - National Society for the Study of Education.

PSSM - Principles and Standard for School Mathematics.

SSCE - Senior School Certificate of Education.

WAEC - West African Examination Council.

N&N - Number and numeration

GM - Geometry

ALG - Algebra

MS - Measurement

STAT&P - Statistics & Probability

Operational Definition of Terms

Ability - The mathematical ability is the various behaviours that students exhibit order to find a solution to a given mathematical problem. In this study the mathematical abilities examined were knowledge, skills and problem solving.

Content Domain – Refers to the various areas in which the mathematics curriculum is grouped. At the senior secondary school they are five: Number and numeration, Measurement, Algebra, Geometry and Statistics & probability.

Knowledge – This includes the ability of students to recall basic mathematical terms, concepts, generalization, rules and recognition of geometrical shapes that might be used to find solutions to mathematical problems.

Problem Solving – This is the students' ability to apply, manipulate and synthesized various mathematical potentials to find solutions to routine as well as non routine mathematical problems.

Skills – This is the ability to compute, manipulate and apply mathematical knowledge using the basic operations, constructions, graph and tables.

CHAPTER ONE

THE PROBLEM

1.1: Background to the Study

Mathematics is recognized as the gateway to future professions in variety of fields. Every area of mathematics has its own specific applications to different career options. At higher level, most programs of study require mathematics as the ability to master mathematical skills is an important indicator of potential for students' success at all levels of their academic endeavor. Thus it will be good for students to enter into university with good background in mathematics. Experience has shown that students who come to the university with a poor grade in mathematics had a difficult time progressing in disciplines they had chosen to major in. As asserted by Obodo (2004), the way many Nigerians feels, think and act towards Mathematics blindfolds them from realizing the benefits accruable from the knowledge and application of the subject. Some people even believed that Mathematics has no practical application outside the classroom settings so they abhor, hate and dislike the subject. Mathematics is a prime instrument for understanding and exploring scientific, economic and social world. In addition to this usefulness, Mathematics serve as a tool for creating new knowledge in all fields for solving problems, stating theories and predicting outcomes. The world today is witnessing a rapid growth in the development of science and technology with the advent of computer and other information and communication technology.

It is believed that hardly can a country survive the pressure of the recent

information and communication technology popularly known as IT without mathematics (Azuka, 2000).

Looking at the explanations above one can see that the importance of mathematics cannot be overemphasized an effort has to be made to eradicate the learning difficulties of students in mathematics and hence improve on the basic mathematical skills acquired in senior secondary school. By doing so, the problem of mass failure in West African Examination Council (WAEC) and National Examination Council (NECO) mathematics examinations will be minimized or eradicated. The basic abilities considered in this study were knowledge, skills and problem solving. There are three main bodies that are responsible for examining students at senior secondary school level in Nigeria; they are West African Examination Council (WAEC), National Examination Council (NECO) and National Business and Technical Examination Board (NABTEB).

Despite all the efforts put in developing an acceptable general mathematics curriculum, students' performance in the subject appears to be declining over the years. This observation is corroborated by Abakporo (2005) who summarizes this by saying that the state of students' achievement in mathematics had left much to be desired. This view is supported by the West African Examination Council (WAEC, 2011) and National Examination Council (NECO 2010) Chief Examiners' Reports of Senior Secondary School Certificate Examination results, which reported very low percentage passes in mathematics at credit level in those years. Adequate preparation in science and mathematics enables students to develop socially and intellectually, and to participate fully in a technological society as informed citizens (Clark, 2006).

However, minority students less frequently study science and mathematics. The teachers

were the life veins of the system hence their effectiveness hinges on their ability to deliver what is expected of them in terms of teaching and learning as opined by Burghes (2008) that the quality, of education received by children depends on the intelligence, knowledge and professional skills of the teacher. On gender issue the low number of women in scientific professions has become a national concern. It has been proposed that the attitude of girls toward mathematics is one factor that influences their lack of participation in science-related careers. This concern has resulted in a variety of studies designed to identify gender differences that could affect the number of girls in the scientific pipeline (Oaks, 2000). Particularly in the United States, boys hold more positive attitudes toward mathematics than do girls. Stated that teachers' expectation of male students of having a good problem solving behavior that makes the boys more confident than the girls who feel in secured in the subject. He further added; the belief that mathematics is a male domain is communicated in many ways to young girls by parents; media, teachers and school counselors. Thus after the general mathematics which is compulsory, very few proportions of female students pursue higher mathematics courses. On school location and performance, Kostman (1977) and Simmelkjaer (1979) in their studies reported that educational institutions in the urban share common features of learning impediments such as reading retardation, high absenteeism, drug abuse, students vandalism, and apathy. These vices as well as overcrowding account for the causes of poor performance in the urban school as compared to schools in the rural areas. However, in contrast, Ogunlade (1973) and Obot (1991) all disagreed on this view. They maintained that schools in the urban are well staffed, and with good facilities. Hence these factors induce better performance in the urban than the rural area. This may be due

to lack of basic skills the students supposed to acquire throughout the period of their studies at the Senior Secondary School level.

1.2 Statement of the Problem

The acquisition of basic Mathematics abilities is one of the most important goals for senior secondary school Mathematics curriculum in line with the objectives of the Federal Government of Nigeria as stipulated in the National Policy on Education (FGN, 2004). But it is observed that performances of students in the senior secondary school mathematics are disappointing and very pathetic with majority of the students scoring less than 40% which in turn affect their further studies, and consequently affect the nation drive for Science and Technology and also produce a large number of redundant youths without future which will add to the complex nature of the societal problem. This may not be unconnected with the lack of basic mathematics abilities on how to handle the mathematical concepts enshrined in the five content domains, which is one of the major areas of concern to parents, teachers, educational administrators and planners. Stakeholders such as teachers, Educational administrators and planners are interested in identifying the causes or contributing factors to the poor performance of students in mathematics so as to proffer possible solutions and the way forward. The major concern of the present study was therefore to investigate the Effects of Mathematics Teachers' Basic Content Abilities on the Performance of Senior Secondary School Students Mathematics in Kaduna State, Nigeria.

1.3 Research Questions

The study examined the following research questions:

1. What is the relationship between the teachers and students mean score in basic ability in the content domain?
2. What is the difference in the performance of students in the five content areas of senior secondary school mathematics curriculum?
3. Are there differences between the performance of male and female students in mathematics basic ability in the content areas?
4. Does location of School (in urban or rural areas) affect the students' performance in Senior Secondary School basic mathematics abilities?

1.4 Hypotheses

On the basis of the research questions, the following hypotheses were formulated for testing at P = 0.05

1. Ho: There is no significant relationship between teachers and the students mean score of the basic ability in the content domain.
2. Ho: There is no significant difference in the performances of students in the five content domain of the Senior Secondary School Mathematics.
3. Ho: There is no significant difference between the performance of male and female students in mathematics basic ability in the content domain.
4. Ho: There is no significant difference between the performance of urban and rural students in mathematics basic ability in the content domain.

1.5 Objectives of the Study

The main objective of the study was to assess the level of basic mathematical abilities acquired in the content of Senior Secondary School in relation to teachers' ability and students' performance in Kaduna state. Specifically the following were the objectives to:

1. Determine the relationship in basic mathematics abilities of the students and teachers.
2. Determine the strengths and weaknesses of the students in the five content domain of Senior Secondary school mathematics curriculum.
3. Determine whether there is a sex difference in mathematical abilities of the Senior Secondary School students.
4. Investigate whether there are differences in mathematical abilities based on School location.

1.6 Justification of the Study

Information and technology based society requires individuals, who are able to think critically about complex issues, analyze and adapt to new situations, solve problems of various kinds, and communicate their thinking effectively. The study of mathematics equips students with knowledge, skills and habits of mind that are essential for successful and rewarding participation in the society. To learn mathematics in a way that will serve them well throughout their lives, students need classroom experience that helps them develop mathematical understanding: learn important facts, skills, and procedure; develop the ability to apply the process of mathematics and require a positive attitude

towards mathematics. FGN, (2004) emphasized the need to equip students with knowledge of mathematics so as to enable them live effectively in modern age of science and technology. The improvement of basic skills and in turn abilities will enhance the performance of senior secondary school students and reduce the number of redundant youths that cannot further their studies. The importance of mathematics to technological development of any country cannot be over emphasized.

Lack of basic skills seriously affect the ability and in turn the performance of the senior secondary school students, identifying the areas of difficulty and deficiencies would in no small measure assist the students and teachers to ameliorate the problems and make the subject interesting and exciting to the students. It has been noticed that there are few researches on this area but at junior secondary school level. Thus this study would justifiably provide a useful contribution to further researches in the findings of this study which will hopefully uplift the standard of mathematics education as follows:

1. Mathematics teachers will be able to see the areas of their weaknesses and the areas of difficulties for students for them to equipped themselves more and also addressed the difficulties of the students in the five content domains by preparing a special remediation package towards demystifying the difficulty areas.
2. It will help the students to put more effort on difficulty areas identified by constant practice and attempting as many questions as possible.
3. Mathematics Association of Nigeria (MAN) can organize a special training programme to teachers on the difficulty areas identified and can also collaborate with publishers to write some books on the difficulty areas in order to assist the students and teachers.

4. Fellow researchers can explore to undergo further studies on each of the content areas in order to bring out more findings or consider the areas suggested for further studies.

On the other hand principals, proprietors and teachers can also use the findings/ recommendations of this research to improve or ameliorate some problems related to gender or location in mathematics performance and at the same time adjust

their mode of instruction such that it will enhance the development of skills and ability at senior secondary school level. This will in the long run help the students to acquire the necessary basic skills and abilities that will enhanced their ability and performance and hence the technological development of our dear country.

1.7 Basic Assumptions

The following assumptions were made for this study:

1. That all the students used for this study completed the required course of study by covering the content and well exposed to the content and therefore possessed the pre-requisites knowledge and ability to attempt all the questions in the test prepared for this study.

2. The senior secondary school mathematics curriculum was categorized into five content domains and to determine the basic abilities such as skills, knowledge and problem solving based on performance of teachers and students. The five content domains were considered in line with the curriculum as the content for their final examination.

1.8 Scope/ Delimitation of the Study

This study is delimited to the terminal class of senior secondary school students SSIII because they are expected to have covered their syllabus at that level. The students' performance was looked into on the basis of content and ability. The senior secondary school mathematics curriculum is being categorized into five content domain, in oder to determine the ability based on the performance of the students and teachers in the five content domains on which they wrote their final examination was considered as

stated in the NCTM (2000):- Number & operations, Measurement, Algebra, Geometry and Statistics & probability. The study was also delimited to:

a. Questions selected were based on some portion of the five content areas not all the areas of the content was covered.

b. Because of the geographical spread of the schools in Kaduna State and the limited financial resources not all students in the selected samples of the three (3) zonal Education offices were used but five (5) schools from each zonal Education office was sampled for the research.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

The purpose of this research is to study whether there is any significant difference between the observed and the expected level of mathematics abilities possessed by the teachers and senior secondary school Students and also consider the strengths and weakness of the students in the five content domains of the senior secondary school Mathematics Curriculum in relation to gender and location in Kaduna State**.**

This Chapter reviewed relevant findings found in Mathematics Education. The chapter was therefore divided into nine subsections as follows:

2.2 Senior Secondary School Mathematics Curriculum

2.3 The Concept of Basic Mathematical Abilities

2.4 Current Studies on Basic Mathematical Skills

2.5 Senior Sec. Sch. Mathematics Content Domains

2.6 Gender Differences and Mathematics Ability

2.7 Teacher Factor and Development of Mathematics ability

2.8 The Effect of School Location on Mathematics Ability

2.8 Assessment for Mathematics Abilities

2.10 Implications of the Reviewed literature on the present study

2.2 Senior Secondary School Mathematics Curriculum

Mathematics occupies a well established position in the school curriculum. While there is wide acceptance of the importance of mathematics, there is also a lack of consensus regarding the content of the curriculum, how that content should be treated, and overall purposes for the study of mathematics. The public expresses concern about the mathematical competence of students which causes educators to examine the achievement of students more closely. In Nigeria the content of the general Mathematics curriculum (1989), is grouped into six sections (Number and Numeration, Algebraic Processes, Mensuration, Plane Geometry, Trigonometry, and Statistics) but recently reviewed to five content areas similar to that of NCTM with each section occurring every year of the three Senior Secondary School programme . As it was emphasized by (Nigerian Educational Research Development Council (NERDC), 2007). In recent years the mathematics curriculum from primary to the secondary school in Nigeria has witnessed several changes in terms of contents, performance objectives, activities, methods and materials and so on to make it more relevant or adaptable to changes occurring every now and then in the society (NERDC, 2007). One of such recent changes is the shift away from the 6-3-3-4 system of education (i.e. six years of primary school, three years of junior secondary school, and three years of senior secondary school and four years of university education). This change led to the development of 9-year basic and senior secondary education mathematics curricular that was published in 2007 by NERDC (FGN, 2004).But there has been no corresponding changes in the general objectives of the secondary school mathematics curriculum(Odili, 2006).

2.3 The Concept of Basic Mathematical Abilities

The concept of ability has been defined in differential psychology:

1) As a latent trait inferred from patterns of individual differences across tasks.
2) As level of performance on a particular task or class of tasks.
3) As a latent cognitive process inferred from within-subject patterns of performance across trials within a task.
4) As an affordance - effectivity relaxation (i.e., a joint property of the union of person and environment.

2.3.1 Mathematical Abilities:

Mathematical Ability - The mathematical ability is the various behaviours that students exhibit in order to find a solution to a given mathematical problem. In this study the mathematical abilities examined were knowledge, skills and problem solving.

Mathematical abilities can be summarized into conceptual understanding; procedural knowledge and problem solving which can be explained as follows:

Conceptual understanding:-Students demonstrate conceptual understanding in mathematics when they provide evidence that they can recognize, label, and generate examples of concepts; use and interrelate models, diagrams, manipulative, and varied representations of concepts; identify and apply principles; know and apply facts and definitions; compare, contrast, and integrate related concepts and principles; recognize, interpret, and apply the signs, symbols, and terms used to represent concepts.

Conceptual understanding reflects a student's ability to reason in settings involving the

careful application of concept definitions, relations, or representations of either. All these aspects of abilities will assist the students and teacher to express themselves very well in attempting any question at all level.

Procedural knowledge:-Students demonstrate procedural knowledge in mathematics when they select and apply appropriate procedures correctly; verify or justify the correctness of a procedure using concrete models or symbolic methods; or extend or modify procedures to deal with factors inherent in problem settings. Procedural knowledge encompasses the abilities to read and produce graphs and tables, execute geometric constructions, and perform non computational skills such as rounding and ordering. Procedural knowledge is often reflected in a student's ability to connect an algorithmic process with a given problem situation, to employ that algorithm correctly, and to communicate the results of the algorithm in the context of the problem setting. This aspect of the ability is fundamental in getting the right answer to any given question and some of the questions to be answered in this study are knowledge based.

Problem solving :-Students demonstrate problem solving in mathematics when they recognize and formulate problems; determine the consistency of data; use strategies, data, models; generate, extend, and modify procedures; use reasoning in new settings; and judge the reasonableness and correctness of solutions. Problem-solving situations require students to connect all of their mathematical knowledge of concepts, procedures, reasoning, and communication skills to solve problems. This is one of the difficult areas in the abilities most of the students fail to answer questions on problem solving

but all these are going to be very useful guides in items generation that will assist in

testing the skills base on the five content domains.

2.4 Current Studies on Basic Mathematical Skills

The basic mathematical skills were very important to every student of mathematics as they pave the way for becoming a better and future mathematics education students or teachers. The researcher reviewed this all important areas under the following subheadings.

2.4.1 Reviving Real "Basic Skills" in Mathematics Education

Basic skills have been scorned and systematically dismissed as a valuable part of learning in mathematics by progressives in many countries for almost 40 years. That negativity escalated to a new level when the National Council of Teachers of Mathematics published their Curriculum and Standards in 1989. "Math wars" have been waged between traditionalists and progressives ever since.

Now a demand for a "return to the basics" among some parents, educators, and businesses is gaining momentum. Consistently low math scores on standardized tests in public schools and college placement tests are prompting that call for action. In life each domain has its own set of "basics" and principles to be learned that impact mastery and success within that domain. The argument on basic skills have been a long standing issue that critics failed to reconcile, but at the end of it all it is now becoming a blessing in disguised as the important aspect of it are gradually being adopted for implementation.

Kimberly, (2005) "The basic skills of reading, writing, and arithmetic have been morphed into the 'hard skills' of basic mathematics, problem solving, and reading at higher levels and the 'soft skills' of working effectively in groups, making effective and written presentations, and using computers well. The wording may be different but the

ideas are the same. So why they declared antipathy of NCTM Standards toward teaching basic skills in K-12 classes which is equivalent to the senior secondary school III (SSIII) in the Nigerian system of Education.. Some mathematics educators are against teaching basic skills, but in reality the basic skills are not mere memorization of facts as Tom, (2003) said “some people argue that students no longer need to learn how to compute now that calculators are widely available. Are basic skills important? And he answered by saying “I will argue they are. Unless every student receives a thorough grounding in arithmetic the nation has little chance of achieving ambitious goals in mathematics”. This shows how he emphasized the relevance and important of basic skills in training towards achieving any country’s desired goals.

The NCTM attempt to introduce meaning and relevance, or transference, centered on the use of "integrated activities" and a multitude of manipulative. They assumed the act of doing math would provide meaningful relationships to learners. Consequently, students' math deficiencies must be met with remedial coursework (basic skills) at the college level, with no credit being earned toward graduation. In a "Position Paper on Basic Mathematical Skills" published in January 1977 by the National Council of Supervisors of Mathematics, expand "basic skills" By saying there are many reasons why basic skills must include more than computation. The present technological society requires daily use of such skills as estimating, problem solving, interpreting data, organizing data, measuring, predicting, and applying mathematics to everyday situations."The changing needs of society, the explosion of the amount of quantitative data, and the availability of computers and calculators demand a redefining of the priorities for basic mathematics skills." There are many people such as educators, parents,

and business leaders, who have been working in the trenches for years to bring balance to math education. These expanded basic skills are far away from the misconceptions of some people to mean rote memorization of facts to a more diverse approach that involves practical application and understanding the concept in question.

The math wars are over. "The National Council of Teachers of Mathematics (NCTM) has come to its senses." Such catch-cries abounded in response to the NCTM's publication of Curriculum Focal Points for Pre-kindergarten through Grade 8 Mathematics (2006a). This document represents a break with tradition in that it focuses attention on a limited number of significant mathematical goals at each grade level. (NCTM, 2006). The Curriculum Focal Points presents a vision for the design of the next generation of state curriculum standards and state tests" (NCTM, 2006b). It sees the focal points as the first step to a national discussion on bringing consistency and coherence to United States mathematics curricula. This document is seen as one response to the "mile wide, inch deep" criticism of United States mathematics instruction, a criticism that most typically arises in the context of comparing the performance of American students with international students on tests of mathematics achievement. The assertion by some critics that the Focal Points document represents a shift in the NCTM position on basic skills is challenged by Skip Fennell (NCTM, 2006c), who claims that the NCTM has always recognized the importance of building students' ability to memorize certain basic math facts and procedures. Hechinger, (2006) state "That having students describe in writing the reasoning behind their answers meant that students were writing about math instead of doing it, and that having students discover their own methods to perform math operations could not lead to mastery. Another critic, Lewin,

(2006), asserted that planned changes in teaching math in American schools were driven by students' lagging performance on international tests and parents' dissatisfaction with their children's performance in mathematics.

The NCTM's recent involvement in mathematics education reform began with the publication of an agenda for Action (1980) which focused on the need for students to learn how to solve problems. More recently, the following documents have caused substantial public reaction: Professional Standards for Teaching Mathematics (1991), Assessment Standards for School Mathematics (1995), and the Principles and Standards for School Mathematics (NCTM) (2000). Certainly, these documents have focused attention on a standard-based approach to mathematics instruction, described by its critics as "fuzzy math" where individual accountability was replaced by group work, proficiency in basic skills was replaced by reliance on calculators, and serious attention to algorithmic thinking was replaced by "real-life problems." In 2000 NCTM, is widely considered to be a more balanced and less controversial vision of reform than its predecessor 1989 Curriculum and Evaluation Standards for School Mathematics. The discussions on these important areas of basic skills in relation to mathematics content at the senior secondary school level are still going on with some experts in support while others are against it. It is the opinion of the researcher that we should strike a balance such that basic skills are important and should be learnt, but at the same time conceptual understanding and procedural knowledge are also very essential and be given due attention, in a summary the basic skills, procedural knowledge and
conceptual understanding should be put together in oder to give the students an up to date and appropriate training in senior secondary school mathematics content.

2.4.2 Knowledge

According to Bloom's Taxonomy of educational Objectives (Bloom, 1956) Knowledge represents the lowest level of learning outcomes in the cognitive domain. In mathematics a test of knowledge consists of students' ability to recognize geometrical shapes, recall basic terms, formulae, reading of graphs, and tables, rules, concepts and generalizations, critical thinking supports the creation of new knowledge and not as improved quality of knowledge. Critical thinking cannot be reduced to one skill or even to a set of skills because it involves intelligent actions enables students to comprehend. Communicate or engage in problem solving or strategy building techniques. Critical thinking enables an individual to be responsible citizen who contribute to the society (Paul, 2004). Similarly (Adetula, 1989 and Odili, 1990) shows that students are bolder in answering problems requiring recall of knowledge than the other abilities. The result of their studies consistently shows that the students could recognize shapes, terms, formulae and generalizations necessary for the solution of a given problem but could not apply their knowledge to solve the related problems. The studies of Jahun (1988) shows that the students got higher scores in knowledge than in other abilities and also responded to questions testing their knowledge in a better way. From these reviews it is evident that students do not go beyond basic knowledge of mathematics. (Ale, 1989) appeal and recommended that teachers should teach the students to see the usefulness of mathematics such that the teaching should be application inclined devoid of all abstractness. Thus class lessons should be centered on applications based on sufficient examples. This will in turn enhanced the performance of students in mathematics performance tests.

2.4.3 Skills:

A computational skill is the ability of students to manipulate confidently, capably and flexibly numbers with the basic operations namely: Addition, Subtraction, Multiplication and division. (Agwagah, 2005). According to National Council of Teachers of Mathematics (n.d), basic mathematics skills that should be inculcated in learners include computation, problem solving, approximation and estimation, presenting results in reasonable form, geometrical knowledge, measurement such as time, height, capacity, temperature, distance, areas with appropriate units, computer application and statistics and probability for predicting events. However, the situation in Nigeria reveals that students do not possess these skills that will enable them to function effectively within the society (Obanya, 2011). The whole numbers and decimals and simple fractions; complicated computations will usually be done with a calculator; knowledge of single digit number facts and mental arithmetic; use of percent should be developed and maintained. Gagne, (1979) consider the development of process skills in children to be the major objective of education.

Today modern technologies especially the development of calculators and computers has been of much help to the individual in handling everyday computational problems. Almost every home or shop has simple calculators to do computational task. Lassa, (1978) asserted that, computation is one of the lowest level in Bloom's taxonomy of educational objectives, yet teachers' instruction, testing and grading tend to emphasize so much on it Studies conducted on basic skills in mathematics show that most students attempted more computational problems than any other types of problems. The National Advisory Committee on Mathematics Education (NACOME) in its report overview and

analysis of school mathematics, grade K-12 (1975) states:

> It appears to us that the case for decreased classroom emphasis on manipulative skills is stronger now than ever before impending universal availability of calculating equipment suggest emphasis on approximation, Oder of magnitude, and interpretation of numerical data not drill for speedy, accurate application of operational algorithms.

As the public reacted to circumstances it perceived as weakness in the school mathematics program. The NCSM (1978) published a position paper on basic skills which was later published in NCTM, in which they did not deemphasized it but posits it to be put in its proper place, The position paper stated:

> Any list of basic skills must include computation. However the role of computational skills in mathematics must be seen in the light of contribution they make to one's ability to use mathematics in everyday living. In isolation, computational skills contribute little to one's ability to participate in mainstream society. Combine effectively with other skill areas, they provide the learner with the basic mathematical ability needed by adults.

Analyzing students' performance on computational skills, Adetula, (1989) found that the results obtained supported that of NAEP. Computations of perimeters, areas of simple geometrical shapes were performed easily by students. Calculation of long distances according to Carpenter et al (1975) was done poorly and needed to be improved upon.

In developing computational skills, sudaym et al (1980) suggested that teaching should be made more meaningful to the learner. Furthermore, drills and practice are considered

as important tools in the mastery of computation. However, drills should be systematic and interesting. It must not be over used and varied from topic to topic.

2.4.4 Problem-Solving

According to Henderson and Pingry (1953), later sees problem solving in mathematics as a situation in which an individual or group is called upon to perform a task for which there is no readily accessible algorithm which determines completely the method of solution while Krulick and Rudnick (1980) defines problem solving as a means by which an individual uses previously acquired knowledge, skills and understanding to satisfy the demands of an unfamiliar situations. Bolaji, (1994) described problem solving as a complex process of solving a problem. The secondary school students' performance in problem solving skills in achievement tests was not encouraging. He also emphasized that one area of problem solving that is a key factor in students deficiency in mathematics is the translation of word problems into mathematical sentence, which usually affect the students performance. This implies that teachers should encourage and expose the students to the semantics of certain key words using variety of examples in order to develop problems solving skills with the spirit of perseverance, interest and ability. Impliedly only those who are mathematically talented should be taught problem solving because of its difficult nature. Problem solving which is an aspect of mathematics curriculum is a process which begins with initial contact with the problem and ends when the obtained solution is reviewed in the light of the given information (Sulaiman, 2010). Therefore students need to learn about the process to deal successfully with problems that may be encountered in schools and in real life situations.

Nigeria as a developing nation requires a lot of problem solvers that will liberate her socially, politically, scientifically and technologically.

2.5 Senior Secondary School Mathematics Content Domain

There are five main content areas in senior secondary school mathematics curriculum. These are Number and Operations, Algebra, Geometry, Measurement, and Data Analysis and Probability. In Nigeria the content of the general Mathematics curriculum (1989), is grouped into six sections (Number and Numeration, Algebraic Processes, Mensuration, Plane Geometry, Trigonometry, and Statistics) but recently reviewed to five content areas similar to that of NCTM with each section occurring every year of the three Senior Secondary School programme . As it was emphasized by (Nigerian Educational Research Development Council (NERDC), 2007).

The NCTM (2000) stated that:

> The new standards were organized around six principles (Equity, Curriculum, Teaching, Learning, Assessment, and Technology) and ten strands which included five content areas (Number and Operations, Algebra, Geometry, Measurement, and Data Analysis and Probability) and five processes (Problem Solving, Reasoning and Proof, Communication, Connections, and Representation).

2.5.1 Number and Numeration

According to Martinez and Martinez (1996), those who do not understand

numbers fear them, and this in turn leads to further misunderstandings that will ultimately lead to insecurities concerning application in society. The National Council of Teachers of Mathematics (2000) pointed out that students should be able to compute and estimate reasonably. This document acknowledged the importance of developing the students' ability to estimate. Students should gain facility with addition, subtraction, multiplication, and division of whole numbers. Today it must be recognized that long, complicated computation will usually be done with calculator. Knowledge of single digit number facts is essential and mental arithmetic is a valuable skill. Moreover there are everyday situations which demand recognition of, and simple computation of fraction (NCTM, 2000).

Leeson (2005) emphasized that high priority should be given to developing students' skills of estimation of measurement .This will help the students in understanding the concept of number and numeration and in turn acquire the basic skills required.

2.5.2 Geometry and Mensuration

Geometry and menstruation is one of the areas that prove to be very difficult to students in the senior secondary school mathematics curriculum an indebt attention deserve to be given to it. According to Adolphus (2011) Mathematics educators are trying to identify the major problems associated with the teaching and learning of mathematics in the nation's schools. Even though scholars view geometry as the most difficult aspect of mathematics such as (Nguma, 2010, Adolphus, 2011). From the Senior Secondary School curriculum, geometrical skills include measurement of distances, plane shapes, areas, volumes, lines, angles, triangles, polygons, circles and tangents, scale drawing,

construction, loci, Parallel, perpendicular, and basic properties of simple geometric figures with emphasis on measurement and problem solving; recognize similarities and differences among objects.

Similarly Odili (1990) found that only 6% of the students were able to pass in geometrical exercises. Earlier study by (Lassa, 1986) shows that the performance of students in geometry was very low. Special attention is needed here for the students to develop the ability to handle questions on geometry properly as on one of the difficulty areas for students from the earlier studies.

2.5.3 Algebra

Algebra is the key to learning and mastery of mathematics knowledge and skills. And mathematics has ever been fundamental to the development of progress of Science and Technology which are indicies for development and progress of all nations in all field of work and study. (Azuka, 2003).

Shoenfeld and Areavi (1988) argue that "Understanding the concept of a variable provides the basis for the transition from arithmetic to algebra and is necessary for the meaningful use of all advanced mathematics." Yet, the concept of a variable is "more sophisticated" than teachers expect and it frequently becomes a barrier to the students' understanding of algebraic ideas (Leitzel, 1989).For example, some students have a difficult time in shifting from a superficial use of "a" to represent apples to a mnemonic use of "a" to stand for the number of apples (Wargner and Kieren, 1989).

Nguuma, (2010) administered a mathematics achievement test to sample of two hundred selected junior secondary three students. He discovered that the students scored an

average of only 30.1% in geometry but 59.3% in algebra. He attributed the poor performance in geometry to the poor syllabus coverage in the area and the good performance in algebra to the fair syllabus coverage in each area before the examinations. A study conducted by Ode (1988) indicated that syllabus coverage has tremendous negative consequences on students' performance if not completely covered. He used a sample of sixty mathematics teachers and a sample of two hundred students for his study. He recommended that students should work independently to complement the teachers' effort of covering the syllabus. He further revealed that out of sixty teachers he sampled 53.4% covered the prescribed syllabus in number and numeration, 59.8% in algebra, 40.2% in statistics and only 22.4% in geometry. The students had the best result in algebra and the worst in geometry signifying that the better the coverage the better the performance. This indicated that content coverage play a vital role in helping students to acquire the basic abilities from the content and hence the improved the general performance

2.5.4 Statistics and Probability

It is the numerical measure of likelihood of an event to occur. (Jaggi, 2006). Probability provides a model for experiment of chance.(Abubakar, 2009). The impact of probability and its twin subject statistics can be felt under almost all discipline; Engineering (signals), Medicine(Measuring effectiveness of drug in the control of diseases as the study of spread and control of epidemics), Chemistry (polymer, failure of Technical devices, error of mechanism). Ugbebor, (1991) Under this area, there are collection and representation of data, measures of central tendencies, probability,

permutations and combinations. Table, charts, and graphs, students should know how to read and draw conclusions from simple tables, maps, charts, and graphs. They should be able to condense numerical information into more manageable or meaningful terms by setting up simple tables, charts, and graphs. Students should also learn how elementary notions of probability are used to determine the likely hood of future events. They should learn to identify situations when immediate past experience does not affect the likelihood of future events. They should become familiar with how mathematics used to help make predictions such as election forecasts.

(NCSM, 1978).

Adetula, (1989) found that 58% of the students could read graphs but less than 50% of them could condense numerical information into a more manageable or meaningful terms by setting up simple tables, **charts** and graphs. Similarly Odili (1990) in his study shows that only 11.3% of the students passed in everyday statistics. A more practical approach must be employed in order to help students to acquire the basic abilities that will enable them to overcome the problem of poor performance under this important content domain.

2.5.5 Measurement:

Measurement as a minimum skill, students should be able to measure distance, weight, time, capacity, and temperature. Measurement of angles and calculations of simple areas and volume are also essential. Students should be able to perform measurement both in metric and customary systems using the appropriate tools. (NCSM, 1978)

Performance on measurement tasks in a variety of assessments leaves something to be desired. The data released from the mathematics portion of National Assessment of

Educational Progress NAEP, (1979b) suggest that more attention should be given to helping students acquire more extensive repertoires of understanding and skills in measurement of particular note is the deficient performance in the areas concerned with application of mathematics (NAEP, 1979c).The instruction should first focuses on using tools of measurement, learning to use rulers, thermometers, measuring cups, scales and the like is important, however without a sense of nature of relationship between these tools and what is being measured, very little insight into the scientific and mathematical process is obtained (NSSE, 1980). Hirstein, et al (1978) on misconception about area measure; they indicate that the probable source of students' lack of understanding is insufficient experience with preliminary primitive measurement concepts prior to dealing with area on a rule basis. Particularly when dealing with measurement system for lengths, area, and volume, learners must have opportunity to tie together a base of geometric understanding with actual number concepts of measurement.

The judicious use of measurement base explanatory models for arithmetic concepts is an effective instructional strategy. Understanding of measurement concepts is positively correlated with achievement of computational skills, considering these five content domains and the abilities acquired within; students will be motivated to do better if all the content areas are well covered.

2.5.6 Teacher Factor and Development of Mathematics Ability

Olaitan, (2002), opined that the quality of a nation teacher education is the

benchmark for assessing the quality of education provided in schools. Good teachers therefore translate in to good education, which in turn translate in to a great nation. Ben-Yunusa, (2000), asserts that a teacher is the main force and the last person that ensures that any curriculum is implemented according to specification. The role of a teacher in the implementation of curriculum in any educational system is paramount and hence cannot be over emphasized. Grifts et al in Akale (1987) state that: "The potential of an educational system is directly related to the ability of its teachers. No matter how distinguished the members of a curriculum team are, how carefully structured media have been exploited, the success or failure of any innovation, ultimately hinges on the perceptiveness and flexibility of the classroom teacher" (Akale, 1987).

(Akale, 1987) reiterates that good syllabus is useless if the quality of the teacher is not developed to meet the challenges. This means that the training of teachers have to be qualitative so as to face the challenges of the curriculum. There are different views on the subject mathematics, thus noting that the angle that it is looked at will depend on the way it is interpreted and filtered down to educators. They in turn come up with their interpretations and then facilitate the teaching of the subject through their understanding of mathematics. Obioma, (2011), opined that poor teaching methodology employed by mathematics teachers lead to poor performance of Senior Secondary School student in mathematics. According to the researcher this could be minimized if teachers are well equipped to use various types of teaching strategies appropriately. If an educator has a certain conception about the subject, then he would manage it in a way that would fulfill his or her beliefs. For example, if an educator views mathematics as a humanistic activity then s/he would provide the right context for the humanistic approach to take

place in the classroom. According to Gates (2001), many see mathematics as "cold, hard and inhuman", and as a male domain. Such a view would prevent teachers adopting a humanistic approach that relates mathematics to the real world Clarity on the nature of mathematics is important for the educators and their methods of teaching the subject.

Their understanding will ultimately affect the way they interpret the outcomes in the mathematics learning area. The educators are designers of their own destiny in the subject matter, which in turn affects the context in which the learners acquire and use the material. Brophy, (1987) on classroom instruction reveals that students´ achievement is determined not only by curriculum content and materials but by amount and quality of instruction that students received from their teachers. Furthermore Brophy emphasizes students achieve more in classes where they spend most of their time being taught or supervised by their teachers rather than working on their own or not working at all. The effectiveness of a teacher affects the amount of learning that takes place in the classroom. Studies conducted by Grows and Good (1977) reveal that the effective teachers consistently produce higher achievers in Mathematics than the less effective teachers. In their assessment, effectiveness of a teacher is based on certain qualities (abilities) exhibited by the teacher during instruction. These are: -

i. Clarity of instruction devoid of ambiguity.
ii. Time spent on content preparation.
iii. Teachers' expectation of students achievement, and
iv. Task focused environment.

According to Brophy (1987) students achieve more in classes where they spend most of their time being taught or supervised by their teacher rather than working on their own or not working at all. The length of time taken and the supervision given contributed in helping the students to acquire the basic abilities and hence performed well. In Nigeria, the low achievement recorded in Mathematics by students has been an issue that Mathematics educators have been trying to find solutions. This resulted in different curriculum changes (Entebbe mathematics, 1963); modern mathematics 1970-1979; and the present curriculum. The result of students' achievement is still low regardless of the curriculum changes. It is very important to re-look into mathematics teacher education programme in order to produce the caliber of teachers with the ability to handle the mathematics content in the five content domains. It has been agreed that no educational system can rise above the quality of her teachers (FME, 2004). Adetula (1989) and other mathematics educators advocated the teaching of secondary school mathematics content in the faculty of education in the universities these will assist in upgrading the ability of teachers. Perhaps it should be stressed that some mathematics teachers are not trained to teach the subject. For instance, geography, economics, agriculture trained teachers have been drafted to teach mathematics just because they have rudimentary training in mathematics.

A reason may well be the paucity of mathematics teachers. But the damages incurred out – weigh the needs, the practice is supposed to meet.

Besides, it is known that learners brought up under this practice exhibit a high degree of deficiency in the subject, (Obioma, 1996).He suggested that competency updating programmes be developed to meet the needs of teachers who are being used to teach mathematics other than areas they originally trained in. This programme should be on a short or long term in-service basis so that the right teachers will be there to train and develop the basic abilities in our younger ones.

2.7 Gender Differences and Mathematics Achievement

Several studies have been carried out on gender issue worldwide, in Nigeria boys are ascribed certain roles different from that of girls. A boy in a family is expected to perform better in anything. Most of the people consider boys to be better in any involvement with girls. Girls are looked upon as weaker sex. Boys and girls are diverse in both biological and cultural terms, therefore one expect a difference in mathematical tasks. On the influence of sex on performance in mathematics tests Agnes et al (2009) emphasized with the following quotations "Mitchelmore (1973) acknowledges the superiority of males over females when he noted that in all tests, boys obtained higher scores than girls at 0.01 levels. Also Maccoby and Jacklin (1974), Opolot, (2005) in separate studies found out that boys clearly perform better than girls in mathematic tests.

Onyeizugbo, (2003) pointed out that "sex roles are somewhat rigid in Africa, particularly in Nigeria where gender differences are emphasized. The differences are as a result of direct effect of sex stereotyped". From the above discussions we may say that perhaps the whole of Africa, gender bias is still very prevalent sex roles are somewhat rigid in Africa; particularly in Nigeria gender differences are emphasized. It is

commonplace to see gender stereotypes manifested in the day-to-day life of an average Nigerian. Certain vocations and professions have traditionally been regarded as men's (medicine, engineering, architecture), and others as women's (nursing, catering, typing, arts). Typically parents call on boys to wash cars, cut grass, fix bulbs, or climb ladders to fix or remove things. On the other hand, chores such as washing dishes, cooking, cleaning, and so on, are reserved for the girls. In a sense, what are regarded as complex and difficult tasks are allocated to boys, whereas girls are expected to handle the more simple tasks.

The second mathematics assessment of National Association of Education Progress (NAEP II) provides the most comprehensive look at sex-related differences in learning mathematics on a nation-wide scale (Fennema and Carpenter, 1981). The study concentrated on courses taken as well as achievement in specific content area (such as variables, relations and word problems) and at different degrees of complexity, (knowledge, skills, understanding and application). Furthermore, Sudaym and Desert (1980) stated that boys score higher in mathematics reasoning and girls were better in the fundamentals. These findings indicated that sex differences in mathematics achievement often occur in favour of boys mainly in higher cognitive abilities, though Fannema and Sherman (1981) studies reported that when boys and girls studied the same mathematics course during higher schools, few sex related difference in achievement were found. Similarly, Obioma (1988) in another study state that sex is also a predicting factor in mathematics achievement.

There are several factors predicting mathematics achievement for instance Goods (1981) states that teacher is a factor affecting female students' participation. The study

shows that high achieving girls receive significantly less attention in mathematics class than high achieving boys from the teacher. The study also added that teachers interact more with male students than female students. Oshafehinti (1988) also found that teachers' expectation of male students of having a good problem solving behavior that makes the boys more confident than the girls who feel in secured in subject. Oshafehinti (1988) furthermore stated that the belief that mathematics is a male domain is communicated in many ways to young girls by parents; media, teachers and school counselors. Thus after the general mathematics which is compulsory, very few proportions of female students pursue higher mathematics courses.

McGaw (2008) provided some explanation for the re-emergence of significant gender differences in the 2006 PISA results in Australia. He reported that there were no significant changes for males from 2003 to 2006 but that there were significant declines for females in Western Australia, Northern Territory and Australia overall. While there may be no significant differences in mean scores for mathematics, significant gender differences have been reported for some content. If an educator has a certain conception about the subject, then he/she would manage it in a way that would fulfill his or her beliefs. For example, if an educator views mathematics as a humanistic activity then s/he would provide the right context for the humanistic approach to take place in the classroom. The Early Years Numeracy Project (EYNRP, Horne, 2004), and the New Zealand Numeracy Project measured student achievement according to thinking strategy used and so valued flexible thinking and more efficient strategies in calculation and problem solving in mathematics. What is noticeable is that findings favouring females occurred more often in studies of primary students' achievement and especially in New

Zealand, whereas findings favoured males in secondary studies including post-compulsory (Grade 12) high-stakes formal assessment. Many studies conducted between 2000 and 2004 showed no significant differences in achievement in mathematics between males and females, though males were more likely to record higher mean scores. However, the latest study, PISA 2006 found significant differences favouring males.

According to Gates (2001), many see mathematics as "cold, hard and inhuman", and as a male domain. Such a view would prevent teachers adopting a humanistic approach that relates mathematics to the real world. This study looked into the gender issue in relation to basic abilities and the performance of the students in the five content domains.

2.8 Effect of School Location on Mathematics Achievement

Several researches have been carried out on school location and performance. Mitchelmore (1973) in his study of students performance on modern mathematics curriculum found that urban students had significantly ($p<0.05$) higher mathematics scores than their rural counterparts. This indicates that urban students are superior to the rural students in mathematics achievement tests. In another study, Ikaetuanye (1988) found that there were differences in verbal reasoning and abstract reasoning. It was found that urban girls' students were better than both urban male students and both sexes from rural schools. Also the rural boys outperformed the other categories in mechanical reasoning. On the other hand, the result of the study conducted by Obioma (1988) indicated that the students in state capitals urban centre were more defificient in mathematics achievement tests than the students in rural schools. This implies that students from rural schools were more prone to higher achievement in mathematics tests

than the urban students. No tangible reason was advanced for this development.

Separate studies by Kalejaiye (1982), on reading performance, Ojo (1986) on achievement in mathematics, Odili (1990) on failure rate in English and mathematics, all showed unequal pattern of performance by rural and urban students with the latter group performing better than the former. In another study Aina (1986) found that there were significant differences in verbal reasoning. It was found that urban female students were better than urban male students and both sexes from the rural schools.

2.9 Assessment on Mathematics Abilities

Assessment is one the most is important learning process that determine the extent to which a learner have absorbed what was presented to him. The development and implementation of any new assessment system, particularly one that provides the basis for 'high stakes' senior secondary school qualifications, requires monitoring of its impact on the people for whom it is designed and their views of its implementation. This is particularly important when the new assessment system has a number of features that differ from the assessment system that it is replacing, and acceptance of the new system is dependent not only upon perceptions that the new system works as well or better than the one it is replacing but also the credibility of the agency implementing the new system (Philips, 1998; Raffe, 2002). In practice, both aspects tend to be interlocked.

> Assessment is a powerful educational tool. It influences the judgments of students and teachers about what is of most importance in the curriculum. The effects can be positive and can Assessment justify expectations of assessment-led reform. The effects can also be negative, for students, teachers, schools and

> the curriculum. It is important, therefore, for those responsible for assessment, particularly high-stakes assessment, to pay attention to the 'consequential validity' of their assessment systems. Assessment cannot be seen only as a technical task. Assessment needs to be fit for purpose. B. Macgaw, 2006 (keynote assessment IAEA).

Mehrens et al, (1991) asserted that too many significant educational policies are being shaped as a consequence of test result, too many educational effectiveness of the teachers are being based on pupils test scores. Too many citizens are forming their views about education as a consequence of published test results. These seem to be the same in Nigeria where lots of decisions are being taken based on pupils test scores. The National Teachers Institute (2006) has observed that most of the existing literatures on evaluation of students' performance indicate that it is unfair to evaluate students using only one short examination which often comes at the end of a learning cycle. This assessment practice has the following negative effects:

i. Too much emphasis is laid on the outcome of final external examination as a result teachers try to cover the syllabus to the detriment of students understanding what they are taught under the content domains.
ii. Teachers do not focus on assessment during instruction thereby denying the opportunity of correcting of mistakes that students make in learning and as such skills and basic abilities to be acquired may not be acquired.
iii. Pupils not given prompt feedback on the progress they are making in learning.

Prompt feedback on learning helps to motivate and keep students in learning. At the senior secondary school level the continuous assessment score were for the years of secondary education which were expressed out of 100% for each year. The continuous

assessment scores were the scores sent to West African Examination Council (WAEC) to form part of the students final grades, in accordance with the Implementation Committee's guidelines for the award of the senior secondary school certificate, 30% of the final grade should come from continuous assessment at SSS level weighted equally for three years that is 10:10:10. (Implementation Committee Federal Ministry of Education, 1988). This will help the student in developing his abilities. This type assessment according to studies can be achieved with the use of standard test. A standard test is a test that have been carefully prepared and refined statistically in order to make them more precise and valid. A test of this nature (FME, 2000) considers the educational goals, course content, concepts and knowledge at a specified level.

Standardized tests may be multiple objective, short answers, oral, or essay types. Teachers should be interested on how students got their answers and why was it right or wrong in order to strengthen the abilities of the students. This implies that there is the need to take into consideration the "thinking process of the students by examining each step of thinking and they arrived at the answers" (Lassa, 1986). In awarding marks to assessment tests, it is worthwhile for the examiner to have a scoring scheme (Kalajaiye, 1982). The preparation of marking scheme for marking the tests items helps the teacher to be reasonably objective in marking. Hence evaluation is very vital in attaining educational objectives as it provides information on students' progress in other words the level of his performance in the content domains.

2.10 Implications of the Reviewed Literature on the Present Study

The literature reviewed in this chapter looked into some relevant literature to the present study. This includes the students' performance on basic mathematical abilities,

basic skills, contributions of National Council of Teachers of Mathematics (NCTM) on mathematics content and skills. Knowledge, skills and problem solving were also discussed in relation to content, students performance and abilities, the five content areas in mathematics curriculum was also discussed; these are number and operation, algebra, geometry, measurement, statistics and probability. Teacher factor, sex differences in mathematics achievement, effect of school location and assessment on mathematics achievement was also looked into. The results of the review showed that the students were weak in their abilities especially in number and operation and geometry was worse than other areas of the mathematics content. Their views indicated that gender differences in mathematics achievement were only significant at a certain level of adolescence. Some of the previous studies showed that students from urban school performed better than students from rural schools in mathematics tests. These are very vital information gotten from the review which will guide the researcher in building and at the same time ascertaining what was earlier done. This study therefore looked into this area and determined the possible effect of senior secondary school mathematics performance based on gender and geographical location in relation to the five content domains and basic abilities of the teachers..

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The main purpose of the study was to assess the level of basic mathematical abilities acquired in the content of Senior Secondary School in relation to teachers' ability and students' performance in Kaduna state. This chapter attempted to explain the research design and the procedure of investigation followed in order to carry out the study. The procedure adopted for the selection of population, sample size, sampling procedure, research instruments and statistical technique used in the study was discussed.

3.1 Introduction

3.2 Research Design

3.3 Population of the Study

3.4 Sample Sampling Procedure

3.5 Pilot Study

3.6 Instrumentation

3.7 Data Collection Procedure

3.8 Data Analysis

3.2 Research Design One Shot Case Study

The one shot case study is a research approach, situated between concrete data taking techniques and methodologic paradigms. (Lamnek, 2005). The researcher finds it

relevant to use this design. Thereafter set the two test items, first test on

Mathematics Performance Test in the Content Domain (MAPTECODO 1) for students while the second test on (MAPTECODO 2) for teachers. The research was design to elicit information on teachers' ability, students' performance, gender difference in students' performance and location difference in students' performance. The two test conducted formed the basis of the analysis carried out at (95%) ninety five percent confidence level.

3.3 Population

The population of the study was made up of the senior secondary school (SSIII) students in Kaduna state. There are twelve Educational zones in Kaduna state, namely; Anchau, Birnin Gwari, Giwa, Godogodo, Kachia, Kaduna, Kafanchan, Lere, Rigachikun, Sabon Tasha, Zaria and Zonkwa. There are 518 Secondary Schools in the State. Out of which 99 schools are senior secondary schools, while 151 schools are operating both junior and senior secondary schools in the same environment. The population included both male and female students because gender was considered to be a factor likewise location was another variable in this study. The total population of students for this research was 31,833 from 250 senior secondary schools in Kaduna state, (Ministry of Education Kaduna, 2011). The details of the population were presented in table 3.3.1

Table 3.3.1 Population of the study

Zone	Male	Female	Total
Anchau	1962	648	2610

Birnin Gwari	431	957	1388
Giwa	1091	611	1702
Godo Godo	1637	957	2594
Kachia	1478	1016	2494
Kafanchan	1689	1305	2994
Kaduna	2049	2017	4066
Lere	1564	544	2108
Rigachikum	1040	656	1696
Sabon Tasha	1878	1420	3298
Zaria	3144	1463	4607
Zonkwa	1251	1025	2276
TOTAL	19,214	12,619	31,833

(Ministry of Education Kaduna, 2011).

The population of teachers: The population of the teachers was drawn from the three sampled educational zones, in each zone five senior secondary schools were selected, three schools for male students and two schools for female students making a total of fifteen senior secondary schools. The teachers that were teaching the SSIII students as at the period of this research in these fifteen senior secondary schools were male teachers and no any female teacher. After the test was conducted only twelve teachers responded and sat for the test out of the fifteen teachers sampled out for the research.

3.4 Sample and Sampling Procedure

The year three students of senior secondary school in Kaduna state were the respondents for this study. The choice for these students was on the basis that they have covered their syllabus adequately. Therefore a representative sample of the students from the population was drawn using Krejcie and Morgan 1970 suggested sample size. Simple random sampling was used in order to select the three zones out of the twelve educational zones in Kaduna state the zones sampled out were; Anchau, Kaduna and Zaria. Thereafter stratified random sampling was used to select five schools from each zone considering male and female schools, making a total of fifteen schools, then classified the fifteen schools based on urban and rural schools. The actual sample was calculated using Krejcie and Morgan tables as indicated in table 3.4.1.

Table 3.4.1 samples for the Study (students)

Zones	Population	Sample
Anchau	**2,610**	**77**
Kaduna	**4,066**	**125**
Zaria	**4,607**	**146**
Total	**11,283**	**348**

Sample for the study (Teachers)

The population sample of the teachers was drawn from the fifteen senior secondary schools selected from the three sampled educational zones which include Anchau zone,

Zaria zone and Kaduna zone, out of the fifteen teachers sampled out only twelve responded and sat for the test. Each school has only one mathematics teacher for SSIII and no single female teacher among them; all the twelve teachers were male.

3.5 Pilot Study

The purpose of the pilot study was to validate the Mathematics Performance Test in the Content Domain MAPTECODO 1for students and MAPTECODO 2for teachers. This was done by determining the reliability and validity of the two instruments to assess the level of basic mathematics abilities of teachers and its effects on the performance of students in senior secondary school in Kaduna state. The pilot study was also meant to serve as a model and an insight to the main study. Barewa College Zaria and Government Girls Secondary School Kofan Gayan Zaria were selected for the pilot study considering both male and female schools. The two tests were developed and administered during the third term examination. The choice of the period was done in order to enable the students do their best as they have already covered their syllabus. Fourty students were randomly selected from SSIII class for the pilot study. Twenty (20) students from both schools were drawn on equal proportion using their class registers. The test MAPTECODO 1 for students contained fifty (50) items and five (5) theory questions while MAPTECODO 2 for teachers contained twenty-five (25) items and five (5) theory questions, the test was administered to the students after they started the two SSIII teachers from the two selected schools also took their own test at least 30 minutes after the students started because they helped in selecting and arranging the students.

3.5.2 Reliability and Validity of the Instruments

According to Adewumi (1991), validity refers to the degree to which a test

measures what it purports to measure. Four experts in the field of mathematics education were asked to comment on the validity of the test items and their comments was in terms of whether each content domain measure exactly what it intends to measure or if it slightly deviate or if there is strong deviation from what it suppose to measure. The first view was ranked 4, the second view was ranked 3, the third view was ranked 2 and the last view was ranked 0.

$$Fe = \frac{mn\,(n+1)}{2n} = \frac{5 \times 4\,(4+1)}{2x4} = 12.5$$

$$\text{Coefficient of concordance} = \frac{12d^2}{m^2\,(n^3 - n)} = \frac{12x89}{25x60} = 0.712 = 0.71$$

The validity coefficient for the test is 0.71 which was found to be significant at 0.05. Reliability was defined by Adewumi (1991) as the consistency or the stability of test scores over time and varying conditions. He added that it is a measure that gives precise and consistent results. The reliability of these test instruments for this study was evaluated by computing the reliability coefficient using Pearson product moment correlation coefficient as indicated in Appendix D. The reliability coefficient is equal to 0.703 which was found to be significant at $\alpha = 0.05$.

3.6 Instrumentation

The purpose of this study was to assess the teachers' basic ability and its effect on student's performance in senior secondary school. Therefore the instruments used were two tests developed by the researcher. The test constructed and administered on the basis

of senior secondary school mathematics curriculum was used for the present study. The items were categorized into two and they are within the senior secondary school curriculum content. The questions were selected from a standardized test of WAEC May/June examinations of an interval of five years that is from the year 2004 -2008 the choice of using this test was that it reflects the behaviors to be measured in senior secondary school mathematics curriculum. The content of the test also reflects the content of the senior secondary school mathematics curriculum to be examined in the study. The Instrument were made of two tests, first MAPTECODO 1 (Mathematics Performance Test in the Content Domain) and (MAPTECODO 2). The MAPTECODO 1 contained fifty (50) test items and five (5) theory questions while the MAPTECODO 2 contained twenty five (25) test items and five (5) theory questions objectives questions and five theory questions, that is one theory questions. The two tests covered five content domains viz: Number and Numeration (NN), Geometry (GM), Algebra (ALG), Measurement (MS), Statistics and Probability (STAT&P).

The Table 3.6.1 contained questions set across the content domains in order to test the students and the test had items measuring students' ability in knowledge, skills and problem solving as indicated.

Table 3.6.1 Distribution of Items per Topic for Students

Content	knowledge	skills	problem solving	TOTAL
NN	**5**	**5**	**1**	**11**
GM	**5**	**5**	**1**	**11**

ALG	**5**	**5**	**1**	**11**
MS	**5**	**5**	**1**	**11**
STAT&P	**5**	**5**	**1**	**11**
TOTAL	**25**	**25**	**5**	**55**

The Table 3.6.2 contained questions set across the content domains in order to test the teachers and the test had items measuring teachers' ability in knowledge, skills and problem solving as indicated.

Table 3.6.2 Distribution of Items per Topic for Teachers

Content	knowledge	skills	problem solving	TOTAL
NN	**3**	**2**	**1**	**06**
GM	**3**	**2**	**1**	**06**
ALG	**3**	**2**	**1**	**06**
MS	**3**	**2**	**1**	**06**
STAT&P	**3**	**2**	**1**	**06**
TOTAL	**15**	**10**	**5**	**30**

3.7 Data Collection Procedure

The tests were administered to the randomly selected students of year three class of senior secondary schools (SS III) students of the fifteen sampled schools. The Zonal Education offices were first contacted on the researcher's intention to conduct the study

in those schools under their zones. Five schools in each zone were randomly selected on a two strata basis that is three male schools and two female schools. The principal and mathematics teachers of the selected schools were also informed of the aims and objectives of the study, on permission of the schools authorities the services of SSIII mathematics teachers were employed to assist the researcher in sample selection using the class registers and also assisted in administering the tests thereafter the research assistant take over the invigilation of the test in oder to allowed the SSIII mathematics to attempt the teacher's test at the same time. Students test lasted for 120 minutes while that of teachers lasted for 90minutes on the average for all the centres. The variation in time was due to the number of items for students they have fifty items the WAEC standard while for teachers was twenty five items. In order to assured the respondents the confidentiality of the study, their names or school centre number was not required. Only sex, school name and researcher's code number for each answer script and question paper for the two to tally in order to ease identification during marking.

3.8 Procedure for Data Analysis

The scores obtained from the two tests were the main data for the study and the data were analyzed using the following statistical techniques at $p = 0.05$

1. Percentages mean and standard deviations were used to describe the data.
2. Pearson product moment of correlation coefficient (PPMCC) was used to compute whether there is significant relationship between students and teachers mean scores and also compute the coefficient of reliability.
3. T- test was used to determine the presence or absence of significant difference in the mean scores between male and female students and also that of urban and rural students.

4, ANOVA (F-Statistic) was also used in determining the significance or non significance difference in the mean scores of the five content domains.

CHAPTER FOUR

RESULTS, ANALYSES AND DISCUSSIONS

4.1 Introduction

The purpose of the study was to assess the level of basic mathematical abilities acquired in the content of Senior Secondary School in relation to teachers' ability and students' performance in Kaduna state. This Chapter presented an analysis of data obtained from this Study. The scores obtained by the students and teachers in the tests were used for the analysis and interpretation of results. Statistical parameters such as mean scores, standard deviation, Pearson product moment of correlation coefficient (PPMCC), T-test and F-test Statistic (one way ANOVA) were used and presented.

4.2 Data Presentation

Considering the general performance of the students in the test, only 56 (24.03% of the population) scored the minimum 40% pass mark. Out of these passes, 9 (16.07% of the passes) were female while the remaining 47(83.93% of passes) were male students. The teachers result shows that 9 (75% of the teachers) scored above the minimum 40% pass mark while 3(25% of the teachers) scored below 40% pass mark. The Summary of the Students and teachers mean scores was given in Table 4.2.1, mean scores of students in each content domain was in Table 4.2.2 and students' performance in the five content domains in Table 4.2.3**,** means and standard deviation of SSIII students' performance by gender in Table 4.3.1, Difference in mean and standard deviation of urban and rural students in Table 4.3.2.

Table: 4.2.1 Mean scores of students and teachers

Schools	Students	Teachers
	Mean scores	Mean scores
S1	20	54
S2	22	50
S3	27	50
S4	11	54
S5	40	55
S6	51	67
S7	57	43
S8	50	43
S9	19	36
S10	56	56
S11	27	26
S12	17	16

Table 4.2.1 showed the mean scores of students and teachers. The scores of the students indicated an average performance with 50% scored above 40% pass mark and the remaining 50% failed, while for the teachers 75% scored above the pass mark and 25% failed. Generally the students' performance was fair while that of teachers was not good enough as pacesetters.

Table 4.2.2 Mean Score of Students in each Content Domain

Schools/Av.	NN	GEOM	ALG	MEASU	STAT	TOTAL
S1	4.40	2.53	4.90	2.43	5.93	20.20
S2	4.33	3.50	6.13	3.57	4.17	21.70
S3	5.14	4.57	6.57	3.81	7.10	27.19
S4	2.26	1.58	3.21	1.63	3.37	12.05
S5	7.88	6.82	8.88	5.94	10.00	39.53
S6	9.67	7.33	15.22	5.56	13.00	50.78
S7	4.56	9.33	14.44	10.56	14.11	53.00
S8	8.87	11.40	12.33	6.87	10.93	50.40
S9	4.40	3.35	3.85	1.95	5.85	19.40
S10	6.38	11.69	12.62	1.38	12.15	56.23
S11	3.58	5.58	4.26	4.95	8.97	27.34
S12	2.33	3.17	2.83	1.58	6.79	16.71
AV. MEAN	5.32	5.90	7.94	5.19	8.53	32.88

Table 4.2.2 showed the mean score of students by content domain. Each content domain was marked out of twenty marks; the highest scores were in algebra and statistics with the average marks of 14.44 and 14.11 respectively. While the least scores were in measurement and geometry, the result is generally poor as all the average mean were less than ten out of twenty while the total average mean stands at 32.88 out of 100%.

Table 4.2.3: Students Average Performance in the Five Content Domains

Content	No. of schools	Mean	Std. Deviation
NN	12	5.32	2.41
GM	12	5.91	3.44
AL	12	7.94	4.58
MS	12	5.19	3.67
ST	12	8.53	3.53
TOTAL	**60**	**6.58**	**3.74**

Table 4.2.3 Showed that the mean scores in each content domain varies from each other. The highest mean was recorded in Statistics 8.53 and the least mean were in measurement 5.19 and geometry 5.91, since these scores were out of twenty that indicated a very weak result.

Table 4.3.1: Means and Standard Deviation of SSIII Students' Performance by Gender

Gender	N	Mean	Std. Deviation	Mean diff.
Male	171	34.75	14.65	
Female	62	28.32	24.91	6.43

Table4.3.1 showed the mean by gender where males performed slightly above the females but generally the performance was poor.

Table: 4.3.2: Difference in Mean and Standard Deviation of Urban and Rural

Students

	N	Students Mean Score	Std. Deviation
Urban	171	34.76	16.92
Rural	62	29.92	18.11

Table 4.3.2 indicated a weak result from the mean as the performances of urban and rural students' even though urban students performed a little better than the rural students.

4.3 Hypotheses Testing

In Chapter One, four hypotheses were formulated with the view to answering the research questions raised. In this section attempts were made to test the hypotheses at 0.05 level of significance.

1. Ho: There is no significant relationship between teacher's basic ability and those of students. To test this hypothesis, Pearson product moment correlation coefficient was computed. A value of $r = 0.362$ was calculated, which indicated a weak correlation and the P-value = 0.247 which also indicated non –significance relationship.

2. Ho: There is no significant difference in the performances of students in the five content domain of the Senior Secondary School Mathematics.

   To test this hypothesis the F-Statistic (one way analysis of variance ANOVA) was used. The result is shown on Table 4.4.2 and Table 4.4.3 below

Table 4.4.1: Summary of F-test (One way ANOVA) on the Five Content Domains

	Sum of Squares	df	Mean Squares	F	P-value	Decision
Between Groups	115.77	4	28.94	2.25	**.076**	**Retained**
Within Groups	709.21	55	12.90			
Total	**824.98**	**59**				

The result has shown that the P- value is greater than 0.05 this indicated that there is no significant difference in the mean performance among SSIII students in the various content areas of the senior secondary school curriculum. Thus the null hypothesis was retained.

3. Ho: There is no significant difference between the performance of male and female students in mathematics basic ability in the content domain.

Table 4.4.3 T-test: Difference between male and female students' performance

Gender	N	Mean	SD	T	df	P	Decision
Male	171	34.75	14.65	0.561	231	**0.587**	**Retained**
Female	62	28.32	24.91				

The mean scores of the male students were 34.75 and the mean score of the female students was 28.32 this indicates a variation in their performance and the p- value showed that there exist a significant difference. Thus the null hypothesis is rejected .The T-test result displayed in Table 4.4.4 above.

4. Ho: There is no significant difference between the performance of urban and rural

students in mathematics basic ability in the content domain.

T-test

Table: 4.4.4 Difference in mean and std. deviation between urban and rural

Location	N	Mean	SD	T	df	P	Decision
Urban	160	34.76	16.92				
				0.457	231	**0.657**	**Retained**
Rural	73	29.92	18.11				

The above results showed that there is no significant difference between the performance of the students in the urban areas and the students in the rural areas and thus the null hypothesis was retained.

4.5 Discussions

The main objective of this study was to investigate the areas of difficulties in the five content domains on the basic abilities acquired at the end of senior secondary school Mathematics Curriculum course content and also considered gender and location as other important factors in the study. The content areas include Number and Numeration, Algebra, Geometry, Measurement and Statistics. The aim was to establish which area of mathematics content students perform poorly or strongly thereby contributing to their very low performance on the test administered. The performances of students were found to be weak and it varied across the components of the school mathematics curriculum contents and the levels of performance according to sex and locations. The areas of

difficulties among the SSIII students in the senior secondary school mathematics curriculum under Number and Numeration include simplifying fractions using the four basic operations (BODMAS), standard form involving decimals with both positive and negative powers, rationalizing surds and differentiating between decimal point and significant figures were areas of difficulty. However Number and Numeration is one of the two areas that students were found to be deficient compared with other areas.

The students had lower performance in Measurement, Number and Numeration and Geometry as shown in Table 4.4.2 above. This would mean that senior secondary school students experienced greater difficulties in understanding: bearings, trigonometry ratios, calculations involving volumes under geometry. The finding of this study support earlier studies conducted by Lassa (1986), who found that geometry was the least understood by students and Odili (1990), who found that only 6% of the students passed in geometric exercises. The main areas of difficulties encountered by students in Algebra were substituting given values, factorizations, inverse variations and word problems. These findings were supported by , Abakpa (1993) , who reported students poor performance in these areas. Adetula (1990) and Opolot (2005) found that students have problem of translating word problems into mathematical sentences. In Statistics the students had problems in identifying the universal set and subsets especially in finding their values under set theory; they also had difficulties in problems involving probability and recall of definitions of statistical terms. These findings were supported by Odili (1990), who found that only 11.3% of the students passed statistics.

The result of analysis for testing the first null hypothesis (HO_1) has shown that there exist no significant relationship between the mean score of the basic ability in the

cognitive domain by the teachers and the students. Possibly due to two different test administered.

The result of analysis associated with the second null hypothesis (HO_2) has shown that there is a difference but not a significant one in the mean performance among SSIII students in the various content areas of the senior secondary school curriculum.

The result of analysis of the third hypothesis (HO_3) has shown that the mean scores of the male students and that of the female students indicated that there is no significant difference in their performances.

The result of analysis of the fourth hypothesis (HO_4) indicated that there is difference but not a significant one in the performance of the students in the urban areas and that of the students in the rural areas.

4.5 Summary of the major findings

Four major hypotheses were formulated and tested at 0.05 level of significance.

The investigation made use of a sample of students and teachers randomly drawn from 15 senior secondary schools in Kaduna state. Various statistical parameters such as mean standard deviation, T-test, F-test, one way analysis of variance and Pearson product moment correlation coefficient were used.

The findings of this study were summarized as follows:

1. There exist no significant relationship between the mean score of the basic ability in the content domain by the teachers and the students.

2. The data suggested that there is difference but not a significant one in the mean performance among SSIII students in the various content domains of the senior

secondary school mathematics curriculum.

3. The mean scores of the male and female students and the p- value indicated that there is no significant difference in their performances.

4. The data indicated that there is difference but not a significant one between the performances of the students in the urban areas and that of students in the rural areas.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter presented a summary of the results of the findings in this study. Suggestions are offered for the improvement of students' low performance and teachers' preparedness at the senior secondary school.

5.2 Summary

The main hypotheses tested in this study were four hypotheses using various statistical parameters such as means, standard deviation T-test, F-test one way analysis of variance (ANOVA) and Pearson Product Moment Correlation Coefficient.

The result of the hypothesis tested showed there were differences but not significant ones in mean performances of the students and teachers, male and female students and also in urban and rural student's performances but on the content domains there are differences in the students' performances which is also not significant. This may not be unconnected with some extraneous variables that might have affected the research process in one way or the other and the problem of using only objective and theory questions only and also administered two different tests for students and teachers. The performances of students were found to be weak and it varied across the components of the school mathematics curriculum contents and the levels of performance according to sex and locations. The areas of difficulties among the SSIII students in the senior secondary school mathematics curriculum under Number and Numeration include simplifying fractions using the four basic operations, standard form involving decimals with both positive and negative

powers, rationalizing surds and differentiating between decimal point and significant figures were areas of difficulty. However Number and Numeration is one of the two areas that students were found to be deficient compared with other areas. The students had lower performance in Measurement, Number and Numeration and Geometry as shown in Table 4.4.2 . This would mean that senior secondary school students experienced greater difficulties in understanding: bearings, trigonometry ratios, calculations involving volumes under geometry.

5.3 Conclusion

From the research findings one can conclude that the students performance in mathematics in the various curriculum content domains of senior secondary school was low, the results were as follows:-

1.The students and teachers performance in the tests administered showed that only 56 (24.03% of the sample) students scored the minimum 40% pass mark, while 9 (75% of the teachers) scored above the minimum 40% pass mark which was determine by constructing 95% confidence interval for the mean difference.

2. The students performance were better in statistics with a (mean: 8.53), Algebra (mean: 7.94) while the students are deficient in Measurement with a (mean: 5.19), Number and Numeration (mean: 5.32) and Geometry (mean: 5.91) as mean scores out of twenty marks. These showed a slight difference with the previous studies at JSS level which showed Number and Numeration as the less deficient area, at SS III level it is also a deficient area.

3.The students major areas of difficulties in Number and Numeration included simplifying fractions using the four basic operations (BODMAS), standard form involving decimals with both positive and negative powers, rationalizing surds and differentiating between decimal point and significant figure.

4. While in Geometry and measurement the areas of difficulties encountered by students include: bearings, trigonometry ratios, calculations involving volumes. This indicated that there is the need for planning an intervention programme to cater for low performance at SSSIII level and that should be directed to specific content areas of these kinds of

problems.

5.The level of performance of both male and female students at senior secondary school showed that sex difference exist but not significant in the various content domains as also indicated In various studies previously conducted at the JSS level.

Performance in Mathematics associated with school location (urban and rural) was also investigated. The findings showed that urban students out performed rural students

These findings implied that remediation for low mathematics achievement among the senior secondary school students should be pursued vigorously.

2.9 Recommendations

1. As students performed poorly in three of the content areas and fairly in two of the content areas, the result will serve as an encouragement to teachers, mathematic educators and curriculum planners to launch new strategies on how mathematical skills could be taught so as to alleviate this problems as its affects the general performance of the students. More efforts and emphasis should be made on how to acquire these mathematics abilities during the teaching and learning process.

2. Teachers should pay more attention to the topics identified in (5.3) as areas of difficulties to most of the students. They should do their best to see that difficult concept and symbols were properly understood by the students in the process of teaching and learning.

3. Many schools visited by the researcher during the investigation witnessed that there are lack of relevant and suitable teaching aids designed to support the

teaching and learning of mathematics at the senior secondary school level. It is in view of these that the researcher recommends the dare need for curriculists to develop relevant teaching aids to support the study of mathematics. Mathematics authors and publishers are also challenged on the need and urgency to prepare teaching aids in mathematics at this level in oder to concretized the teaching and learning process.

4. Over confidence in solving problems in Number and Numeration has resulted in a lot of computational errors. Thus students should be advised to be more careful in their computations so as to avoid making unnecessary mistakes; a lot of exercises need to be done.

5. The result indicated that male students outperformed female students; it is recommended that more research should be carried out to find the cause effect of the sex difference in mathematics performance and how to improve female participation in Mathematics so as to eliminate this imbalance. Such findings should be made available to school teachers who are the principal actors in the implementation of the Mathematics curriculum.

6. This study has also confirmed that location of schools in urban or rural areas affects the students performance in the content domains, the urban students performed better than the rural students.

7. It is recommended that both urban and rural schools should be provided with the basic needs for a school to function well such as structures, facilitities therein, qualified teachers, text books, teaching aids and proper supervision from the inspectorate division.

Contribution to knowledge

The research Contribution to knowledge is as follows:-

1. The research identified the difficulty areas that will assist both students and teachers to give special attention to those areas in order to improve the performance of students and in turn also improve on the basic mathematical skills to be acquired by the students.

2. The findings also indicated the three deficient areas in the mathematics curriculum content where the students performed woefully, the areas are: number and numeration, measurement and geometry, these are some of the areas to be given attention for further research.

5.5 Suggestions for Further Research

The results of this research had created some challenges for further research so as to improve the present level of students' performance in mathematics curriculum content:

1. Why should students have problem in measurement number and numeration and geometry.

2. Why should students from rural schools {be} inferior to their urban counterparts?

3. The assessment of JSS III students to determine the level of preparedness for senior secondary school Mathematics curriculum.

Limitations

In any research of this type there were limitations, the limitations as at the period of the

research were as follows:

1. Because of the geographical spread of the schools in Kaduna State and the limited financial resources not all students in the selected samples of the three (3) zonal Education offices were used but five (5) schools from each zonal Education office was sampled for the research.
2. Questions selected were based on some portion of the five content areas not all the areas of the content was covered.
3. Number of items generated for teachers and students were different as such each of the two groups sat for a different test.
4. Questions generated were restricted to objectives and theory only.
5. some extraneous variables might have affected the research proces

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APPENDIX A

SENIOR SECONDARY SCHOOL THREE (SSIII) MATHEMATICS

PERFORMANCE TEST FOR STUDENTS BASIC ABILITIES IN THE

CONTENT DOMAIN

SEX (MALE/FEMALE) ----------

SCHOOL----------

AGE----------

CLASS----------

TIME ALLOWED: 2HOUR

PREAMBLE

This test is aimed at assessing the Basic Abilities of Mathematics Students (SSIII) in the Cognitive Domain of the senior the Secondary School Mathematics Curriculum. Each item is designed to test an important idea from Mathematics Curriculum content.

There are fifty objective questions and five theory questions from the five Content Domains of Mathematics Curriculum. Circle the correct answer in each question. You can use log table or calculator.

SECTION 'A' OBJECTIVE QUESTIONS

INSTRUCTION: ATTEMPT ALL QUESTIONS

1. Correct 0.04945 to two significant figures.

A.0.040 B. 0.049 C. 0.050 D. 0.49

2. Simplify: $\frac{5}{\sqrt{3}} - \frac{3}{\sqrt{2}}$ ***A.*** $\frac{1}{6}(5\sqrt{3} - 3\sqrt{2})$ ***B.*** $\frac{1}{6}(15\sqrt{3} - 6\sqrt{2})$

C. $\frac{1}{6}(3\sqrt{2} - \sqrt{3})$ ***D.*** $\frac{1}{6}(10\sqrt{3} - 9\sqrt{2})$

3. evaluate correct to the nearest whole number:

$7\frac{1}{2} - \left(2\frac{1}{2} + 3\right) \div \frac{33}{2}$

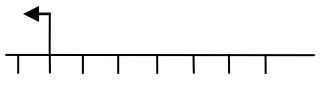
A.33 B.8 C.7 D. 0

4. If $log_9^x = 1.5$, find x.

A. 36 ***B. 27*** ***C. 24.5*** ***D. 13.***

5. Represent the solution of $3x + 15 > 0$ on a number line.

A.



- 6 -5 -4 -3 -2 -1 0 1

B.



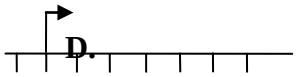
-1 0 1 2 3 4 5 6

C.



-1 0 1 2 3 4 5 6

D.



-6 -5 -4 -3 -2 -1 0 1

6. Simplify: $11011_{two} - 1101_{two}$

A. $\mathbf{101000_{two}}$ ***B.*** $\mathbf{1100_{two}}$ ***C.*** $\mathbf{1110_{two}}$ ***D.*** $\mathbf{1011_{two}}$

7. What is the place value of 9 in the number 3.0492?

A. $\frac{9}{10000}$ ***B.*** $\frac{9}{1000}$ ***C.*** $\frac{9}{100}$ ***D.*** $\frac{9}{10}$

8. If the simple interest on a sum of money invested at 3% per annum for $2\frac{1}{2}$ years is N123, find the principal. ***A. N676.50*** ***B. N820*** ***C. N1, 640*** ***D. N4, 920***

9. A machine valued at N20, 000 Depreciates by 10% every year. What will be the value of machine at the end of two years? ***A. N16, 200*** ***B. N14, 200*** ***C. N12, 000*** ***D. N8, 000***

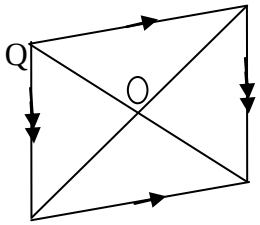
10. Simplify $(0.3 \times 10^5) \div (0.4 \times 10^7)$. leaving your answer in the standard form.

A. 7.5 X $\mathbf{10^{-5}}$ ***B. 7.5X*** $\mathbf{10^{-3}}$ ***C. 7.5 X*** $\mathbf{10^{2}}$ ***D. 7.5 X*** $\mathbf{10^{-3}}$

11. What is diameter of a circle of area $77cm^2$? $\left(\text{Take } \pi = \frac{22}{7}\right)$.

A. $\frac{\sqrt{2}}{7}$ ***cm*** ***B.*** $3\frac{1}{2}$ ***cm*** ***C. 7cm*** ***D.*** $7\sqrt{2}$ ***cm***

12. The figure shows a quadrilateral PQRS having equal sides and opposite sides parallel. The diagonal PR and QS intersect perpendicularly at O. Which of the following statements cannot correct?



A. |PO| = |RO|

B. PQR is an equilateral triangle

C. PQRS is a parallelogram

D. There are two lines of symmetry

13. What is the total area of a closed cylinder of height $10cm^2$ and diameter 7cm?

$\left(Take\ \pi = \frac{22}{7}\right)$.

A. $77cm^2$ ***B.*** $227cm^2$ ***C.*** $297cm^2$ ***D.*** $374cm^2$

14. A Regular polygon has 9 sides. What is the size of one of its exterior angles?

A. 20° ***B.*** 40° ***C.*** 90° ***D.*** 140°

15. A rectangular packet has inner dimension 16cm by 12cm by 6cm. How many cubes of sugar of sides 2cm can be neatly packet into the packet? ***A. 90*** ***B. 144*** ***C. 150*** ***D. 288***

16. The Bearing of a point Q IS $310^{0.}$ If |PQ|=200m, how far west of Q is P?

A. 128.6m ***B. 153.2m*** ***C.167.8m*** ***D187.9m***

17. Two circles have radii 16cm and 23cm.What is the difference between their circumferences?

(Take $\pi=\frac{22}{7}$). ***A.244.92cm*** ***B.149.92cm*** ***C.44.00cm*** ***D. 43.96cm***

18. If x^0 is obtuse which of the following is true?

A. $X > 90$ ***B. $180 < X < 270$*** ***C. $X < 90$*** ***D. $90 < X < 180$***

19. If tan x=1, evaluate sin x + cos x, leaving your answer in surd form.

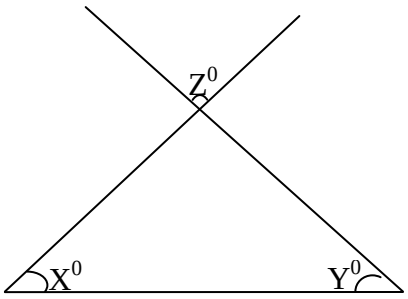
A. $\sqrt[2]{2}$ ***B.*** $\frac{1}{2}\sqrt{2}$ ***C.***$\sqrt{2}$ ***D.2***

20. What is the diameter of a circle of area 77cm ? (Take $\pi = \frac{22}{7}$)

A = $\frac{\sqrt{2}}{7}$ cm B =$3\frac{1}{2}$cm C =7cm D = $7\sqrt{2}$

21. In the diagram, what is x+y in terms of z? ***A. $180° - Z$*** ***B. $180°$*** ***C. $Z - 180°$***

D. Z



22. Solve the equation $2^7=8^{5-x}$. ***A. 5/8*** ***B.8/3*** ***C. 3/2***

D. 15/4

23. Expand (2x − 3y) (x − 5y). ***A. $2x^2 + 13xy - 15y^2$*** ***B. $2x^2 - 13xy - 15y^2$***

C. $2x^2 + 13xy + 15y^2$ ***D. $2X^2 - 13xy + 15y^2$***

24. Make f the subject of the Type equation here.relation v=u + ft.

A. $\frac{v-u}{t}$ ***B.***$\frac{u-v}{t}$ ***C. t (v+u)*** ***D.*** $\frac{v}{u} - t$24.

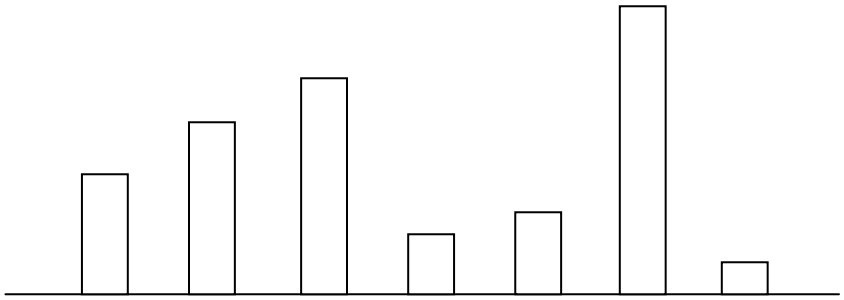
25. The bar chart shows the pocket money received by the students in class in a week.

Use the bar chart to answer questions **a**. and **b**.

a. Find the total number of the class. ***A. 27*** ***B. 31*** ***C. 33*** ***D. 34***

b. How many student received N300 and N500 for a week?

A. 7 ***B. 11*** ***C. 18*** ***D. 19***



26. Ladi sold a car for N84, 000 at a loss of 4%. How much did Ladi buy the car?

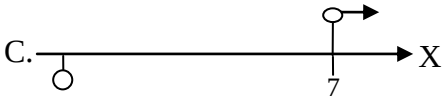
A. N80. 500 ***B.N80, 640*** ***C. N8, 360*** ***D.N87, 500***

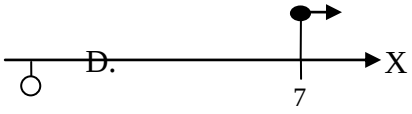
27. Given that y $=\frac{1-2x}{4x-3}$, find the value of x for which y is undefined.

A. 3 ***B.*** $\frac{3}{4}$ ***C.*** $-\frac{3}{4}$ ***D.*** -3

28.



C. 

D. 

Represent the solution of the inequality $\frac{y-2}{2} \geq \frac{x+3}{4}$ on the number line.

29. What must be added to x^2-3x to make it a perfect square?

A. $\frac{9}{4}$ ***B.***$\frac{9}{2}$ ***C.6*** ***D.9***

30. Simplify $\sqrt[3]{27xy}$ A=$9XY^3$ B=$3XY^6$ C=$3XY^3$ D=$9Y^3$

31. A train moving at a uniform speed covers 36km in 21 minutes. How long does it take to covers 60km?

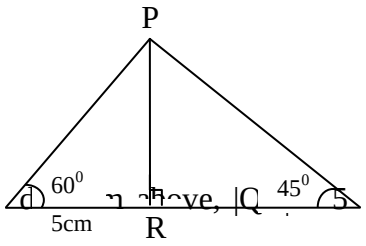
A. 35min. ***B. 40min.*** ***C. 45min.*** ***D. 90min.***

32. The total surface area of the walls of a room, 7m long, 5m wide and xm high is $96m^2$.

Find the value of x. ***A.***$\frac{2}{3}$ ***B.2*** ***C.4*** ***D.8***

33. Evaluate (0.13)3 correct to three significant figures.

A. 0.00219 ***B.0.00220*** ***C. 0.00300*** ***D. 0.00390***

34. 

Ir Q [illegible] PQP^ -60^0 and PSR^=45^0. Find |PS|, leaving your answer in surd form. ***A.*** $\sqrt[4]{5}$ ***cm*** ***B.*** $\sqrt[3]{7}$***cm*** ***C.*** $\sqrt[4]{6}$***cm*** ***D.***$\sqrt[5]{6}$***cm***

35. a baker used 40% of a 50kg of bag of flour. If 1/8 of the amount used was for used for

cake

A. $2\frac{1}{2}$ ***B.*** $6\frac{1}{4}$ ***C.*** $15\frac{5}{8}$ ***D.*** $17\frac{1}{2}$

36. The temperature in a chemical plant was -5^0C at 2.00a.m. the temperature fell by 6^0C and then rose again by 7^0C. What was the final temperature?

A. -6^0C ***B.*** -4^0C ***C.*** 4^0C ***D.*** 8^0C

37. A ladder 16m long against an electric pole. If the ladder makes an angles of 65^0 with the ground, how far up the electric pole does its top reach?

A. 6.8m ***B. 14.5m*** ***C.17.7m*** ***D. 34.3m***

38. **The** Wheel of a tractor has diameter 1.4m. What distance does it cover in 100 complete revolutions? [Take $\pi\ \frac{22}{7}$] **A=140m B=220m C=280m D=440m**

39. A messenger was paid N2.50k an hour during the normal working hours and N4.00k an hour during overtime. If he received N31.00k for 10 hour work, how many hours are for overtime ***A=2 B=3 C=4 D=6***

40. XY is a chord of a circle centre o and radius 7cm. The chord XY which is 8cm long subtends an angle of 120^0 at the centre of the circle. Calculate the perimeter of the minor segment. [Take $\pi = \frac{22}{7}$].

A= 14.67cm B= 22.67cm C=29.33cm D=37.33cm

41. The probabilities that John and James pass an examination are $\frac{3}{4}$ and $\frac{3}{5}$ respectively. Find the probability of both boys failing the examination. ***A.*** $\frac{1}{10}$ ***B.*** $\frac{3}{10}$

C. $\frac{9}{20}$ ***D.*** $\frac{11}{20}$

42. Find the mean of numbers 1, 3, 4,8,8,4 and 7 ***A. 4*** ***B. 5*** ***C.6***

D.7

43. A fair die is tossed ones. What is the probability of obtaining neither 5 nor 2?

A. $\frac{5}{6}$ ***B.*** $\frac{2}{3}$ ***C.*** $\frac{1}{2}$ ***D.*** $\frac{1}{6}$

44. The ratio of boys to girls in a class is 5:3. Find the probability of selecting at random, a girl from the class. ***A.*** $\frac{1}{8}$ ***B.*** $\frac{1}{3}$ ***S*** ***C.*** $\frac{3}{8}$ ***D.*** $\frac{3}{5}$

45. Which of the following is not a measure of central tendency?

A. mean ***B. mode*** ***C. range*** ***D. median***

Mark	1	2	3	4	5	6
Frequency	5	3	6	4	2	5

46. Find the mode of the distribution.

A. 2 ***B. 3*** ***C. 5*** ***D. 6***

47. If the probability of an event occurring is x, what is the probability of the event not occurring?

A. 1-X ***B. X-1*** ***C. 0*** ***D.*** $\frac{1}{X}$

Age (years)	1	2	3	4	5
Number of children	2	3	5	6	4

The above table shows the ages (in years) of twenty children chosen at random from a community. Use the information provided to answer questions 8 and 9

48. What is the mean age?

A. 4.46YEARS ***B. 3.35YEARS*** ***C.3.30YEARS*** ***D. 3.00YEARS***

49. What is the median of the distribution?

A. 3.5YEARS ***B. 3.0YEARS*** ***C.2.5YEARS*** ***D. 2.0YEARS***

50. Every staff in an office owns either a Mercedes and / or a Toyota car. 20 own Mercedes, 15 own Toyota and 5 own both. How many staff are there in the office?

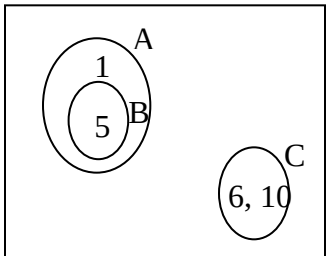
A. 25 ***B. 30*** ***C. 35*** ***D. 45***

SECTION 'B' THEORY QUESTIONS

INSTRUCTION: ATTEMPT ALL QUESTIONS

1. (a) evaluate without using the mathematical table or calculator,

$\log_{10}\sqrt{30} - \log_{10}\sqrt{6} + \log_{10}\sqrt{2}$



(b) $U = \{1,2,3,\ldots\ldots, 10\}$,

A = {1, 2, 3, 4, 5} B = {2, 3, 5}

and $C = \{6,8,10\}$. (i)

Given that the Venn diagram

represents the sets above, copy

and fill in the elements.

(ii) Find $A \cap C$. (iii) find $A \cap B^1$

2. (a) Two fair dice are thrown once. Find the probability of getting:

(i) The same digit

(ii) A total score greater than 5

(b) Given that $x = \cos 30^0$ and $y = \sin 30^0$ evaluate without using a mathematical table or calculator: $\frac{x^2+y^2}{y^2-x^2}$

3. (a) Simplify: $\frac{4\frac{2}{9} - 1\frac{13}{15}}{\frac{21}{5} + \frac{4}{7} \times \frac{21}{3}}$

(b) By rationalizing the denominator, simplify: $\frac{7\sqrt{5}}{7}$

(Leave your answer in surd form).

4. (a) a sector of circle of radius 8cm subtends an angle 90^0 at the center of the circle. If the sector is folded without overlap to form the curved surface of a cone, find the: (i) base radius (ii) height (iii) volume of cone. (Take $\pi = {}^{22}/_{7}$)

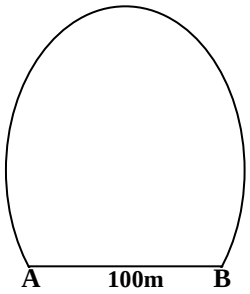
(b) A map to a scale of 1:20,000. Used it to calculate the: (i) distance in

Kilometers, represented by 4.5cm on the map; (ii) distance in meters,

on map, between two towns 16km apart (iii) area on the map, of a

forest, which covers $85km^2$.

5.



The diagram shows the cross-section of a railway tunnel. If |AB| = 100m and the radius of the arc is 56m, calculate correct to the nearest meter, the perimeter of cross-section.

APPENDIX B

SENIOR SECONDARY SCHOOL THREE (SSIII)

MATHEMATICS PERFOMANCE TEST FOR TEACHERS BASIC ABILITIES IN THE CONTENT DOMAIN

SEX (MALE/FEMALE) ----------

SCHOOL----------

AGE----------

TIME ALLOWED: 2HOUR

PREAMBLE

This test is aimed at assessing the Basic Abilities of Mathematics Teachers in the Cognitive Domain of the Senior Secondary School Mathematics Curriculum. Each item is designed to test an important idea from the Mathematics Curriculum content.

There are twenty five objective questions and five theory questions formed from the five Content Domains of Mathematics Curriculum. Circle the correct answer in each objective question. You can use log table or calculator.

SECTION 'A' OBJECTIVE QUESTIONS

INSTRUCTION: ATTEMPT ALL QUESTIONS

1. A Farmer planted 5000 grains of maize and harvested 5000 cobs, each bearing 500 grains. What is the ratio of the number grains sowed to the number harvested? A.1:500 B. 1:5000 C. 1:25 000 D. 1:250 000

2. Three teachers shared a packet of chalk. The first teacher got 2/5 of the chalk and the second teacher received 2/15 of the remainder. What fraction did the third teacher received? A. 11/25 B. 12/25 C. 13/25 D. 8/15

3. Given that $\sqrt[3]{4^{2x}}$ = 16, find the value of x A. 2 B. 3 C. 4 D. 6

4. If $6\text{Log}_x 2 - 3\text{Log}_x 3 = 3\text{Log}_5 0.2$. Find x. A. 3/8 B. ¾ C. 4/3 D. 8/3

5. A father decided to give 20% of his monthly income to his three children as their monthly allowance. The eldest child got 45% of the allowance. How much was the father's monthly income if the second child got N 3,000? A. N33, 000

B. N45, 000 C. N50, 000 D. N60, 000

6. Find the midpoint of the line joining P(-3,5) and Q(5,-3) A. (4,-40) B. (4, 4) C. (2, 2) D. (1, 1)

7. The shadow of a pole 5root 3m high is5m. Find the angle of elevation of the sun. A. 30^0 B. 45^0 C. 60^0 D. 75^0

8. A chord of circle subtends an angle of 60 at the centre of a circle of radius 14cm. Find the length of the chord A. 7cm B. 14cm C. 21cm D. 28cm

9. A sector of a circle is has an area of 55cm. If the radius of the circle is 10cm, calculate the angle of the sector. A. 45^0 B. 63^0 C. 75^0 D. 90^0

10. Find the curved Surface area of a cone with circular base diameter 10cm and height 12cm. A. $25\pi cm^2$ B. $65\pi cm^2$ C. $120\pi cm^2$ D. $156\pi cm^2$

11. Find the values of x where the curve y = x+2 x – 5x- 6 crosses the x-axis A.-2,-1 and 3 B. -2,1 and -3 C. 2, -1 and -3 D. 2,1 and 3

12. Find the remainder when $3x^3 + 5x^2 - 11x + 4$ is divided by x+3 A. 4 B. 1 C. -1 D -4

13. Factorise completely $ac – 2bc – a^2 = 4b^2$ A. (a-2b) (c + a -2b)

B. (a-2b) (c-a-2b) C. (a-2b) (c+a+ 2b) D. (a-2b) (c-a+2b)

14. The sum of the interior angles of a pentagon is 6x + 6y. Find

Y in terms of X A. y=60 - x B. y = 90 –x C. y = 120 – x D. y = 150 – x

15.Find the value of $\alpha^2 + ß^2$ if $\alpha + ß = 2$ and the distance between the points $(1,\alpha)$ and (ß,1) is 3 units. A. 3 B. 5 C. 11 D. 14

16. The length L of a simple pendulum varies directly as the square of its period T. If a pendulum with period 4sec. is64cm long, find the length of a pendulum whose period is 9sec. A. 36cm B. 96cm C. 144cm D. 324cm

17. An arc of a circle of length 22cm subtends an angle of $3x^0$ at the centre of the circle. Find the value of x if the diameter of the circle is 14cm. A. 30^0 B. 60^0 C. 120^0 D. 180^0

18. The time taken to do a piece of work is inversely proportional to the number of men employed. If it takes 30 men to do a piece of work in 6days, how many men are required to do the work in 4days? A. 20 B. 35 C. 45 D. 60

19.PQ and RS are two parallel lines. If the coordinates of P,Q,R,S are (1,q), (3,2), (3,4), (5,2q) respectively, find the value of q. A. 2 B.4 C. 1 D. 3

20. What is the locus of points equidistant from the line ax + by + c = 0? A. A line bx – ay + q = 0 B. A line ax – by + q = 0 C. A line ax + by + q = 0 D. A line bx + ay + q = 0

21.1n a class of 40 Students each Student offers at least one of Physics and Chemistry. If the number of Students that offer Physics is three times the number that offer both subject and the number that offer Chemistry is twice the number that offer Physics, find the number of students that offer Physics only. A. 25 B. 15 C. 10 D. 5

22. In how many ways can 2 students be selected from a group of 5 students in a debating competition? A. 10 ways B.15 ways C. 20 ways D. 25 ways

23. A container has 30 gold medals, 22 silver medals and 18 bronze medals. If one medal is selected at random from the container, what is the probability that it is not a gold medal? A. 4/7 B. 3/7 C. 1/35 D. 9/35

24. What is the probability that an integer x, ($1 \leq X \leq 20$) chosen at random is divisible by

both 2 and 3? A. 17/20 B. 1/3 C. 3/20 D. 7/10

25. A box contains 5 red, 3 green and 4 blue balls. A boy is allowed to take away two balls from the box. What is the probability that the two balls are red? A. 5/33 B. 5/36 C. 103/132 D. 31/36

SECTION 'B' THEORY QUESTIONS

INSTRUCTION: ATTEMPT ALL QUESTIONS

1. (a) Simplify $(2a + b)^2 - (b - 2a)^2$

(b) Given that S= K $\sqrt{m^2 + n^2}$, (i) Make m the subject of the relations (ii) If S=12.2, Type equation here.K=0.02, and n=1.1, $\sqrt{a^2 + b^2}$ Find correct to the nearest whole number, the positive value of m.

2. (a) The sets A={1,3,5,7,9,11}, B={2,3,5,7,11,15}, C={3,6,9,12,15}, are subsets of E={1,2,3,…15} (a)Draw a Venn diagram to illustrate the given information. (b) Use your diagram to find (i) C$\cap A^I$ (ii) $A^1 \cap (B \cup C)$

(b). The Probabilities that Ade, Kujo and Fati will pass an examination are 2/3, 5/8 and ¾ respectively. Find the probability that (a). The three (b). None of the three, (c). Ade and Kujo only; will pass the examination.

3. (a) A manufacturer offers distributors a discount of $20\frac{1}{2}\%$ on any article bought and further discount of 2 ½ % for prompt payment. (i) If the marked price of an article is ₦25,000, find the total amount save by the distributor for paying promptly. (ii) If a distributor pays N11, 700 promptly for an article marked ₦x, find the value of x.

(b) Without using calculator or Mathematical tables, /evaluate $\frac{3}{\sqrt{3}}\left(\frac{2}{\sqrt{3}} - \frac{\sqrt{12}}{6}\right)$

4(a).An open rectangular tank is made of steel plate of area $1440m^2$. Its length is twice its width. If the depth of the tank is 4m less than its width, find its length.

(b). The angles of a pentagon are x^0, $2x^0$, $3x^0$, $2x^0$, $(3x10)^{0.}$ Find the value of x.

5(a). The weight of an object varies inversely as the square of its distance from the centre of the earth. A small satellite weights 80kg on earth's surface. Calculate, correct to the nearest whole number, the weight of the satellite when it is 800km above the surface of the earth, [Take the radius of the earth as 6400km]

(b). Using ruler and a pair of compasses only, (a) Construct: (i) triangle XYZ with /XY/ =8cm < YXZ =60^0 and < XYZ = 30^0 (ii) the perpendicular ZT to meet XY in T; (iii) the locus l_1 of points equidistant from ZY and XY.

APPENDIX C

Coefficient of correlation between Students and Teachers mean score

Score X	Score Y	X^2	Y^2	XY
20	54	400	2,916	1,080
22	50	484	2,500	1,100
27	50	729	2,500	1,350
11	54	121	2,916	594
40	55	1,600	3,025	2,200
51	67	2,601	4,489	3,417
57	43	3,249	1,849	2,451
50	43	2,500	1,849	2,150
19	36	361	1,296	684
56	56	3,136	3,136	3,136
27	26	729	676	702
17	16	289	256	272
397	**550**	**16,199**	**27,408**	**19,136**
$\sum X$	$\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$

Use the following equation to calculate Pearson's coefficient:

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\left(\sum X^2 - \frac{(\sum X)^2}{N}\right)\left(\sum Y^2 - \frac{(\sum Y)^2}{N}\right)}}$$

Substitute the values obtained from the table into the equation:

$$r = \frac{19{,}136 - \frac{397 \text{ x } 550}{12}}{\sqrt{\left(16{,}199 - \frac{397^2}{12}\right)\left(27{,}408 - \frac{550^2}{12}\right)}}$$

Simplify the equation:

$$r = \frac{19{,}136 - 18{,}195.833}{\sqrt{(16{,}199 - 13{,}134.083)\ (27{,}408 - 25{,}208.333)}}$$

$$r = \frac{940.167}{\sqrt{(3{,}064.917)\ (2{,}199.667)}}$$

$$r = \frac{940.167}{\sqrt{6{,}741{,}795.028}}$$

$$r = \frac{940.167}{2{,}596.497}$$

$r =$ **0.362**

APPENDIX D

Reliability

Score X	Score Y	X^2	Y^2	XY
32	45	1,024	2,025	1,440
11	18	121	324	198
25	33	625	1,089	825
14	21	196	441	294
54	39	2,916	1,521	2,106
32	25	1,024	625	800
28	20	784	400	560
40	32	1,600	1,024	1,280
56	43	3,136	1,849	2,408
41	34	1,681	1,156	1,394
18	27	324	729	486
37	42	1,369	1,764	1,554
20	14	400	196	280
52	39	2,704	1,521	2,028
30	22	900	484	660

19	27	361	729	513
26	20	676	400	520
33	41	1,089	1,681	1,353
40	31	1,600	961	1,240
29	19	841	361	551
637	**592**	**23,371**	**19,280**	**20,490**
$\sum X$	$\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$

Use the following equation to calculate Pearson's coefficient:

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\left(\sum X^2 - \frac{(\sum X)^2}{N}\right)\left(\sum Y^2 - \frac{(\sum Y)^2}{N}\right)}}$$

Substitute the values obtained from the table into the equation:

$$r = \frac{20{,}490 - \frac{637 \text{ x } 592}{20}}{\sqrt{\left(23{,}371 - \frac{637^2}{20}\right)\left(19{,}280 - \frac{592^2}{20}\right)}}$$

Simplify the equation:

$$r = \frac{20{,}490 - 18{,}855.200}{\sqrt{(23{,}371 - 20{,}288.450)\ (19{,}280 - 17{,}523.200)}}$$

$$r = \frac{1{,}634.800}{}$$

$$\sqrt{(3{,}082.550) \quad (1{,}756.800)}$$

$$r = \frac{1{,}634.800}{\sqrt{5{,}415{,}423.840}}$$

$$r = \frac{1{,}634.800}{2{,}327.106}$$

$$r = \mathbf{0.703}$$

APPENDIX E

Marking Guide

ANSWERS TO APPENDIX A

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

6. D

7. B

8. C

9. A

10.D

11.D

12.B

13.C

14.D

15.B

16.B

17.C

18.D

19.C

20. B

21.A

22.B

23.D

24.A

25.(a) D, (b) C

26.D

27.B

28.D

29.A

30. C

31.A

32.C

33.B

34.D

35.A

36.B

37.B

38.D

39.C

40. B

41.A

42.B

43.B

44.C

45.C

46.B

47.A

48.D

49.B

50. B

ANSWERS TO APPENDIX B

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

13. B
14. B
15. C
16. B
17. B
18. C
19. A
20. C
21. C
22. D
23. B
24. A
25. C

APPENNDIX F TEST BLUE PRINT MAPTECODO 1 FOR STUDENTS

CONTENT	NN	GM	ALG	MS	STAT&P	TOTAL
No.of Items	**10**	**10**	**10**	**10**	**10**	**50**
No. of Theory	**01**	**01**	**01**	**01**	**01**	**05**
TOTAL	**11**	**11**	**11**	**11**	**11**	**55**

APPENDIX G TEST BLUE PRINT MAPTECODO 2 FOR TEACHERS

CONTENT	NN	GM	ALG	MS	STAT&P	TOTAL

No.of Items	**05**	**05**	**05**	**05**	**05**	**25**
No. of Theory	**01**	**01**	**01**	**01**	**01**	**05**
TOTAL	**06**	**06**	**06**	**06**	**06**	**30**

APPENDIDIX H

RANKS OF EXPERTS VIEW ON VALIDITY OF TEST ITEMS FOR THE FIVE CONTENT DOMAINS

Expert (n)	**Topics (m)**					**Observed**	**Expected**	**Fo –Fe**	**(Fo – Fe)^2**
1	**1**	**2**	**3**	**4**	**5**	**(Fo)**	**(Fe)**		
1	3	4	3	4	3	17	12.5	4.5	20.25
2	2	4	4	3	4	17	12.5	4.5	20.25
3	1	1	1	2	1	06	12.5	-6.5	42.25
4	2	3	1	2	2	10	12.5	-2.5	6.25

Origami Mathematics Lessons' Influence on Spatial Skills of College Age Students

Norma J. Boakes
Richard Stockton College of NJ

The proposed presentation is a continuation of research presented at 4OSME. The initial research
focused on the impact of Origami-mathematics lessons on middle school students' spatial visualization
and mathematical abilities (Boakes, 2009a). A one-month study of the influence these lessons had on
learning was conducted in 2006. Key to this study was the use of classroom slessons that blended the art
of paper folding with concepts and terminology of mathematics. Findings from this research showed that
origami-mathematics lessons blended with traditional math instruction were as

effective as traditional
instruction (Boakes, 2009c).
The continuation of this study has taken place over the past two years in the form of a college-level
course. The course, called “The Art & Math of Origami”, is a general studies course with a strong
mathematics and art element. The course is designed to explore the connections of Origami to art,
mathematics, culture, and history. Students regularly practice and hone their Origami skills in the 3 1/2
month long course. Students are asked to complete a number of performance-based assignments as
requirements of this course. To continue research done with middle school children, college students’
spatial skills were tested at the start and end of the course (similar to those used in the 2006 study). Data
gathered and analyzed resulted in highly significant improvements in students’ spatial skills (Boakes,
2009b). In this presentation, the researcher will share the organization, structure, and details of this
course and research.
Though Origami continues to be an accepted tool for teaching and learning mathematics, there remains a
void of research that attempts to quantify the impact Origami has on students’ mathematical skills. It is
the intent of this researcher to provide the needed evidence to substantiate the claim that Origami is a
valuable tool for instruction and learning in mathematics.
References
Boakes, N. (2009a). Impact of Origami-mathematics lessons on achievement and spatial ability of
middle school students. In Lang, R. (Ed.) *Origami4: Fourth International Meeting of Origami
Science, Mathematics, and Education,* pp.471-481. London, England: AK Peters, LTD.
Boakes, N. (2009b). *Origami-mathematics lessons: Researching its impact and influence on
mathematical knowledge and spatial skills of children.* Paper presented at the Mathematics
Education into the 21st Century Project’s 10th International Conference, Dresden University of
Applied Sciences, Saxton, Germany.
Boakes, N. (2009c). Origami instruction in the middle school mathematics classroom: Its impact on
spatial visualization and geometry knowledge of students. *Research in Middle Level Education*,

After marking the scripts of the administered test based on content areas of the mathematics curriculum, the performance of all the students in the cognitive domains were obtained as well as the following:

1. Scores of all students in each cognitive domains
2. Scores of all male students.
3. Scores of female students.
4. Scores of urban and rural students

The test of hypotheses in this study involves a lot of variables as such means, standard deviations, T- test and analysis of variance (ANOVA) was used to test the hypotheses. The level of significance was put at 5% for all the tests.

32(7), p.1-12

Score X	Score Y	X^2	Y^2	XY
32	45	1,024	2,025	1,440
11	18	121	324	198
25	33	625	1,089	825
14	21	196	441	294
54	39	2,916	1,521	2,106
32	25	1,024	625	800
28	20	784	400	560
40	32	1,600	1,024	1,280
56	43	3,136	1,849	2,408
41	34	1,681	1,156	1,394
18	27	324	729	486
37	42	1,369	1,764	1,554
20	14	400	196	280
52	39	2,704	1,521	2,028
30	22	900	484	660
19	27	361	729	513
26	20	676	400	520
33	41	1,089	1,681	1,353

40	31	1,600	961	1,240
29	19	841	361	551
637	**592**	**23,371**	**19,280**	**20,490**
$\sum X$	$\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$

Use the following equation to calculate Pearson's coefficient:

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\left(\sum X^2 - \frac{(\sum X)^2}{N}\right)\left(\sum Y^2 - \frac{(\sum Y)^2}{N}\right)}}$$

Substitute the values obtained from the table into the equation:

$$r = \frac{20{,}490 - \frac{637 \text{ x } 592}{20}}{\sqrt{\left(23{,}371 - \frac{637^2}{20}\right)\left(19{,}280 - \frac{592^2}{20}\right)}}$$

Simplify the equation:

$$r = \frac{20{,}490 - 18{,}855.200}{\sqrt{(23{,}371 - 20{,}288.450)\ (19{,}280 - 17{,}523.200)}}$$

$$r = \frac{1{,}634.800}{\sqrt{(3{,}082.550)\ (1{,}756.800)}}$$

$$r = \frac{1{,}634.800}{\sqrt{5{,}415{,}423.840}}$$

$$r = \frac{1{,}634.800}{2{,}327.106}$$

$$r = \mathbf{0.703}$$

Create a table of the variable scores and the product of the two scores.

Score X	Score Y	X^2	Y^2	XY
20	54	400	2,916	1,080
22	50	484	2,500	1,100
27	50	729	2,500	1,350
11	54	121	2,916	594

40	55	1,600	3,025	2,200
51	67	2,601	4,489	3,417
57	43	3,249	1,849	2,451
50	43	2,500	1,849	2,150
19	36	361	1,296	684
56	56	3,136	3,136	3,136
27	26	729	676	702
17	16	289	256	272
397	**550**	**16,199**	**27,408**	**19,136**
$\sum X$	$\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$

Use the following equation to calculate Pearson's coefficient:

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\left(\sum X^2 - \frac{(\sum X)^2}{N}\right)\left(\sum Y^2 - \frac{(\sum Y)^2}{N}\right)}}$$

Substitute the values obtained from the table into the equation:

$$r = \frac{19{,}136 - \frac{397 \text{ x } 550}{12}}{\sqrt{\left(16{,}199 - \frac{397^2}{12}\right)\left(27{,}408 - \frac{550^2}{12}\right)}}$$

Simplify the equation:

$$r = \frac{19{,}136 - 18{,}195.833}{\sqrt{(16{,}199 - 13{,}134.083)\ (27{,}408 - 25{,}208.333)}}$$

$$r = \frac{940.167}{\sqrt{(3{,}064.917)\ (2{,}199.667)}}$$

$$r = \frac{940.167}{\sqrt{6{,}741{,}795.028}}$$

$$r = \frac{940.167}{2{,}596.497}$$

$$r = \mathbf{0.362}$$

» Therefore, Pearson's correlation coefficient is **0.362**.

1 Create a table of the variable scores and the product of the two scores.

Score X	Score Y	X^2	Y^2	XY
32	45	1,024	2,025	1,440
11	18	121	324	198
25	33	625	1,089	825
14	21	196	441	294
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40	32	1,600	1,024	1,280
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37	42	1,369	1,764	1,554
20	14	400	196	280
52	39	2,704	1,521	2,028
30	22	900	484	660
19	27	361	729	513

26	20	676	400	520
33	41	1,089	1,681	1,353
40	31	1,600	961	1,240
29	19	841	361	551
637	**592**	**23,371**	**19,280**	**20,490**
$\sum X$	$\sum Y$	$\sum X^2$	$\sum Y^2$	$\sum XY$

2 Use the following equation to calculate Pearson's coefficient:

$$r = \frac{\sum XY - \frac{\sum X \sum Y}{N}}{\sqrt{\left(\sum X^2 - \frac{(\sum X)^2}{N}\right)\left(\sum Y^2 - \frac{(\sum Y)^2}{N}\right)}}$$

3 Substitute the values obtained from the table into the equation:

$$r = \frac{20{,}490 - \frac{637 \text{ x } 592}{20}}{\sqrt{\left(23{,}371 - \frac{637^2}{20}\right)\left(19{,}280 - \frac{592^2}{20}\right)}}$$

4 Simplify the equation:

$$r = \frac{20{,}490 - 18{,}855.200}{\sqrt{(23{,}371 - 20{,}288.450)\ (19{,}280 - 17{,}523.200)}}$$

$$r = \frac{1{,}634.800}{\sqrt{(3{,}082.550)\ (1{,}756.800)}}$$

$$r = \frac{1{,}634.800}{\quad}$$

$$\sqrt{5{,}415{,}423.840}$$

$$r = \frac{1{,}634.800}{2{,}327.106}$$

$$r = \mathbf{0.703}$$

Therefore, Pearson's correlation coefficient is **0.703**. Calculate Another Pearson's Correlation Coefficient?

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In the name of Allah, Most Gracious, Most Merciful

I am grateful for all the bounties that Allah has showered on me which enabled me complete this doctoral thesis. I also thank Allah for providing me with a supportive family and supportive colleagues and friends during my graduate studies.

I would like to express my appreciation to all the individuals without whom the completion of this thesis would not be possible. First of all, my heartfelt thanks go to my thesis major supervisor, Associate Professor Dr. Merza bin Abbas, for his warm personality, continual and unwavering encouragements, support, tutelage, patience, and perseverance in guiding me through the entire research and thesis-writing process. My deepest thanks also go to my co-supervisor Associate Professor Dr. Wan Mohd Fauzy for his invaluable assistance.

I would also like to express my particular thanks to the faculty and administrative staff of the Center for Instructional Technology and Multimedia, University of Science Malaysia, who provided facilities, and advice and support. My thanks also go to the administrative staff of the Institute of Post-graduate Studies, IPS, USM, for their assistance and support. I would also like to gratefully acknowledge the principals, teachers, and students of the primary schools which served as research sites: Al-Muthana bin Harethah School, Huthaifa bin Alyaman School, and Abd Arrahman Alhalholi School. My profound gratitude goes to the Director of the Educational Development and Research Department, Jordan Ministry of Education and the Director of First Public Educational Directorate in Irbid Governorate for their assistance.

I am grateful to my colleagues, Dr. Sayed Anwar, Dr. Sharifa, Zainal, Oi, Husaini, and Aree in Center for Instructional Technology and Multimedia for their friendship over the past few years and the immense help during my research process. My gratitude also goes to the administrative staff of the University of Science Malaysia's Library for their patience and assistance.

My acknowledgement is also extended to Dr. Jeremy Kilpatrick, University of Georgia, Dr. Marjorie Montague, University of Miami, Dr. David Johnson and Dr. Roger Johnson, University of Minnesota, and Dr. Khattab Abu Libdeh, Jordan National Center for Educational Research and Development who provided valuable documents, articles, and suggestions throughout my thesis-writing.

Last but not least, my affectionate thanks go to my family for their unfailing love,

continual understanding, sacrifice, prayers and confidence, and selfless support: My parents, my brothers and sisters, and my wife and my mother in-law. I would like to express my gratitude to my father and my brothers who financially supported me during my graduate studies and patiently waited for me to finish my study. My mother, may Allah reward you for your patience and prayers before and during my graduate studies. I thank Allah for having a very understanding and loving wife. She has given me tremendous support and continuous encouragement during my thesis-writing. Words are inadequate to express my gratitude for their sacrifice, support, and patience and I love them with all my heart. "*May Allah reward and bless all of my family members*".

Ibrahim Mohammad Ali Jbeili

Table 4.4.2: Scheffe's Post Hoc tests on difference in the five content Domains

Multiple Comparisons

F-testScheffe

(I) Difference inTopics	(J) Difference inTopics	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
					Lower Bound	Upper Bound
NN	GM	-.58786	1.46599	.997	-5.2604	4.0847
	AL	-2.62100	1.46599	.531	-7.2935	2.0515
	MS	.13184	1.46599	1.000	-4.5407	4.8044
	ST	-3.21415	1.46599	.321	-7.8867	1.4584
GM	NN	.58786	1.46599	.997	-4.0847	5.2604
	AL	-2.03314	1.46599	.750	-6.7057	2.6394
	MS	.71970	1.46599	.993	-3.9528	5.3922
	ST	-2.62629	1.46599	.529	-7.2988	2.0462

AL	NN	2.62100	1.46599	.531	-2.0515	7.2935
	GM	2.03314	1.46599	.750	-2.6394	6.7057
	MS	2.75285	1.46599	.481	-1.9197	7.4254
	ST	-.59315	1.46599	.997	-5.2657	4.0794
MS	NN	-.13184	1.46599	1.000	-4.8044	4.5407
	GM	-.71970	1.46599	.993	-5.3922	3.9528
	AL	-2.75285	1.46599	.481	-7.4254	1.9197
	ST	-3.34599	1.46599	.281	-8.0185	1.3265
ST	NN	3.21415	1.46599	.321	-1.4584	7.8867
	GM	2.62629	1.46599	.529	-2.0462	7.2988
	AL	.59315	1.46599	.997	-4.0794	5.2657
	MS	3.34599	1.46599	.281	-1.3265	8.0185