EFFECT OF COMPARATIVE GRADING IN MATHEMATICS ON STUDENTS' ACADEMIC SELF-EFFICACY BELIEFS AND ACHIEVEMENT IN ABA EDUCATION ZONE OF ABIA STATE

BY

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TITLE PAGE

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APPROVAL PAGE

This Thesis has been approved for the award of Master Degree in the Department of Educational Foundations (Educational Psychology Unit), University of Nigeria, Nsukka.

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Uduka Onyighi Kalu, a postgraduate student of the department of Educational Foundations (Educational Psychology Unit), University of Nigeria, Nsukka with Registration Number PG/M.Ed/11/59066, has satisfactorily completed the requirements for research work for the Master of Education in Educational Psychology. The work embodied in the project is orginal and has not been submitted in part or full for diploma or degree of this or any other University.

.....	.....
Uduka Onyighi Kalu	**Dr. D. U Ngwoke**
PG/M.Ed/11 /59066	**Supervisor**

DEDICATION

This work is dedicated to the Almighty God for his infinite mercy, and to my late grandmother for her words of encouragement..

ACKNOWLEDGEMENT

I want to express my profound gratitude to the Almighty God for His unfailing love, care, sustenance provided, the inspiration, knowledge and physical enablement to bring this work to completion.

It worthwhile to give honour to which honour is due, in this regards I cannot but show gratitude to my supervisor, Dr. D. U. Ngwoke who patiently and tirelessly saw that this work was successfully completed. He tolerated and guided me closely during the course of this study; hence I can say that he is the mentor of this work. Therefore, he is a research guru.

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I thank all my course mates and friends in their effort in making this work a reality especially Onyishi Charity, Rev.Sis. Adogu, and Amaefula, praying that God will reward them abundantly

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ABSTRACT

The study was carried out to investigate the effect of comparative grading on students' mathematics achievement and self-efficacy beliefs in Aba education zone. Also, the study explored the influence of gender and interaction effect on comparative grading in mathematics achievement of students' self-efficacy. Four research questions were asked and four hypotheses were formulated and tested at the (P<0.05) level of significance. The study adopted a non – equivalent control group quasi- experimental research design involving one experimental group and one control group. Four co-educational secondary schools in Aba North Local Government. Area of Abia State were randomly selected and assigned to experimental and control group, and used for the study. A total of 200 SS One students (100 males and 100 females) in four intact classes were sampled and used for the study. Two instruments, Students' Academic Self-efficacy Beliefs Questionnaire (SASEBQ), and Mathematics Achievement Test (MAT).were used for both pre-test and post-test. Data collected using the instruments were analyzed using descriptive statistics in answering the research questions while Analysis of Covariance (ANCOVA) was used to test the null hypotheses. The result of the study showed that Students who were exposed to comparative grading achieved significantly higher than those exposed to criterion referenced grading. Also, there was no significant difference between the self-efficacy belief scores of male and female students on mathematics. Based on the findings, discussions implications and recommendations of this study, suggestions for further studies were mad

CHAPTER ONE

INTRODUCTION

Background of the Study

Every day people operate one form of math or the other without knowing they are applying mathematical concept. For instant, a carpenter has to measure the length and width of the door or window the carpenter is constructing. Similarly, mothers prepare food using correct quantity of the ingredients without knowing that they are applying math. Likewise, when children are given money to buy something, they will ask for their change after buying depending on how much they are given. All these activities involve math yet when they are put in sentences or in figures, students see it as a very difficult task. Mathematics is the science of addition and subtraction which involves everyday activities whether consciously or unconsciously. Math is done from the pre-school where children recite nursery rhymes with numbers. In primary school, pupils do simple addition, subtraction and simple algebra. From primary, pupils proceed to secondary school where students are expected to write math as one of the core subjects; in fact, math is one of the requisite one is expected to have (credit) before being admitted into the university. This showed that its important cannot be over emphasized, our parents that are doing business apply math even though it is not written down in mathematical terms. But it is seen in the measurement they do in the process of selling fabrics. No one can do without math as it is very vital in our daily lives.

Mathematics is an aged, wide, and deep discipline or field of study that deals with daily activities of human beings (Moursund, 2006; Mikhail, 2006). Mathematics is as old as human existence, throughout the history; humans have faced the need to measure and communicate about time, quantity, and distance. To a layman, it is the addition and subtraction of numbers. In Brouwerôs view**,** math is the mental activity which consist in carrying out construct one after the other. This might be why Soyemi (2005) said that

everybody uses mathematics in one way or the other in solving life problems. Nations that desire to forge ahead scientifically and technologically cannot afford to toy with the mathematical knowledge of her citizenry.

Mathematics arises from many different kinds of problems such as commerce, architecture and astronomy. It is the idea of math that made the physicist Richard Feynman to invent the path integral formulation of quantum mechanics using a combination of mathematical reasoning and physical insight which in turn becomes string theory (Johnson & Lapidus, 2002). Mathematics comprises many things such as human endeavour ï measurement of time (seconds, minutes, hours, days, weeks, months, seasons and years). Equally measurement of distance is considered, and the different systems of distance measurement that developed throughout the world. Even in art, music, and dances, mathematics play important roles.

There is abundantly history of human development of math and mathematical uses in our contemporary society. Mathematics is an indispensible tool that even a layman performs (Abakpa and Iji, 2011). Mathematics is much more than enrolling in algebra, geometry and calculus during high school. It is about acquiring skills students need to reach their goals in high school in future.

There are so many reasons for students to learn mathematics; math teaches logic and order, teaches life skills, it supports continuing education and career among others (Elise, 2014). No wonder (Salmon, 2005) asserted that math is an originator for intellectual development, scientific discoveries and intervention. As can be seen from above that math is an interdisciplinary language which explains the relationships, structures quantities, properties and forms of objects, time, construct and the space. No wonder math is regarded as an indispensible tool. Therefore, when students have the capability to solve mathematical

problems and get the rightful skills that are needed, there is the tendency that such students will do well in any external examination which in turn leads to academic self-efficacy in math.

In spite of the recognition accorded to mathematics due to its relevance, Elekwa (2010) remarked that students exhibit non-chalant attitude towards mathematics, even when they know that they need it to move ahead in their studies and in life. Such students who have already conditioned their minds that mathematics is a difficult subject are usually not serious in the learning of mathematics and therefore perform poorly in mathematics tests and examination**.** Even though the importance of mathematics to all aspect of life cannot be overemphasized, researches show that there is increasingly poor achievement in the subject among students in secondary schools as asserted by Awolola (2010). For instance the results of May/June 2012 West African Examination Council of West African Senior School Certificate Examination(WASSCE), reveals that 38.81 per cent candidates record credits in English and Mathematics (Tide, 2012). Similarly, the former education minister, Professor Ruquyyatu Rufai (2012), lamented on the poor performance of students in Nigeria. She said that an average of 30% of over one million students, who sat for May/ June WAEC examination in the last six years, obtained five credits including English and Mathematics. The studentsô underachievement in math has been the chief worry to parents, mathematics teachers, science teachers and curriculum experts across the nation.

Analysis of school certificate mathematics examination results showed that studentsô performances in mathematics are consistently poor, that nothing much has been achieved. Uwadiae, (2010) reported that less than 42% of registered candidate in SSCE obtain credit pass in mathematics. Even the SSCE results released by WAEC and NECO for 2012 indicated poor achievement of students in mathematics. According to Olunloye (2010), this ugly trend of high failure rate in mathematics is a national tragedy. Therefore**,** feasible ways

of improving the performance has remained an area of great concern for researchers. The deplorable state of mathematics achievement is attributed to a number of factors such as attitude of students (Uhumuavbi and Umoren, 2005); lack of instructional resources (Yara and Otieno, 2010); Instructional techniques (Olulonye, 2010) among others.

Although several measures have been in use to improve the studentsô achievement in math, only a little has been achieved. Example, the 2010, 2011 and 2012 WAEC results showed that there was about 6% improvement ï from 35% to 41%. In Aba education zone, specifically, in Aba North local Government Area, out of three thousand five hundred(3500) candidates that sat for math in 2011 WAEC, only one thousand four hundred and fifty (1450)candidates got credits and distinctions and that represents 41% (Secondary Education Management Board, Aba Zonal office, 2012).

Over the past decades in Nigeria, studentsô attitudes to achievement in math seem to have taken a negative direction. According to Osuji in Ali (2006), research studies on achievement patterns in mathematics among secondary school students in Nigeria showed that amid 1979 and 2001, there was a steady annual average of 1.7% annual decline in studentsô A_1 to C_6 grades in mathematics at the West African School Certificate Examination. The results of November 2006 West African Senior School Certificate (WASSCE) indicated that out of 423,518 candidates who sat for the examination, only 50,065 candidates were seized due to examination irregularities and that represent 85% of the total candidates. The various ways like deploying of security personnel to various centers to checkmate students had not yielded much fruit, executors often ingeniously outwit them (Edukugho, 2007).

Academic achievement or (academic**)** performance is the outcome of education, that is, the extent to which a student, teacher or institution has achieved their educational goals.

Academic achievement is commonly measured by examinations or continuous assessment, but there is no general agreement on how it is best tested or which aspects are most important ð procedural knowledge such as skills or declarative knowledge such as facts.

High dropout rates, poor grades and scores among secondary school students seemed to be as a result of wrong orientation to achievement. Dependency on other peoplesô effort seems to have become the order of the day among secondary school students as a result they lose self-confidence, and the spirit of hard work will no longer be there. Students attitudes towards achievement emerges from some parents or role models who had achieved much thereby sending out wrong signals that might lower studentsô efficacy by making them to believe that they have it all, therefore have no need to work hard any longer. So students will have such notion at the back of their minds and at the end of the day, they will have nothing to achieve.

The persistent studentsô poor performance in mathematics has been assumed to be highly related to their level of math task persistence and self-efficacy beliefs. The reason is because studentsô previous experiences of success or failure in a given field determine their level of self-efficacy and persistence as regard to tasks that relate to that area (Woolfolk, 2010). So when students have the capability to solve mathematical problems and get the rightful skills that are needed, there is the tendency that such students will do well in any external examination, which in turn leads to academic self-efficacy in math.

Students are motivated by grades they receive at the end of a term or semester. When a student scores low grade in any examination, there is the tendency that the student will not be focused in any academic activities especially those students that are extrinsically motivated. On the contrary if a student scores high grade in any exam, that student will be motivated the more as the student will be eager to perform more complicated academic task, for instance, if a student solves a math task involving basic operations or algebra taking into

considerations the necessary steps. It is likely that studentsô beliefs about their abilities to succeed in courses (math and English, for example) might directly impact their performance in those courses. This is in line with Math professor Vaden-Goad (2009) who thought that students might be more motivated to study and be able to succeed in introductory math courses if he allowed them to replace early grades with higher ones received subsequently.

Grades are an institutionally required measurement of the studentsô demonstration of well defined and communicated learned outcomes **(**Dave & Robert, 2013**).** Grading is the segregation of students according to their proficiencies by way of evaluation. It is a form of assessment, which describes the process of gathering information about studentsô learning including all kinds of ways to sample and observe studentsô skill, knowledge and abilities **(**Linn and Miller, 2005). For that reason, itôs useful to consider alternative approaches that might affect not just the motivation to get the grade, but the motivation to learn and develop important skills. Walvoord and Anderson (1998) classify the multiple roles that grades serve: as an evaluation of student work; as a means of communicating to students, parents, graduate schools, professional schools, and future employers about a studentôs performance in college and potential for further success; as a source of motivation to students for continued learning and improvement; as a means of organizing a lesson, a unit, or a semester in that grades mark transitions in a course and bring closure to it. Additionally, grading provides students with feedback on their own learning, clarifying for them what they understand, what they donôt understand, and where they can improve. Grading also provides feedback to instructors on their studentsô learning, information that can inform future teaching decisions.

Grading is often a challenge simply because grades are used as evaluation of student work, itôs important that grades accurately reflect the quality of student work and that student work is graded fairly. Grading with accuracy and fairness can take a lot of time, which is

often in short supply for college instructors. Students who arenôt satisfied with their grades can sometimes protest their grades in ways that cause headaches for instructors. Also, some instructors find that their studentsô focus or even their own focus on assigning numbers to student work gets in the way of promoting actual learning. Given all that grades do and represent, itôs no surprise that they are a source of anxiety for students and that grading is often a stressful process for instructors (Walvoord & Anderson, 1998).

Parents expect their children to excel, as much importance is attached to grades and grading. With this expectation from parents and guardians, some students prefer short-cut by avoiding intellectual risk to learning. One can see that much emphasis on assessment can invariably affect the pursuit of excellence, (Maher & Midgley, 1996). In this same note, how people behave can often be better predicted by the beliefs they hold about their capabilities than by what they are actually capable of accomplishing.

Every parent wants to boast the child as ña straight óAô studentò; is at the top of the classò, or on the honour rollò. Example, a man from Minnesota threatened his daughter with a gun for getting two óBôs instead of straight óAô on her report card (Daily Sun, 2013). One may wonder what generally determines this prized status. Grade is a symbol that represents the degree to which students have a set of well-defined instructional objectives. Grades which are most often, report cards, are the primary means of measuring a childôs progress through school, ñDoing wellô in school is measured by series of letters on a piece of paper: A is great; B is ok; C is not so good; and D, E or F means that one has failed. Some parents reward students for good grades, either by ascribing a monetary value to each good letter, or taking away privileges for each bad one.

So, for many families, the grade is the goal. One wonders the importance of these grades. Considering Aba as a commercial area where students combine academic work with

business, they lack concentration and at the end, they have low grades; in order for them to maintain their academic self-efficacy, they find means of upgrading their low grades. Some parents on their parts are bribing teachers to upgrade their childrenôs grades whether they know what they are doing or not. So, one might see that when these students graduate from secondary schools, they find it very difficult to gain admission into the university. Literature reveals that many works have been done in relation to academic self-efficacy and math but nothing much has been done on comparative grading. Having this in mind, it poses a problem for the researcher, hence this research work.

In fact, grading could be considered a component of assessment which comprises a formal, summative, final and product-oriented judgment of overall quantity of worth of a studentôs performance or achievement in a particular educational activity, example, and a course. It employs a comparative standard of measurement and sets up a competitive relationship between those receiving the grades. Operationally, grading is seen as a part of appraisal of overall quality worth of a studentôs performance or achievement in a particular education activity. One might think that comparative grading is the use of different types of grading system to assess studentsô academic work, that might be true, but in this research work CG is same as norm-referenced grading.

Comparison is the act of finding out the differences and similarities between two or more things or people. Comparison can take place whenever there are two or more things at the same time; either for the purpose of having a better understanding of the relationship existing between them or for the purpose of having a better choice. Parents at home compare their childrenôs behaviour; children equally compare their parents as well to know the one that loves them more. Therefore, comparative is a comparison or an assessment of similarities or differences between two or more things relating to, based on, or involving in comparison, or relating to the scientific or historical phenomena, institutions, or objects such

as language, legal systems, or anatomical structures, in an effort to understand their origin or relationships (The American Heritage). In this study, comparative grading is synonymous with norm-referenced grading and is the major concept in this study.

Several grading systems have evolved over the years. Common among these grading systems are letter grading, 4.0 point scale grading, mastery grading, norm referenced grading and criterion referenced grading system. With the letter grading system, students can receive A, B, C, D, E, or F for 90 percent accuracy or above, 80 percent to 89 percent accuracy respectively in that order, to F grade, which is the least and could be for performance below 60 percent. The 4.0 point scale grading is typically used as a means to calculate a grade point average (GPA) in tertiary institutions. The mastery grading system uses M for mastery, which demonstrates that a student has mastered the standard by showing accuracy 80 percent of the time, P for progressing, which connotes that the student is not quite showing mastery but is progressing. If a student exceeds mastery of the standard he can receive an E and if a student is failing to progress toward mastery, he receives an LP grade. In the mastery grading system, grades are broken down by each content standard, rather than broad subject area, with a score of, E, M, P, or LP given for each standard (CFE, 2012).

Grading brings about competition. One would think that competition would always lead to improved learning to all students but Woolfolk (2010) observes that, ôhighly competitive classes may be particularly hard on anxious students, students who lack self-confidence, and students who are less preparedô. To woolfolk (2010), high standard and competition tend to be generally related to increase academic learning**.** The two basic approaches to grading student work are norm-referenced and criterion referenced grading.

In norm- referenced (comparative) grading, a student grade is determined by how well the individual performs relative to the performance of all the other students in the class,

because the highest grades will only be awarded to the highest performing students. The students are implicitly in competition with one another for a limited number of the most desirable grades. Common example of comparative grading are standardized test such as University and Tertiary Matriculation Examination (UTME), Scholastic Assessment Test (SAT), Graduate Record Examination (GRE) or The use Of English as a Foreign Language (TOEFL). Comparative grading is designed to identify which students have learned the most or the least but may not be able to indicate whether the students have learned enough. More of this will be discussed in chapter two.

By contrast in criterion- referenced grading, a studentôs performance is measured not against that of other students, but against a fixed standard of performance, such that a studentôs grade reflects the degree to which a student demonstrates particular level of knowledge or skill, irrespective of other studentsô level of achievement. Typical examples of criterion referenced tests are Medical Licensing examination and Bar examination for Lawyers (University of North Carolina, 2012**).** Criterion- referenced (absolute) tests are designed to indicate whether students have learned enough but may not be able to identify which students have learned the most (Rose, 2011). Unlike norm-referencing, there is no pre-determined grade distribution to be generated and a studentôs grades are in no way influenced by the performance of others **(**University of Minnesota, 2011).

Theoretically, all students within a particular group could receive very high (or very low) grades depending solely on the levels of individualsô performances against the established criteria and standards. The goal of criterion-referencing is to report student achievement against objective reference points that are independent of the group being assessed. Criterion-referencing can lead to simple pass-fail grading schema, such as in determining fitness-to-practice in professional fields. Criterion-referencing can also lead to

reporting student achievement or progress on a series of key criteria rather than as a single grade or percentage**.** Criterion-referencing requires giving thought to expect learning outcomes: it is transparent for students, and the grades derived should be defensible in reasonably objective terms ï students should be able to trace their grades to the specifics of their performance on set tasks. Criterion-referencing lays an important framework for student engagement with the learning process and its outcomes**,** (Centre for the Study of Higher Education, 2002). Grading may not be all that good to provide feedback because it does not actively motivate students, encourage them, and it does not provide method of student improvement. Similarly, it may not highlight strengths and weaknesses of students. Studentsô beliefs about their abilities to succeed in courses such as math and English directly impact their performance in those courses.

Some factors play an important role to promote or decline academic achievement such as Self- efficacy and gender. The confident that an individual has to accomplish a given task at a designated level is referred to as self-efficacy. Bandura (1994) asserted that self-efficacy is a personôs belief in their capacity to successfully perform a particular task. These effects are particularly apparent, and compelling, with regard to behaviours affecting health (Luszczynska & Schwarzer, 2005). Self-efficacy refers to judgments of a personôs capabilities, and is a capability to carry out the actions needed to succeed in a task. It is one of the strongest factors predicting performance in domains as diverse as sports, business, and education. In academic settings, self-efficacy is a strong predictor of performance (Klassen, Krawchuk, Rajani**,** 2008). Self-efficacy is the measure of one's own competence to complete tasks and reach goals **(**Ormond, 2006).

The research of self efficacy goes back to original ideas of Albert Bandura. According to Bandura (1995), self efficacy is the belief in oneôs capabilities to organize and execute the

courses of action required to manage prospective situations which could be academics or otherwise. Researchers hypothesize that students beliefs in their ability to succeed in courses or activities and their amount of science self efficacy, influences their choices of school related tasks, the effort they expend on those activities, the perseverance they show when encountering difficulties, and the ultimate success they experience in their courses. Another definition of self efficacy is the strong belief that a student has that they can succeed in any given task or activity, having the ability to persevere in the face of difficulty, and being able to promote confidence as they meet obstacles. Self efficacy is also known as a judgment of confidence. It is context sensitive, it can be task specific. It is made and used in reference to some type of goal. It is domain specific, and is more of a question of can. Students with self efficacy ask themselves ñCan I do this?ò There are four sources of self efficacy that are formed by students as described by Bandura(1986, 1997). The four sources are mastery experience, social persuasion, physiological states, and vicarious experience. Mastery experience is the most influential of the four.

Individuals have to be motivated to learn before the actual learning can take place, during the process of learning and after the task has been learned. In order to increase a studentôs self efficacy beliefs they should surround themselves with positive and encouraging role models. This peer modeling works best for all types of students whether they are considered to be gifted, special education, or regular students. Students need to be taught what it looks like to have high self efficacy beliefs, because many students do not have the proper role models to teach or encourage high self efficacy traits. If students are around people that are positive confident in their own abilities then that is a very good way to motivate the students to strive for better. Rewards and positive reinforcement is not a factor that is used when encouraging higher self efficacy beliefs in students. Majority of the beliefs of self worth and confidence must be derived from within the student and based on their

knowledge and success at a task. The student should not be confused by receiving rewards for having confidence. Many extrinsic rewards will undermine the effects of self efficacy. It has been stated in research that providing rewards only for participation in an activity has generally led to decreased interest in that activity (Bates, 1979) and that is not the results that teachers desire in the students that they teach. They want them to continue to have interest in the tasks that are presented to them.

Students can develop their own self efficacy by knowing how they learn best. Once a student is more knowledgeable about their own learning and what works best for them, they will be able to experience more success. That student should then focus more on their strengths, but still attempt to work at the task that are more difficult for them.

When people successfully accomplish a task, their perceived ability to accomplish a similar task in the future increases. On the contrary, failure at a task diminishes or decreases self-efficacy and can result to a decline in the likelihood to persist or engage in behaviours related to the original tasks. As it applies to studentôs success, when students successfully achieve academic goals, academic self-efficacy is increased and the tendency of achieving future academic goals also increases. There are some variables that may be related to the role of mastery in shaping efficacy beliefs. For instance, age as a variable, with regard to the role of mastery experiences in shaping academic self-efficacy beliefs (Hampton, 1998).Mastery may be more influential for older students because they are more likely to sustain a longer performance history and more successful experiences to inform self-efficacy beliefs compared to younger students. Students can have belief about themselves in the area of studying and writing, such as, time for studying, and strategies used in preparation for examination. When these are effectively used, there is the tendency that such studentôs academic self- efficacy will be enhanced.

Academic self-efficacy is defined as individualôs perceived capability in performing necessary tasks to achieve goals (Bandura, 1997). Academic self-efficacy refers to individualsô beliefs that are formed specifically toward academic (as different from non-academic, general social, emotional, or physical) domains. This in other word means individualsô convictions that they can successfully perform given tasks at designated levels (Schunk, 1991). Poor academic performance in sciences could probably link to low self-efficacy among secondary school performance, the higher their opportunity to compete for lucrative and competitive courses (Mbathia, 2005). Academic performance is influenced by many factors, such as; attitude leads to achievement (Njuguna, 1998; Owiti, 2001). Self-efficacy influences the choice and engagement in a task, the effort expended in performing it, and the standard of the performance (Bandura, 1997).

Studentsô academic self-efficacy is the confidence that students have in them in order to do well in their academic tasks. Similarly, student academic self-efficacy is studentôs degree of confidence in performing various school related tasks to produce a desired outcome such as passing examination, (Solberg, OôBrien, Villarreal, Kennel, & Davis, 1993).Secondary school students with high self-efficacy approach difficult tasks as challenges to be overcome rather than as threats to be avoided (Pajares & Schunk, 2001).Reverse is the case for students with low self-efficacy. Students may also believe that despite their perceived capability they will not make a good grade in the class because they do not have a positive relationship with their teacher, (Wilder, 1993). Operationally, studentsô academic self-efficacy is the level of self-assurance students has in performing different academic activities in order to have good grades in their academic tasks.

Several studies have investigated female studentsô choice of courses and careers, and self-efficacy has turned out to be critical predictor. For instance, in the United States, boys hold more positive attitudes toward mathematics than do girls, (Kahle, 2003 & Kurth,2007).

These gender differences seem to predominate as students move from the primary to the secondary school level, (Kanai & Norman, 2007). Some other research (AAUW, 2002; NSF, 2004) studies indicate that gender differences in attitude toward mathematics do not exist in the primary grades. In the middle school grades, gender differences begin to appear in attitudes toward mathematics and boys are more likely than girls to find mathematics interesting (American Association of University Women, 2002). By high school, few young women consider mathematics and science-related careers as desirably options. Experts attribute this phenomenon to the fact that, during the middle school years, adolescents formulate their gender identities and career aspirations (AAUW, 2002). Also, statistics revealed that women are underrepresented in science-related and mathematics-related careers. Women make up a staggering 46% of the labour force in all occupations, but only 22% of the science and engineering labour force (National Science Foundation, 2004). A World Bank study conducted in 2001 in Sub-Saharan Africa noted that gender differences are close to being eliminated at the primary school level at least in the region as a whole. However, the disadvantage towards females is still prominent at the secondary school level (World Bank, 2001)

Gender is seen by Bassow (1991) as a psychological term describing behaviour and attributes expected of individuals on the basis of being born either male or female. Gender has a crucial role in performance. Girls perform as capable as boys in academic tasks but have lower self-efficacy (Pajares, 1996b).However, a study showed that women had a higher ability (Greenglass & Miller, 1999) to cope with stress, by setting and striving to achieve academic goals. This study intends to help in resolving this controversy regarding the influence of gender in achievement.

Statement of the problem

Parents and guardians expect their children to excel; so much importance is attached to grades and grading. With this expectation from parents and guardians, some students prefer short-cut by avoiding intellectual risk to learning. How people behave can often be better predicted by the beliefs they hold about their capabilities than by what they are actually capable of accomplishing. The self-efficacy perceptions held determine what individuals do with the knowledge and skills they have. Results showed that studentsô performances in mathematics are consistently poor, but nothing much has been achieved. Uwadiae, (2010) reported that less than 42% of registered candidate in SSCE obtain credit pass in mathematics. Even the SSCE results released by WAEC and NECO for 2012 indicated poor achievement of students in mathematics. In Aba education zone, specifically, in Aba North local Government Area, out of three thousand five hundred (3500) candidates that sat for math in 2011 WAEC, only one thousand four hundred and fifty **(**1450)candidates got credits and distinctions and that represents 41% (Secondary Education Management Board, Aba Zonal office, 2012).

Considering Aba as a commercial area where students merge academic work with business, they lack concentration and at the end, they score low grades; in order for them to maintain their academic self-efficacy, they find means of upgrading their low grades. Some parents on their parts bribe teachers to upgrade their childrenôs grades whether they know what they are doing or not. So, one might see that when these students graduate from secondary schools, they find it very hard to gain admission into the university. Having this in mind, it poses a problem for the researcher, hence the need to investigate the effect of comparative grading in mathematics on studentsô academic self-efficacy beliefs and achievement.

It is very obvious that students who are confident in their academic skills expect high marks on examinations and expect the quality of their work to remain personal and professional benefits. The opposite is true of those who lack confidence. This could be the reason for students who lack self-efficacy in their academic skills envision a low grade even before they begin an examination or enroll in a course. Discontent with the academic achievement of students in secondary schools especially in the science subjects in the national examination, the researcher is very much worried, hence the general research question ñwhat effect does comparative grading in mathematics have on studentsô academic self-efficacy beliefs and achievement in secondary school?ò

Purpose of the study

The purpose of this study was to ascertain the effect of comparative grading in mathematics on studentsô academic self-efficacy beliefs and achievement. Specifically, it sought to:

1. Ascertain the achievement mean scores of students exposed to comparative grading in math and those exposed to criterion referenced grading.
2. Determine the academic self-efficacy belief mean scores of students exposed to comparative grading in math and those exposed to criterion reference grading..
3. Determine the achievement mean scores of male and female students in math.
4. Ascertain the academic self-efficacy of mean scores of male and female students in math.

Significance of the study

The significance of this study is based on the framework of Banduraôs social cognitive theory and the expectancy theory of Vroom. Banduraôs social cognitive theory

states that: in a learning setting there exist reciprocal influences of the three forces (personal, social and behavioural) on each other, relationship of which determine the learnerôs level of achievement. The study will help to create the level of reciprocal relationship among personal, environmental and behavioural factors during CG instruction and how such affect achievement and this in turn will help to promote the social cognitive theory. Comparative Grading (CG) allows students to compare with one another in the class based on Banduraôs proposal. Therefore, the investigation and establishment of the effectiveness of comparative grading will help to affirm the theory.

On the other hand the study will be of great importance in strengthening the expectancy theory which states that an individualôs effort will lead to performance, which in turn, will lead to a specific outcome. Mostly, self-efficacy is based on an individualôs belief about their ability to perform specific behaviours. This means that a person will decide to behave in a certain way because they are motivated to select a specific behaviour over other behaviours due to what they expect the result of that selected behavior will be. The study will help to establish the level of reciprocal relationship among Expectancy, Valence and instrumentality during classroom instruction and how such affect achievement. This in no doubt will help to uphold the expectancy theory.

Practically, the findings of this study will be of great benefits to secondary school principals, mathematics teachers, students, parents, community, ministry of education, curriculum planners, and future researchers when published and implemented.

The Finding with the help of the mathematics teachers will assist principals to identify the strengths and weaknesses of the students especially in the course content. With this in mind students attitude towards mathematics will change positively as their minds are channeled to actualize their dreams especially those of them in sciences. When CG is

effectively done by the mathematics teachers, this will help to boosts studentsô academic self-efficacy.

The findings will also equip mathematics teachers with alternative and more effective approach to grading of students in secondary schools. Furthermore, it creates room for good teacher-student relationship in such a way that will prevent students from having mathematics phobia, when CG is effectively done this in turn helps to boost studentsô academic self-efficacy. As self-efficacy is boosted, this will in turn help students to achieve their academic excellence.

The findings will help students to have good rapport with their math teacher knowing that the math teacher does not hate or intimidate any student in the class; rather wants to help them realized their math potentials as they further their academic pursuit. On that note, with CG, students will work harder academically since they have to compete with other students in the class, which in the long run will boost academic self-efficacy. And this will facilitate students to engage in meaningful academic activities instead of causing trouble in the community. This will in turn help to improve studentsô math performance in the secondary school certificate examination, and other external examinations**.**

Findings of this study will help parents to be aware of their responsibilities as regards to their childrenôs academic performance. Realizing that they are not to force their children to engage in any course or subject they do not have the capability, with comparative grading students will know the important of believing in themselves; consequently, academic self-efficacy will be enhanced.

To the Ministry of Education (MOE), the research if efficiently completed and published will help to identify areas that need enhancement in the teaching and learning of mathematics in secondary schools, especially in the number of periods it will be taught in a

day and the time frame. Again, it will help MOE in decision making as well as in organizing seminars and workshops for math teachers in order to improve their competencies in concepts that are difficult, as the math teachers are loaded with facts after the Workshops and Seminars (WSs) this will have positive impact on the students, definitely, this will help to increase math academic self-efficacy of students, especially those with high academic self-efficacy to have the confidence that they are capable of achieving their dreams.

With the report from the Ministry of Education, curriculum planners will be able to determine areas that need to be reviewed and recommend new strategies as well as textbooks that math teachers should be used in order to make teaching of math interesting to the students. When this is done there is the tendency that students perception about math will increase thereby making students realize that when once a student masters any math concept, it becomes part of life to that student, hence math academic self-efficacy will be boosted.

To the future researchers, the findings of this study will provide them with information for future researches on area of comparative grading. And data from this study will serve as empirical basis for research work.

Scope of the study

The study aimed specifically to find out the effect of comparative grading in mathematics on studentsô academic self-efficacy beliefs and achievement. Senior Secondary One (SS1) students in Aba Education zone will be used for the study. The content scope of the study is mathematics. Specifically, researcher will cover the following topics: Number system, algebra, fractions among others. The researcherôs choice of number system for the study is motivated by the fact that the area has always been identified as one of the candidatesô area of weaknesses in the Junior WAEC examination in Nigeria, (WAEC Chief

Examinerôs report 2008-2012). The chief examiner maintains that students show poor knowledge of algebra, number system, fractions especially when it involves halves. Similarly, interview conducted with students showed that students find the topic very difficult because of the fact that letters that are used to represent numbers confuse them.

Research Questions:

The following research questions will guide the study:

1. What are the achievement mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading?

2. What are the academic self-efficacy belief mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading?

3. What are the achievement mean scores of male and female students in mathematics?

4. What is the academic self-efficacy of mean scores of male and female students in mathematics?

Hypotheses:

The following hypotheses will guide the study and will be tested at 0.05 level of significance.

Ho_1: There is no significant difference between the achievements mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading.

Ho_2: There is no significant difference between the academic self-efficacy mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading.

Ho_3: There is no significant difference between the achievement mean scores of male and female students in mathematics.

Ho_4: There is no significant difference between the academic self-efficacy belief mean scores of male and female students in mathematics.

CHAPTER TWO

REVIEW OF LITERATURE

In this chapter, the related works to the present study was organized under conceptual framework, theoretical framework, empirical study and review of literature review.

Conceptual framework:

Concept of comparative grading

Concept of self-efficacy

Concept of academic self-efficacy

Concept of mathematics

Concept of Achievement

Concept of gender

Relationship among grading, comparative grading, self-efficacy, academic self-efficacy and achievement

Theoretical framework

Banduraôs self-efficacy theory (1997)

Vroom expectancy theory (1964)

Empirical Studies

Studies on comparative grading

Studies on academic self-efficacy

Studies on self-efficacy Beliefs and Achievement

Studies on gender and academic self-efficacy

Summary of Review of literature

Conceptual Framework

Concept of comparative grading

Grading in education is the process of applying standardized measurement of varying levels of achievement in a course. Grade is a symbol that represents the degree to which students have a set of well-defined instructional objectives. Grades can be assigned in letters, as a range, as percentage of a total number correct, or as a number out of a possible total (Popham, 2008) Grades are used to communicate with students and parents about studentsô performance. It is meant to be a concrete evaluation of student knowledge. Grading challenges teachers, and teachers want to be sure they are evaluating student work fairly, that their judgment is not subjective or inconsistent since students deserve fairness. However, grading can consume a lot of time as teacherôs evaluation sometimes show slight differences of accomplishment in problem sets, presentations, essays, and exams, and as teachers decide how to comment on studentsô work. Teachers need to make their efforts at grading efficient as well as fair Grades cause a lot of distress for students and often seem to inhibit enthusiasm for learning for its own sake, but grades are reality of life. They need not be counterproductive if students know what to expect.

There are various types of grading systems such as letter grading, 4-point grading scale and mastery grading. With the letter grading system, students can receive A, B, C, D or F grade with óAô being associated with 90 percent accuracy or higher, B 80 percent to 89 percent and so on, with F grade given to performance with 59 percent accuracy or less. The 4-point grading scale is often used in conjunction with the letter grades, especially in schools and colleges where it is used to compute a grade point average (GPA). The mastery grading system uses M for mastery, which demonstrates that a student has mastered the standard by showing accuracy 80 percent of the time. If a student is not quite showing progress in performance, the student is given a score of P. If a student exceeds mastery of the standard, that student can receive an E and if a student is failing to progress toward mastery, the student

receives an LP grade. Mastery grading demonstrates to students that their achievement is a work in progress. The goal is a report card containing all M grades, meaning the student has mastered all the standards for their level, (Leary, 2010).

The commonest types of grading systems are the comparative grading otherwise called norm-referenced system and the absolute grading also known as criterion-referenced system. The comparative grading system is a grading system in which studentsô achievements are assessed in relation to one another. **(**Woolfolk, 2010). This means that CG consists of comparisons between a student and others in the same class, that is, the norm group. The standard to be used for the grade is the mean or average score of the class on a test, term paper, or project. The grade distribution can be set objectively by determining the percentage of Aôs, Bôs, Côs and Dôs that will be awarded. Therefore, in comparative grading the standard depends on the performance of other students in the class.

In any sizeable group of students there exist meaningful differences in knowledge and skills, and grades should reflect these differences, so that the capable students can be distinguish from the less capable. Norm reference grading has the following merits: it can help prevent grade inflation by limiting the number of high grades awarded; it identifies those students whose work truly stands out as exceptional, which is very useful when a teacher writes a recommendation letter, (Piontek, 2008). While its demerits are as follows: it does not encourage collaboration and teamwork, simply because students recognize that they are implicitly competing against each other for the limited number of high grades; it undermines studentsô motivation by weakening the relationship between studentsô effort and grade outcome, because a studentôs grade depends not merely on individualôs effort and performance, but on the performance of other students in the class. Similarly, it can exaggerate minor achievement differences by assigning substantially different letter grades to

students who performed similarly. This is mostly seen in relatively small classes of academically homogenous students.

Generally, grading system irrespective of type and method and in particular comparative grading system has the following merits besides what have been said in the preceding paragraphs. Comparative grading is based on ranks ordering or percentiles. Hence evaluation which is mainly judgment based on measurement is uniform. It provides better comparability of scores irrespective of the scoring possibility, that is, whether a subject is scoring or non-scoring. The gap between scoring and non-scoring subjects is done away with for grading is not based on absolute marks but is based on rank order or percentiles. It provides a more meaningful profile of the performance or achievement of a student or group. If all universities adopt the same scale, students can move from one university to another much more easily. Teachers employing many procedures for evaluating achievement (test, oral recitation, quiz, project work, lab/practical work, assignments, tutorials, checklist, rating scales, among others) will find that a grading system is much more meaningful and feasible. Perhaps the strongest argument in favour of comparative grading is that it is highly unfair to discriminate say, a score of 33 from 32 by which one student is declared ópassô and the other ófailô(The Clearing House, 2011).

Criterion grading on the other hand are based on preset expectations or criteria, in theory, every student in that course could get an A if each met the preset expectations. The grades are usually expressed as the percentage of success achieved (example, 90%, and above is an A, 80-90% is a B, 70-80% is a C, 60-70% is a D, and below 60 is an F).Pluses or minuses can be worked into this range. Students come into the course with the view of scoring an A, and it is theirs to loss through poor performance or absence, late submission of papers. With this in mind, the teacher takes away points, rather than adding them.

Effective grading requires an understanding of how grading may function as a tool for learning, an acceptance that some grades will be based on subjective criteria, and a willingness to listen to and communicate with students. It is important to help students to focus on the learning process rather than on ñgetting the grade,ò while at the same time acknowledging the importance that grades hold for students. It helps to consider grading as a process. It is not simply a matter of assigning number or letter grades. As a process grading may involve some or all of these activities:

- Setting expectations with students through a grading policy
- designing assignments and exams that promote the course objectives establishing standards and criteria;
- calibrating the application of a grading standard for consistency and fairness
- Making decisions about effort and improvement; deciding which comments would be the most useful in guiding each studentôs learning.
- Returning assignments and helping students understand their grades. (OID, 2011**).**

Grading is the process teachers used to evaluate students ôacademic work. Assessment focuses on learning, teaching and outcomes. It provides information for improving learning and teaching. Assessment is an interactive process between students and faculty, it informs faculty how well their students are learning and what they are teaching. The information is used by faculty/school to make changes in the learning environment, and is shared with students to assist them in improving their learning and study habits. This information is learner-centered, course based, frequently anonymous, and not graded (Angelo & Cross, 1993). This means that assessment is based upon an individualized approach to learning, and it concerns with ranking individuals, that is, within a class.

Evaluation is defined as a systematic process of determining the extent to which instructional objectives are achieved by the learner **(**Gronlund, 1976). Equally, it is a process of collecting and using information to make decisions about an educational programme (Cronbach, 1963). The information may be collected using measurement or non-measurement techniques. This includes both qualitative and quantitative description of learnerôs behavior plus value judgment (decision) concerning the desirability of that behavior, (Ezeudu, Agwagah & Agbaegbu, 1997). Evaluation focuses on grades and may reflect classroom components other than course content and mastery level. (Angelo & Cross, 1993).

From the above, one can see that assessment deals with norm reference while evaluation deals with domain (criterion) referencing. Nevertheless, both assessment and evaluation suggest judgment and decisions based on data and observations (Ezeudu et al, 1997), and they are inseparable. The effectiveness of different types of evaluations depends upon the design of specific course materials and goals. Good grading methods are characterized by attributes such as Validity (face validity and content validity) and reliability. Although performances may be varying, the goal is to eliminate as many sources of error as possible. It has been observed that the three common source of error in evaluating students reliably are:

- Poor communication of expectations ï It is very important that the student understands the question or the task assigned as poor student performance can be as a result of failure to provide clear instructions.
- Lack of consistent criteria for judgment ï This occurs where the basis for making the judgment is not clear. So, when consistent criteria is lacking, the grader can evaluate identical task differently at a later date or by another grader concurrently. But, if a specific set of criteria is stipulated prior to the evaluation, this type of error can be minimized.

- Lack of insufficient information about performance ï This is another source of error in evaluating students and it occurs when the teacher does not have enough information. It is imperative that this information shows a studentôs performance in a variety of formats. Using a single paper that a student submitted at the end of a semester or term to determine the entire course grade would violate this principle, this might result into grade inflation.

Grade inflation is the tendency to award progressively higher academic grades for work that would have received lower grades in the past. In a situation where all the students in a class get Aôs, or a high percentage of Aôs and Bôs, other professionals can interpret the distribution in different ways. A teacher does not need to be bias in grading of students, as this will create misunderstanding among students. As a teacher, you do not have to love and hate some students in your class, whereby the teacher gives high marks for those the teacher likes. But if on the other hand you do not show sign of favoritism to some of your students. Then by all means give the grades with confidence. However giving good grades to students who do not earn or deserve them is not helpful either to your paper or your personality as a teacher. Definitely, all students will like an A, but those who burnt their midnight candles (who spend their time and effort to earn an A); do not like to see those who merely slid be given similar grades.

The only way to avoid this situation is that the teacher must have definite goals and standards for performance. This is because when a teacher expects a lot from students, then ask for a lot and assign grades with regards to performance. It is a known fact that students get upset when they think that they have been graded unfairly. The most complain students make is lack of alignment or correlation between what is taught and what was tested. The following are the principles of grading:

- Tell students how you are going to grade them so that they will ask questions where they do not understand.

- Ask for studentôs opinion about your grading system, and consider their rationale for their concern.

- Let them know how attendance and missed exams will affect their grades.

- Give them varieties of opportunities to show what they have learnt. A few short tests generally give better information than a single long one .This means that when a teacher is setting questions, you consider the brilliant ones as well as the slow ones in order to give room for them to do well. It is not a good impression that students fail after spending a term or semester in a school.

- Provide corrective informative feedback that will help them improve as the course progresses.

- Grades linked to course learning stated or printed in the syllabus are more defensive than those that are not.

- Grades are very important to students, therefore very important to be fair as this will boost their academic self-efficacy beliefs. The following are the importance of grading.

- To give students constructive feedback.
- To rank students in order of their performance.
- To identify who the best students are in a class.

A teacher can provide feedback in different ways such as verbal method ï having conversation with your students. Another is non-verbal, whereby a teacher could have a facial expression in response to something the students say. Similarly, as a teacher, one can give

students assignments that will not be graded, and evaluate them in writing. The two basic types of grading are norm-referenced (comparative) grading and criterion (absolute) grading; the main focus of this study is on norm-referenced otherwise known as comparative grading.

Norm or comparative referenced grading is the measurement of a studentôs performance in relationship with the performance of other students. This in other word means that the students who have taken the test provide the norms for determining the meaning of a given individual scores. By comparing the individualôs raw score (the actual number correct) to the norm, one can determine if the score is above, below, or around the average for that group (woolfolk, 2010). Under this system, students are ranked from best to worst, and the grades are awarded based on that ordering, using some set distribution of grades (Feinman, 1997). It is accomplished by requiring teachers to assign a specific percentage of the class to each grade, or by conforming to a prescribed mean or median (Jeffery, 2002).

Rose (2011), purported that under the norm-referenced or comparative grading system approach, students are evaluated in comparison to each other, with specific limitations placed on how many students can receive certain grades, with the fewest at the top and the bottomô. Woolfolk (2010) argues that, ón norm referenced grading, the major influence on a grade is the studentôs standing in comparison with others who also took the course. If a student studies very hard and almost everyone else does too, the student may receive a disappointing gradeô. The most classic form of norm-referenced grading system is the óbell curveô in which most grades are at the top of the bell which represents the middle range, with the highest and lowest grades at the extremes, see figure 1 below.

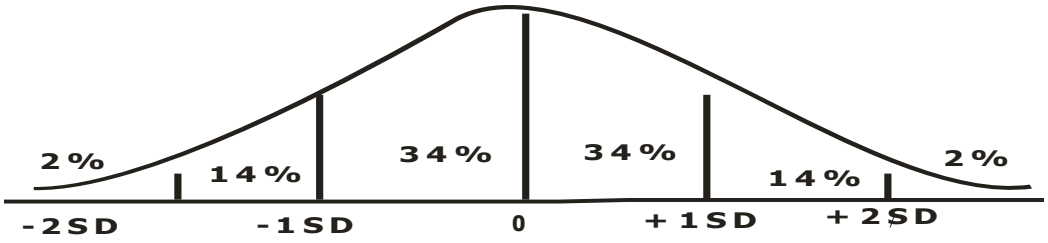

Figure 1 : **Bell-shaped curve**

The figure shows that 68% of the scores are clustered within 1 standard deviation (SD) below and 1SD above the mean, while 4% fall at the extreme points of best performance and worst performance. The mean is the middle point of the entire distribution.

Proponents of norm referenced grading argue that it results in greater fairness and consistency among teachers and sections, protecting students from teachers who give extreme grades, at either the high or low ends (Downs & Levit,1997). Norm referenced grading system does not require that students meet an objective standard or achievement, instead it merely assesses how students perform in relation to other students in a course rather than how well they achieve the educational objective of the course.

The norm referenced grading system has been criticized because it is based on the assumption that teachers cannot improve students competence, and because it increases students stress, interferes with deep learning and does not adequately inform students whether they have reached a level of competence (Christensen, 2009). Critics of this system of grading hypothesize further that , ôteachers are limited in their ability to grade students on their proficiency relative to objective criteriaõ (Feinman, 1997); and that those who use norm referenced grading assume that, ôfor all positive characteristics represented in the class which might contribute to grade achievement, there are in existence exactly equal counterbalancing

negative characteristicsô and that any positive changes wrought by the teacher must be counterbalanced by negative changes. Krumboltz and Yeh (1996), argue that this type of grading damages relationships among students, and between teachers and diminishes motivation for most students, especially those students with academic low self-efficacy.

In criterion-referenced grading, a studentôs performance is measured not against that of other students, but against a fixed standard of performance, such that a studentôs grade reflects the degree to which a student demonstrates particular levels of knowledge or skill, irrespective of other studentsô level of achievement (Jeffrey, 2000). These students are not compared to other students. When using criterion (absolute), one must be careful in designing the criteria that will be used to determine the studentsô grades. Professional competency evaluations such as the U.S. Medical Licensing Examination or the bar examination for lawyers are examples of criterion referenced assessments.

Concept of Self-efficacy Belief

Bandura (2006) defined self efficacy as a belief that influence different people decisions, their goal, amount of effort required in conducting a task and the level of perseverance if encountered with obstacles and difficulty. Emphasis on the different between self efficacy and self esteem is put across to avoid confusion in that self efficacy is based on self capability whereas self esteem is concerned with self worth. Both also have similarity in that they are concerned with individual judgments. (Ford, 2011).

Self-efficacy beliefs are the self-perception that individuals hold about their capabilities. Self-efficacy beliefs provide the foundation for human motivation, well-being, and personal accomplishment. Unless people believe that their actions can produce the outcome they desire (that will favour them), they have little incentive to act or to persevere in the face of difficulties. These self-perceptions touch virtually every aspect of peopleôs lives,

be it thinking in a productive manner, debilitating, pessimistically or optimistically; how well they motivate themselves and persevere in the face of adversities; their vulnerability to stress and depression; and the life choices they make (Moos & Azevedo, 2009). The process and use of these self-beliefs is an intuitive one. People engage in behaviour, interpret the results of their actions, use these interpretations to create and develop beliefs about their capability to engage in subsequent behaviours in similar domains/situations.

Some researchers (Pintrich & De Groot, 1990) have suggested that these self - beliefs may play a meditational role in relation to cognitive engagement and that enhancing them might lead to increase the use of cognitive strategies that, in turn, lead to improved performance. For instances, in school, the beliefs that students develop about their academic capabilities help determine what they do with the knowledge and skill they have learned. In this case, their academic performances are in part the result of what they come to believe that they have accomplished and can accomplish. This is the reason for the studentsô academic performances which may differ remarkably when they have similar abilities necessary to attain a specific goal, self-efficacy judgments are related to specific tasks in a given domain (pajares, 2005; Bandura, 1997).

Self-efficacy is goal directed this means that self-efficacy assessments direct respondents to rate their level of confidence for attaining a specific goal. Math self-efficacy, for instance, could be assessed by the following questions, ñHow confident are you that you can pass mathematics at the end of this term?ò and ñHow confident are that you can get a grade better than a B in math?ò (Bong & Skaaivik, 2003). Self-efficacy influences the choice individuals make in term of goal choice, the effort expended to reach those goals, and persistence when difficulties arise (pajares,2005;Bandura, 1997). Self-efficacy is significant predictor of both the level of motivation for a task and ultimately task performance (Bandura

& Locke, 2003); on average, individuals with high academic self-efficacy perform better and persist longer in science disciplines relative to those with lower self-efficacy**.**

The amount of self efficacy a student has can determine the amount of effort exerted on a task. If students have a high level of self efficacy then they will make wiser choices about their education and put more effort into making sure that they are successful in school. Also self efficacy influences how long students persist when they confront obstacles or failures in the classes that they take. Most of all, it impacts how the students feel. This impacts whether or not a student has a high or low self esteem in life in general. How a student feels in their academic life determines how they feel in their personal, non academic life. Self efficacy beliefs affect academic performance by influencing a number of behavioural and psychological processes (Bandura, 1986).

Self efficacy beliefs are also positively associated with key motivation constructs such as self concept (Bong & Skaalvik, 2003), (the studentsô perceptions about their ability and their feelings of self worth associated with this ability), self- regulation (students are able to set goals for their learning and then attempt to monitor, regulate, and control their cognition, motivation, and behaviour, guided and constrained by their goals and the contextual features of the environment (Pintrich, 2000), and adaptive causal attributions (Stajkovic & Summer, 2000). There are different ways students develop self efficacy, however it is not a fixed trait. Everyone does not have the same levels of self efficacy beliefs. The four sources are mastery experience, social persuasion, physiological states, and vicarious experience Bandura(1986, 1997).

Self-efficacy can be divided into two ï high self-efficacy and low self-efficacy, depending on personal characteristics and nature of the task (Woolfolk, 2011). One thing that showed that a student has a high sense of self efficacy is being observant. This is especially

when a learner observes people of the same level with themselves succeed in their work. By such observation, a student may say; óif my friend can do it, I too canô. This will make the student have a desire to make an attempt on the similar problems, and if they succeed, they want to solve other problems. In the end, students will start believing in themselves and their abilities, thereby enhancing their self esteem and efficacy (Evans, 2009). Besides, students with a high perceived self efficacy will maintain a positive attitude and mood in their activities. According to Silvia (2011), a positive attitude enables one to create a perception of efficacy while negative attitudes weaken this ability. They argue that learners with a positive attitude can also benefit from what they call ñUpward Spirals,ò meaning that they may find more solutions than those with a negative attitude.

High self-efficacy promotes achievement and success while low self-efficacy limits studentsô achievement. Students with high self-efficacy are characterized with the following traits: high confidence, accurate self-evaluation, willingness to take risks, and sense of accomplishment. While students with low self-efficacy are characterized with fear of risks, uncertainty, feelings of failure, and impression management (Frank, 2011).Therefore, high self-efficacy is highly needed for one to master some process-involved learning materials like those in math and sciences.

Self-efficacy is a concept drawn from Banduraôs (1977) broad theory of the person, which posit that human achievements depend on the reciprocal interaction of the personôs behavior, personal factors (self) and environmental conditions. Self-efficacy is one of the personal factors. It is defined as oneôs convictions that individual can successfully execute the behavior required to produce the desired outcomes (Rosen & Dalton, 2010). They maintained that self-efficacy beliefs should be relevant for understanding academic outcomes because

self-efficacy leads to specific behaviours and motivations that can encourage or discourage effective performance, example, in math.

Self-efficacy beliefs constitute a key component of Banduraôs social cognitive theory. The construct indicates a personôs beliefs, concerning oneôs ability to successfully perform a given task or behaviour (Niclaidou & Philipon, 2002). It was discovered that self-efficacy is a major determinant of the choices that individuals make, the effort they expand and the perseverance they exert in time of difficulties, the thought patterns and emotional reactions they experience (Bandura, 1986). As a result, self-efficacy plays an important role in achievement motivation, interact with self-regulated learning process, and mediate academic achievement (Nicolaidou et al, 2002).

McMillan (2005) viewed self-efficacy as oneôs self-judgments of personal capability to initiate and successfully perform specified task at designated levels, and expend greater effort and persevere in the face of adversity. This means that self-efficacy is not only on domain-specific but also situation-specific.

Again self-efficacy can be seen as the perceived awareness of oneôs ability to produce the desired results for a particular task (Zimmerman, 2000). According to Zimmerman, studentôs motivation can be enhanced by evoking the studentôs sense of self-efficacy. This is in agreement with Schunk (1991) who asserted that self-efficacy draws on a sense of competence motivation which in turn leads to a non-defensive approach to new learning. Schunk further said that self-efficacy is one of the personal expectancy that can influence behavioural instigation, direction, effort and persistence.

Pajares and Miller (1994) affirmed that self-efficacy is a meditational construct which mediates the effect of gender and prior experience of self-concept, perceived usefulness and problem solving. They argued that gender and prior experiences influenced self-concept,

perceived usefulness and problem solving only on through the meditational role of self-efficacy. Also they argue that the gender difference that habitually occur in mathematics achievement, and other related constructs were due, mainly, to the influence of self-efficacy and difference in intellectual endowment since gender has direct effect on self-efficacy.

Bandura affirmed that how people behave can often be better predicted by their beliefs about their capabilities than by what they are actually capable of accomplishing, for these beliefs help to determine what individuals do with the knowledge and skills they have. Conversely, what determines how efficacious an individual can be and how people acquire information to appraise their efficacy could be traced to their previous performance or accomplishments, vicarious (observational) experiences, forms of persuasions, and physiological indices (Schunk, 1991). Though, individualôs own performance offers the most reliable guide for assessing efficacy. It is a known fact that success raises efficacy while failure erodes it, but once a strong sense of efficacy is developed, a failure may not have much impact (Bandura, 2002; Zimmerman, 2000).

Invariably, among others, self-efficacy could be seen as a combination of some or all of the following statements:

- Self-efficacy is a personal construct which gives an individual a strong conviction on what one can or cannot do at a particular time and situation.
- It is the individualôs belief about oneôs capacity to fully complete a task at a designated level of performance.
- It is based on previous mastery experiences-verbal, social, peculation and physiological and emotional excitement.
- It is affected by gender especially at middle age school. In math for example, the malesô self-efficacy supersede the females in middle school and high school.

- Self-efficacy is oneôs perceived capability to control individualôs performance in emotionally tasking, or otherwise difficult situation.
- Equally, it is a motivational factor which instigates the learners to learn difficult tasks even in the face of success or failure. This implies that self-efficacy enhances other constructs that are necessary for problem solving like attribution, persistence and mastery goal orientation.
- High self-efficacy promotes self-regulation and use of learning strategies whereas low self-efficacy results in task avoidance, dependence and at the end low achievement (grades) among students.

From what has been said in above, academic self-efficacy is the individualôs (studentôs) level of conviction about studentôs capability to successfully complete academic tasks or achieve academic goals. This level of conviction may be influenced by previous successes or failures in academic or mathematics-related experiences of the student or individual. Again, it determine to a large extent, the individualôs confidence in facing mathematical problems. With CG as a means of assessing studentsô performance, students might be able to assess themselves when they know their academic capabilities.

Then how can CG be applied in boosting studentsô academic self-efficacy**?** As aforementioned in the preceding paragraphs, CG can be applied in the following ways - Mastery experience ï studentôs successful experience boost self-efficacy, failures erode it; Vicarious experience ï observing a peer succeed at a task can strengthen beliefs in oneôs own abilities; Verbal persuasion ï teachers can boost self-efficacy with credible communication and feedback to guide the students through the task, or motivate them to make their best effort; Emotional state ï a positive mood can boost studentôs belief in self-efficacy, while anxiety can deter it. A certain level of emotional stimulation can create energizing feelings that contribute to strong performances. Teachers can help by reducing stressful situation and

lowering anxiety surrounding events such as exam or presentation (Margolis & McCabe, 2006).

Concept of Academic self-efficacy

Academic Self-Efficacy is personôs confidence in their ability to organize, execute, and regulate performance in order to solve a problem or accomplish a task at a designated level of skill and ability. Academic self-efficacy refers to a person's conviction that they can successfully achieve at a designated level in a specific academic subject area. Academic self-efficacy is grounded in self-efficacy theory (Bandura, 1977). In adolescents and adults, academic self-efficacy contributes to students' motivation and persistence for learning.

There are two types of self-efficacy; these are high self-efficacy and low self-efficacy. Having a high degree of self-efficacy leads individuals to work hard and maintain persistence in the face of setbacks and adversity. When learning complex tasks, high self-efficacy leads people to work in order to improve their assumptions and strategies, rather than look for excuses such as not being interested in the tasks (Bandura, 1994). Therefore, students with high academic self-efficacy persevere in the face of difficulty and see difficult tasks as challenges that must be overcome. For example, when a teacher is solving math problem on proportion, students with academic high self-efficacy will be eager to know what the teacher is doing and will pay much attention in order to follow the steps the teacher has used. No wonder students with high academic self-efficacy like challenges as these will strengthen them to solve similar tasks in future, thereby making them to excel where others have failed.

Low self-efficacy brings about doubt on personal capabilities which cause individuals to shy away from difficult tasks which are often seen as personal threats. Low self-efficacy brings about low aspirations and weak commitment to the goals they choose to purchase. Students with low self-efficacy dwell on personal deficiencies, adverse outcomes rather than

on how to perform successfully or better (Bandura, 1994). This implies that students with academic low self-efficacy cannot withstand in the face of difficulty and perceive difficult tasks as something that cannot be overcome. Hence students with low academic self-efficacy suffer setbacks and drop out of school.

Self-efficacy is the belief in oneôs ability to accomplish a task and the understanding that actions one takes will influence a taskôs outcome. Academic self-efficacy that is the belief in oneôs ability to perform an academic task that is particularly important for success in school. Academic self-efficacy refers to individualsô beliefs that are formed specifically toward academic domains. This in other word means individualsô convictions that they can successfully perform given tasks at designated levels (Schunk, 1991). Academic self-efficacy is seen as personal judgment of oneôs capabilities to organize and execute courses of action to attain designated types of educational performances (Zimmerman, 1995). Studies have shown that academic self-efficacy promotes or enhances academic achievement directly and indirectly by increasing the academic aspirations and prosaically behaviour (Bandura, Barbaranelli, Capara & Pastorelli, 1996).

Greater efficacy leads to greater effort and persistence in the face of setbacks, even if oneôs is interrupted example in reading (task), one is likely to return to that task without minding the interruption simply because one has a goal. Self-efficacy influences motivation through goal setting, Example, if one has a high sense of efficacy in a given area, the individual will set higher goals, be less afraid of failure, and find new strategies when old ones fail. Again, if oneôs sense of efficacy for reading this chapter is high, you are likely to set high goal, for completing the chapter, but, if oneôs sense of efficacy is low, one may avoid the reading altogether or give up easily when problems arise or one is interrupted with a better offer (Bandura, 1993,1997).

Although, there are problems with high efficacy such as resistant to learning new knowledge and skills, and a tendency to stick with what works, that is, the ways of teaching that have provided the sense of mastery in the past. In the word of Wheatley (2002), overconfident may quickly be followed by giving up if the task proves more difficult than first thought, he further said that lower efficacy beliefs are essential to teacher/students learning; doubt motivates change**.**

An individualôs sense of academic self-efficacy influences the level of effort students put forth, their persistence and perseverance when confronted with challenges, and their resilience in the face of obstacles. Research showed that children sense of academic self-efficacy can differ across subjects and even across specific tasks within subjects. Students who have strong academic self-efficacy believe that they can successfully complete their work, based on their abilities and prior experience, (John, Shadrack & Bernard, 2010).

It is important to know that the probable relationship between academic self-efficacy and mastery orientation in primary school is that mastery orientation helps primary school pupils/students persevere when faced with challenges. It may thus be important in developing and reinforcing academic self-efficacy, which in turn supports academic success. Substantial evidence has shown that academic self-efficacy is associated with academic and social outcomes. For example, students with high academic self-efficacy exhibit better learning strategies and better tracking of their own outcomes than students with low academic self-efficacy (Zimmerman, 1989). Children with high academic self-efficacy in first and second grade have been found to have higher literacy and math achievement than children with low academic self-efficacy.

Other studies have associated academic self-efficacy with longer term academic success, example, an academic self-efficacy in second grade has been positively correlated with math

and reading outcomes in third grade. Similarly, another longitudinal study found that fifth and sixth gradesô math and science self-efficacy were predictive of math and science achievement ten months later (Phan, 2012). Results showed that a trajectory of increasing science self-efficacy during the school year was associated with success in science learning. Academic self-efficacy is important in later phases of development as well. Adolescents with strong academic self-efficacy have been found to have higher achievement in school, both independently and a function of high academic aspirations, more positive social behavior, and reduced vulnerability to feelings of futility and depression (Bandura et al 1996,2001).

For college students, academic self-efficacy has been associated with better first- year GPAs, more accumulated credits, and better retention in school after the first year Zajacova, Lynch, and Espendshade (2005). Another study showed that college students with high academic self-efficacy not only had stronger academic performance but were also better adjusted personally Chemers, Hu, and Garcia (2001). Strategies for improving academic self-efficacy are as follows:

1. Assisting students with goal setting, especially in the short ï term. Focusing on specific, immediate, and somewhat challenging goals is very essential, because it helps children demonstrates that they can complete a particular task and then internalize the belief that they can do it again the next time.
2. Engaging in self-assessment, which is typically done with adult assistance and then eventually by the students themselves. This helps the students understand the steps needed to successfully reach a goal and develop a sense of making progress.

In line with the theory, self-efficacy theory affects studentsô academic attainment due to the effects they produce through the four ñpsychological processesò (Bandura, 1993) such as; the cognitive, motivational, affective, and selection processes**:**

- At the cognitive level, the nature of beliefs students hold about their abilities in relation to a given task influences the way they perceive their prospective future academic results. Students who believe in their abilities visualize successive outcomes while those who do not trust their capabilities are likely to suffer from what Bandura (1997) termed as ócognitive negativityô, this is a state where students become somewhat ñfixatedò by their shortcomings and too skeptic about their capacity to succeed in the face of challenging learning situations.
- Motivation - At this level, there is a high sense of self-efficacy increases studentôs readiness to invest efforts in their learning, serves them well to persist when facing difficulties and helps them to recover more quickly after a negative attainment. On the contrary, a perceived sense of inefficacy diminishes studentsô interest in their learning, lessens from their capacity to resist when facing impediments and undermines their commitment to achieving their goals.
- At the affective level - At this level, a strong perceived sense of competence is likely to reduce the amount of stress students might experience in the course of their learning while a low self evaluation of capacity might result in a high level of anxiety and agitation that often lead to órationalô thinking that ultimately impair their cognitive and intellectual effectiveness.
- Selection level ï The belief that students develop about their academic abilities are likely to influence the type of decisions they take, the environment they opt for and the kind of choice they select. Most people engage in tasks in which they feel competent and confident and avoid those in which they do not.

Concept of Mathematics

Mathematics is the science of numbers and their operations, interactions, combinations, generalizations and abstractions as well as space configurations and their structures; measurement, transformations (Richard and Robbins, 2013). Mathematics often shortened to math or maths, is the study of topics such as quantity (numbers), structure among others. (Ramana, 2009).

Mathematicians resolve the truth or falsity of conjectures by mathematical proof. When mathematical structures are good models of real phenomena, then mathematical reasoning can provide insight or predictions about nature. Through the use of abstraction and logic mathematics developed from counting, calculation, measurement and measurement, and the systematic study of the shapes and motions of physical objects (Ziegler, 2011)). Practically, mathematics has been a human activity for as far back as written record exists. The research required to solve mathematical problems can take years or even centuries of sustained inquiry.

Aristotle defined mathematics as "the science of quantity", and this definition prevailed until the 18th century (Tobias, 2012). Starting in the 19th century, when the study of mathematics increased in rigor and began to address abstract topics such as hand, which have no clear-cut relation to quantity and measurement, mathematicians and philosophers began to propose a variety of new definitions. Some of these definitions emphasize the deductive character of much of mathematics, some emphasize its abstractness, and some emphasize certain topics within mathematics. Today, no consensus on the definition of mathematics prevails, even among professionals (Mura, 1993). There is not even consensus on whether mathematics is an art or a science.

Mathematics has since been greatly extended, and there has been a fruitful interaction between mathematics and science, to the benefit of both. Mathematical discoveries continue to be made today. Mikhail (2006) asserted that the number of papers and books included in the mathematical reviews database since 1940 (the first year of operation of MR) is now more than 1.9 million, and more than 75 thousand items are added to the database each year. The overwhelming majority of works in this ocean contain new mathematical theorems and their proofs.

Concept of Achievement

Achievement is an outcome of the experiences which one gains through exposure to learning. In the standards for test construction, it is seen basically as the competence a person has in an area of content (APA, 1999). Educationally, it may be seen as the mastering of major and principles, important facts and propositions, skills, strategic knowledge and integration of knowledge (Nieme, 1999). According to Ugwuda (2008), achievement can be defined as a measure of learnersô level of knowledge, skills or performances (2008).

Looking at the various definitions of achievement by these authorities, one can therefore say that it is the progress people make toward their set goals. Also, it is something which one has worked hard for, and in the end the result has been successful. In summary, it can be viewed as oneôs ability or the extent of oneôs knowledge in a specific content area or the competence of a person in relation to a domain of knowledge. Ruiz-Primo (1998), achievement is something fractionated into knowledge components, such as declarative, procedural and strategic refer to specific production systems (Anderson & Lebiere, 1998) and specific heuristic (Schoenfeld, 1992). Operationally, achievement is the progress one makes in life toward academic set goals or objectives.

Brown (2005) defined achievement as the level of goal accomplishment. Achievement can be seen as the extent of success or failure of goal accomplishment in a given content which the learner has been exposed to before (Eze,2003). This showed that secondary school students perform badly in mathematics skills, knowledge, performance and goal accomplishment in Nigeria, and this is very obvious in the West African Examination results.

Achievement is an English word which means a thing which someone had done successful; especially using their own effort and skill. This concept is defined in various ways in different fields. In the field of education, achievement is seen as the act of accomplishing or attaining of goal (Nkpaoro, 2006), this means that an individual has achieved a set of educational goal, if the goal is successfully accomplished. This concept has different definitions - Enyi (2004) see it as the degree of success attained by an individual on a task he/she has earlier been exposed to. In this case it means the level at which an individual is successful over a given task which the individual engage in or related task at the same time. This is in agreement with what Eze (2008) stated ï achievement is the extent of success attained by an individual in some general or specified area. As a result, Ugwu (2008), said that achievement is the measure of knowledge, skills or performance, these performances can be measured using achievement test. In summary, achievement could be seen as a process and a product of learning which has to do with the act, measure, extent and even the success or failure of goal accomplishment in a specified content. Therefore, it is a performance through a standardized test for measuring an individualôs progress in mastery of a subject content or task to be learned. There are certain factors that can affect individualôs level of achievement such as learnerôs level, age and other environmental factors , as well as personal factors ï studentsô self-efficacy, persistence in the task, teachersô competence and

attitude. Achievement as a concept could be measured using different achievement test like teacher-made test and standardized test.

Academic achievement or (academic) performance is the outcome of education, the extent to which a student, teacher or institution has achieved their educational goals. Academic achievement is commonly measured by examinations and continuous assessment but there is no general agreement on how it is best tested or which aspects are most important ð procedural knowledge such as skills or declarative knowledge

Achievements are either intentionally or unintentionally acquired positive or desirable developments in life and career, Stern (2010). Intentional achievements are those that result from hard work and patience. And these are in the form of sports, promotions and other winnings or completions. While unintentional achievements are those that naturally crop up or results from a long period of practice of some behaviour or attitude. These are by way of achieving credibility, respect, and authority. They are unintentional because when one performs something either as an assignment from his or her job or out of personal desire, the respect, honour, credibility, or authority is not usually what one desires to attain but the simple accomplishment of the said task assigned.

For instance, a teacher who diligently discharges his duties very well may not directly think of earning an achievement of being called a competent or dedicated teacher in the area of teaching. Rather, his main and direct concern other than to successfully teach the students is to achieve promotion or increase in salary. But by teaching very well, these intentional achievements are joined with those unintentional achievements of being a person of competent and efficient teacher. In fact, achievement is the end result of successes, a successful teacher may enjoy promotion in terms of levels and increment in salary and these are intentional desire and wanted. At the same time, the teacher unintentionally holds the trust

and confidence of his students as a renowned and reputable teacher in the school. Therefore, the person can confidently say that he has many achievements both in his career and life in general.

On that note, Stiggins (1994) asserts that there are four types of achievement outcomes which appeared in hierarchy. These are knowledge mastery, building knowledge mastery; students develop reasoning proficiencies and skills. And these are necessary for students to be able to create products. The mastery of knowledge has core facts, information and relationship that students memorize, and these knowledge that students acquire are needed through references and research, here, success is mastery or getting hold of foundational knowledge. Mastery of knowledge, students reason and solve problems. At this level, students use what they know within the context of the problem to achieve a desired solution**.**

Concept of Gender

Gender refers to socially constructed roles and socially learned behaviours and expectations associated with males and females (Okeke, 2000). The concept gender usually refers to traits and behavior to a particular culture judges to be appropriate for men and for women. However, sex refers to biological differences (Brannon, 2002). The issue of gender can be seen in parenting and parental pattern or family organization; for instance childrenôs toys are genderized. A girl child is made to know that her role is to nurture children, take care of the house chores, and be pathetic and sensitive to things whereas boys are regarded as strong and self-assured. With this gender orientation in mind, students carry this into academic performance and consequently it affects all that they do. When these students are in secondary schools, the orientation direct their choice of school subject as well as their career choice in life, this will in turn have an impact in their performance or achievements.

Most studies show that, on average, girls do better in school than boys. Girls get higher grades and complete high school at a higher rate compared to boys (Jacobs, 2002). Standardized achievement tests also show that females are better at spelling and perform better on tests of literacy, writing, and general knowledge *(*National Center for Education Statistics, 2003). An international aptitude test administered to fourth graders in 35 countries, for example, showed that females outscored males on reading literacy in every country. Although there were no differences between boys and girls in fourth grade on mathematics, boys began to perform better than girls on science tests in fourth grade (International Association for the Evaluation of Education Achievement). Girls continue to exhibit higher verbal ability throughout high school, but they begin to lose ground to boys after fourth grade on tests of both mathematical and science ability. These gender differences in math and science achievement have implications for girlsô future careers and have been a source of concern for educators everywhere. (Zembar & Blume, 2009).

Part of the explanation can be traced to gender differences in the cognitive abilities of middle-school students. In late elementary school, females outperform males on several verbal skills tasks: verbal reasoning, verbal fluency, comprehension, and understanding logical relations (Hedges & Nowell, 1995). Males, on the other hand, outperform females on spatial skills tasks such as mental rotation, spatial perception, and spatial visualization (Voyer, Voyer, & Bryden, 1995). Males also perform better on mathematical achievement tests than females. However, gender differences do not apply to all aspects of mathematical skill. Males and females do equally well in basic math knowledge, and girls actually have better computational skills. Performance in mathematical reasoning and geometry shows the greatest difference (Fennema, Sowder, & Carpenter, 1999). Males also display greater confidence in their math skills, which is a strong predictor of math performance **(**Casey, Nuttall, & Pezaris, 2001).

Gender schema theory has it that both environmental pressures and childrenôs cognition work mutually to shape gender role identity, this seems to influence ones aspiration, self-concept/ efficacy goal setting and therefore academic self-efficacy. When a studentôs aspiration is very high and that student is discouraged on gender bases then that studentôs aspiration is thwarted. To that extent gender role destroys onesô confidence in the ability one has to achieve on a particular goal.

The poorer mathematical reasoning skills exhibited by many female adolescents have several educational implications. Beginning at age 12, girls begin to like math and science less and to like language arts and social studies more than do boys (Kahle & Lakes, 2003; Sadker & Sadker, 1994). They also do not expect to do as well in these subjects and attribute their failures to lack of ability (Eccles, Barber, Jozefowicz, Malenchuk, & Vida, 1999). By high school, girls self-select out of higher-level, ñacademic-trackò math and science courses, such as calculus and chemistry. One of the long-term consequences of these choices is that girls lack the prerequisite high school math and science courses necessary to pursue certain majors in college (e.g., engineering, computer science). Consequently, the number of women who pursue advanced degrees in these fields is significantly reduced (Halpern, 2004**).**

Relationship among Comparative Grading, Academic Self-efficacy and Achievement.

As the concepts of each of the variables that make up the basis of this research has been dealt with, it is very imperative to establish the relationship among the variables. Although all the variables are inter-related and over lapping with one another, the independent variable ócomparative gradingô (CG) is the one that directly correlates with the dependent variable studentsôacademic self-efficacy beliefs and mathematics.

The relationship between comparative grading and studentsô academic self-efficacy and mathematics is indivisible. When comparative grading is competently utilized by the

mathematics teacher, it might be seen that students will not be tired of the task at hand until they accomplish it (high self-efficacy). This is in support with Woolfolk (2011) who said that learning is influenced by how the math teacher delivers the lesson.

It is very apparent that mathematics tasks are often abstract and difficult in a way that even the best students in the class have difficulties in basic math task that is necessary for studying and understanding sciences. However, these difficulties are surmounting by perseverance, that is, those students with high academic self-efficacy. Therefore one way to overcome the math phobia is by introducing grading system that involves high persistence, in a way that even if the student experiences failure at any point in the learning process, they will continue with the task in order to overcome the task. One and the most effective of such grading are comparative grading (CG).

High task determination has direct common relationship with academic self-efficacy; studies show that self-efficacy affects individualôs choice of activities, effort and persistence. Persistence leads to high self-efficacy; by improving the learnerôs skill. This means that as a student performs a task, studentôs effort is improved on the tasks skill in order to overcome the task. Even though students may experience failure or success, students will be able to perceive their own strengths and weaknesses; this will lead to improvement on their mistakes as the needed task is improved upon, thereby increasing academic self-efficacy. So when high self-efficacy is developed, task persistence increases as well.

As self-efficacy is related to grading, it is also related to achievement. When self-efficacy is improved, equally achievement is improved and vice-versa. Again as high grading is a sign of oneôs level of self-efficacy, and self-efficacy directly affects success. It can be seen from the preceding discussions that the two variables are directly and equally related to one another and they are inter-related, as the student engages in a task**.** If the grading of

oneôs performance is properly done using comparative grading. The individual will be eager to perform another task which will in turn lead to academic self-efficacy. The concept of comparative grading cannot function on its own without involving studentsô level of knowledge in a given task. When represented schematically, the relationship among grading comparative grading and academic self-efficacy and achievement will look like the diagram below.

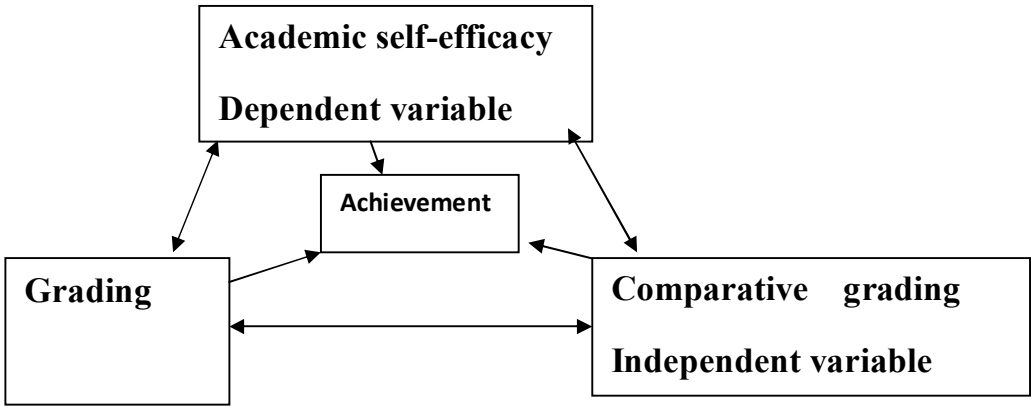

Figure 2: Schematic representation of the relationship among grading, comparative grading, academic self-efficacy and achievement.

Theoretical Framework

This research work based its theoretical framework on two theories;

- Albert Banduraôs self-efficacy theory(1997).
- Victor Vroomôs Expectancy theory (1964).

Bandura's Self-efficacy theory (1997)

This theory was propounded by Albert Bandura in 1977, this emanated from his original work on social learning theory in response to his *s*atisfaction with principles of behavourism and psychoanalysis, by adding cognitive factors such as beliefs, expectation and self-regulation. In addition to the emphasis on the role of other people serving as models and teacher, social cognitive theory of learning also taken into consideration factors such as thinking, believing, expecting, anticipating, self-regulating as well as making comparison and judgment (Woolfolk, 2011). This theory emphasizes how cognitive, behavioral, personal, and environmental factors interact to determine motivation and behavior (Crothers, Hughes, & Morine, 2008). Bandura asserted that, human functioning is the result of the interaction among all three of these factors (Crothers et al., 2008)

Bandura (1997) asserted that of all the beliefs that people hold about themselves and that affect their day-today functioning, and standing prominent at the core of social cognitive theory, are self-efficacy beliefs, which can be defined as the judgments that individuals hold about their capabilities to learn or to perform courses of action at designated levels. In short, self-efficacy beliefs are the self-perceptions that individuals (people) hold about their capabilities.

According to this theory, self-efficacy beliefs provide the foundation for human motivation, well-being, and personal accomplishment: Unless people believe that their actions can produce the outcomes they desire, they have little incentive to act or to persevere in the face of difficulties. These self-perceptions touch almost every aspect of peopleôs lives and how well they motivate themselves and persevere in the face of adversities; their vulnerability to stress and depression; and the life choices they make.

Self-efficacy beliefs are not same as outcome expectations, which are peopleôs judgment of the consequences that their behavior will produce. Naturally, self-efficacy beliefs help to foster the outcome one expects. Positive individuals anticipate successful outcomes. Students confident in their social skills anticipate successful social encounters. Those confident in their academic skills expect high marks on exam and expect quality of their work to reap academic benefits. However, those who lack confidence in their academic skills expect low marks on exams. So, people who doubt their social skills often envision rejection even before they establish social contact. Students who lack confidence in their academic skills foresee a low grade even before they begin an exam or enroll in a course. The expected results of this imagined performance will be differently envisaged: Social success or greater profession for those with high self-efficacy beliefs, while social isolation or reduced academic possibilities for those with low self-efficacy beliefs.

When self-efficacy belief and outcome expectation differ, the self-efficacy belief is more likely to determine the behavior. Students may realize that strong academic skills are vital for obtaining a good (UTME) score or grade and being admitted to the college of their choice, this in turn ensure a comfortable lifestyle in future. On the contrary, if students lack confidence in their capabilities, they may as well shy away from challenging courses or tasks, will approach the UTME with apprehension and self-doubt, and may not consider college attendance. In the social interaction, people may realize that pleasing manners and physical attractiveness are very important for attracting the attention of others, which is the first step toward building our long-lasting relationships. But, if they have low confidence in their social skills and doubt their physical attractiveness, they may hesitate to make contact thereby miss potentially promising opportunities.

For the fact that individuals operate collectively as well as individually, self-efficacy is both a personal and social construct. Collective system increases a sense of collective

efficacy, this means a groupôs shared belief in its capability to attain goals and accomplish desired tasks. For instance, schools develop collective beliefs about the capability of their students to learn, of their teachers and otherwise enhance the lives of their students, and of their administrators and policy makers to create environments conducive to these tasks. Self-efficacy can be constructive or potential detrimental as highlighted below: Constructive Attributes:

- When faced with a difficult task, people who have high self-efficacy will face the challenge as something to be learned and mastered. Their interest and motivation in mastering the task will drive them to succeed in their difficult, yet approachable goal (Pajares & Schunk, 2001).
- While striving to complete a challenging task or difficult goal, individuals with high self-efficacy may face failures or setbacks, but they will not give up. Where people with low self-efficacy may decide the task is impossible, people with high self-efficacy strive to develop a higher amount of knowledge and increase their effort in order to overcome their failures and setbacks (Pajares & Schunk, 2001).
- People with high self-efficacy are more likely to set more challenging goals for themselves and be more committed to the goal, which enhances self-efficacy (Bandura, 1995).
- Researchers have demonstrated the positive effects of self-efficacy beliefs on effort, persistence, goal setting, and performance (Pajares, 2009).

This shows that students with high academic self-efficacy may solve any mathematical concept provided the teacher is competent enough to deliver, with the belief they have, this will enable them to excel even if they fail, and they keep on moving ahead. So *people who regard themselves as highly efficacious act, think, and feel differently from those*

*who perceive themselves as inefficacious. They produce their own future, rather than simply foretell it (*Bandura, 1994**).** Potential Detrimental Attributes*:*

- Very high self-efficacy can sometimes lead to degradation in performance of a particular task. This is because high self-efficacy can lead to overconfidence in one's aptitude, which creates a false sense of ability. Overconfidence can lead to employing the wrong strategy, making mistakes, refusal to take responsibility for mistakes, and rejecting corrective feedback (Clark, 2001). Overconfidence can also result in lower effort and attention being devoted to the task (Stone, 1994).
- Verbal and tangible rewards can have both positive and negative effects on self-efficacy depending on the context and environment in which the reward or praise is delivered (Manderlink & Harackiewicz, 1984).

Victor Vroom's Expectancy theory (1964)

The expectancy theory, also known as the VIE (expectancy, instrumentality, and valence). This theory was propounded by Victor Vroom (1964) of the Yale School of Management, and is based on the beliefs that an individualôs effort will lead to performance, which in turn will lead to a specific outcome**.** Comprehensively, self-efficacy is based on an individualôs belief about their ability to perform specific behaviours. Expectancy theory explores how rewards affect motivation, whereas self-efficacy explores how beliefs about capabilities affect motivation. Bandura (1997) affirmed that individuals take action when they hold efficacy beliefs and outcome expectations that make the effort seem worthwhile. They expect given actions to produce desired outcomes and believe that they can perform those actions. To successfully achieve the desired outcome, individuals must possess the necessary skills as well as the confident (self-belief) that they are capable of controlling the specific situational factors (Bandura, 1989). People with high self-efficacy are more likely to

respond with renewed effort (expectancy) when feedback shows that they are not reaching their goals by developing more successful strategies (Smith & Hitt., 2005).

However, individuals with low self-efficacy, given the same circumstances, may perform poorly because their low self-efficacy impairs their motivation and effort. For example, a teacher with high self-efficacy and ability for teaching math, but low self-efficacy for teaching a new student will most likely be an inadequate teacher. On the whole, perceived self-efficacy can be distinguished as being competence-based, prospective, and action-related as opposed to related ideas that only share some of these elements (Bandura, 1997).Expectancy theory proposes that a person will decide to behave in a certain way because they are motivated to select a specific behaviour over other behaviours due to what they expect the result of that selected behaviour will be. Most importantly, the motivation of the behaviour selection is determined by the desirability of the outcome. But the centre of this theory is the cognitive process of how an individual processes the different motivational elements.

Individuals make choices based on estimation of how well the expected results of a given behaviour are going to match up with or eventually lead to the desired results. Motivation is a product of the individualôs expectancy that a certain effort will lead to the intended performance, the instrumentality of this performance to achieving a certain result, and for the desirability of this result for the individual, known as ñvalenceò. This means that individuals engage themselves in a task that raises their self-efficacy beliefs, that is, those tasks in which they succeeded.

And it explains how individuals make decision to achieve the end they value. Vroom in his study introduces three variables within the expectancy theory which are valence (V), expectancy (E), and instrumentality (I). Expectancy is the belief that oneôs effort will result in

attainment of desired performance (P) goals. Usually based on individuals past experience, self-confidence (self-efficacy), and the perceived difficulty of the standard or goal. Factors associated with the individual expectancy perception are self-efficacy, goal difficulty, and control. Self-efficacy is the personôs belief about their ability to successfully perform particular behaviour. Goal difficulty occurs when goals are too high or performance expectations that are made too difficult are most likely to lead to low expectancy perceptions. Control is oneôs perceived control over performance. In order for expectancy to be high, individuals must believe that they have some degree of control over the expected outcome. That is to say, if studentsô expectancy is high, those students must believe that have some degree of control over the expected outcome or grades.

Instrumentality on the other hand is the belief that a person will receive a reward if the performance expectation is met. This reward which is grade in the context of this research work may come in the form of scoring very high grade in the examination, recognition or sense of accomplishment. Instrumentality is low when the grade (reward) is same for all performance given. Valence is the value the individuals place on the rewards based on their needs, goals, values and sources of motivation.

Expectancy theory help math teachers to relate grades directly to performance and to ensure that the grades given are those grades deserved and wanted by the recipients (students), as students maximize pleasure and minimize pain. Vroom realized that individualôs performance is based on individual factors such as personality skills, knowledge, experience and abilities. Furthermore, Vroom stated that effort, performance and motivation are linked in a personôs motivation; using variables like expectancy, instrumentality and valence to account for this. Expectancy is the belief that increased effort will lead increased performance, that is, if a student work hard and score good grade in math, this will be affected by having the right steps in solving problems, example, teacherôs method of

teaching; having the basic skills to solve the math problem and the necessary support by the teacher ï correcting the work thereby making students know why they could not get the problem correctly.

Instrumentality, which is the belief that if an individual performs well that a good grade will be received or given. The degree to which a first level of outcome will lead to the second level of outcome, that is, if a student had a good grade in math during the first term exam, there is something for that student and is affected by: clear understanding of the relationship between performance and outcomes, example, the steps used in solving the problem; trust in the teacher who will take the decision on who get what grades and the transparency of the process that decides who get what outcome (grade). Finally, valence is the importance that the individual (student) places upon the expected grade/outcome, for the valence to be positive the student must attain the outcome to not attaining it. For instance, if a student is mainly motivated by money, the student may not value offer of additional time in solving the problem.

Empirical studies

The following empirical studies by various researchers were reviewed under studies on grading and studies on academic self-efficacy, achievement and gender.

Studies on Grades

Nwaogazie (2009) investigated the relationship between continuous assessment scores and Junior Secondary School Certificate Examination (JSCE) final scores in Imo State. A sample of 400 students was purposively sampled from 38000 students who took the 1997 JSCE in Imo State. The study used correlation survey research design. The population consisted of JSS three students who took the 1997 JSCE in Imo State. The sample size was

determined by using the Yaro Yamenôs formula. Instrument for data collection was done by using cumulative records of studentsô scores in continuous assessment obtained from the selected schools. The data used were collected from the cumulative records of studentsô scores in continuous assessment and JSCE grades and analyzed using person product moment formula for research questions while all the hypotheses were tested using z-ratio at 0.05 level of significance. Three out of the four null hypotheses tested were rejected but one was accepted. Finally, recommendations and suggestions were made for further study.

Salahdeen and Murtala (2005) investigated the relationship between admission grades of Senior Secondary School Certificate Examination (SSCE) result, Joint Admissions and Matriculation Board, Organized Universities Matriculation Examination (JAMB-UME) scores, and studentôs academic performance at Lagos State University College of Medicine (LASUCOM), Nigeria. Data transformation were completed and subsequently standardized descriptive statistics and correlation coefficient were used to determine the correlation between the variables. The sample comprised of 54 students admitted into the medical school in 1998/1999 session. Data were collected from the Academic Record office of the University Medical School. Each studentôs record contains detailed information on the personal characteristics, SSCE grades, scores at JAMB-UME, academic performance at the 100 level examination and part 1, MBBS examination. The data were collected while frequency distribution and descriptive statistics were used to summarize the data. Analysis of variance and student t-test were to assess the effect of age, sex quality of SSCE scores and the JAMB-UME scores on the performance of students at the 100 level examinations. The Spearman correlation was used to determine the relationship between the SSCE, JAMB, JAMB-UME scores 100 level examination results and pre-clinical sciences performance. The result reveals that SSCE is better predictor of studentsô performance at pre-clinical sciences examination than JAMB scores.

Joshua and Kritsonis (2006) carried out a research to examine the issues characterizing the use of students assessment test (SAS) as a basis of teacher assessment. The study adopted a survey design. The population of the study comprised all the secondary teachers in Akwa Ibom State number 3000: out of which 480 was sampled (240 males and 240 females). Stratified random sampling technique was used. 20 schools in the area were selected for the study, 10 from urban school while 10 were selected from rural area. Instrument for data collection was a questionnaire constructed by the researchers. The data gathered were analyzed using independent t-test and ANOVA for the research questions. The results revealed that professionally trained teachers and their untrained counterparts are not significantly different.

Studies on academic self-efficacy

Salami and Nweke (2012) carried a study to find out the influence of alternative educational system on academic self-efficacy of students in university education in Nigeria. The study adopted ex-post facto design. The target population of the study is the entire undergraduate students in public universities in Nigeria, while university of Ibadan was used as a case study. The study involves 941 students in the 200 level of their programmes in 53 departments across 16 faculties, colleges and institutes in the university. Multi-stage sampling technique was used to select the departments. A self developed instrument titled ñAlternative Primary and Secondary Education and University Educationò (APSEUE) questionnaire was used to gather the data. A total of 17 items were in the questionnaire. Five research questions and hypotheses were used to guide the study. Four weeks was used to administer the instrument all over the university and the data collected was analyzed using both descriptive and inferential statistics: frequency count and percentage were the descriptive statistics used while inferential statistics were chi-square, t-test and correlation. The results revealed that there is no significant difference between undergraduate students

that attended both public and private secondary schools with regards to their academic self-efficacy and access to university education.

Azari (2013) investigated the relationship between academic self-efficacy, achievement motivation and academic procrastination with academic achievement and interaction with gender in Orumieh, Kuala Lumper. The study was carried out in Orumieh, Kala Lumper. Area of study was students from high schools in Orumieh **.** The study adopted a descriptive design. Samples of 200 (100 males and 100 females) students were selected by multi-stage cluster sampling from high schools of Orumieh. Three instruments were used for the study; Layôs academic procrastination scale, Hermanôs achievement motivation scale and self-efficacy scale. The data were analyzed using mean, standard deviation, and one-way ANOVA, t-test and regression analyses. The result of multiple regression analysis revealed that academic self-efficacy and gender were the best predictors. This showed that there was significant difference among boys and girls, in terms of the level of achievement motivation.

Adeyinka, Adedeji, Ayeni and Omoba (2007), carried a study to examine the level of influence of self-efficacy and the use of electronic information resources on studentsô academic performance in Ibadan, Oyo State. The study adopted a descriptive survey research approach. The population of this study comprised 700 undergraduates and graduate students from the faculty of education, university of Ibadan, Nigeria. The sample of one hundred (100) students was drawn. Data was collected with the use of Morgan-Jinks (1999) academic self-efficacy and the use of electronic information scale (UEIS). Three research questions and three hypotheses were raised to guide the study. Data obtained was analyzed using multiple regression analysis, Pearson product moment correlation matrix and simple percentage statistical tools. The results revealed that self-efficacy and the use of electronic information jointly predict and contribute to academic performance. This showed that studentsô self-efficacy is the main thing one needs to excel in academic world.

Adeyinka, Adedeji, and Olufemi (2011), investigated on locus of control, interest in schooling and self-efficacy as predictor of academic achievement among junior secondary school students in Osun State, Nigeria. The sample size of the study consisted of 500 students (300 boys and 200 girls). Stratified random technique was used to select twenty-five (25) secondary schools. Design for the study was ex-post-facto. Multiple regression analysis (ANOVA) was used to analyze the data. Three research questions and three hypotheses were used for the study. The results indicated that locus of control, interest in schooling and self-efficacy jointly and relatively contribute significantly to the prediction of academic achievement of students.

Ademo and Torubeli (2008), investigated on self-efficacy, self-concept and peer influence as correlate of academic performance among adolescents in transition. The descriptive survey design was adopted. The simple random sampling technique was used to select 300 participants in senior secondary school one (SS1) from six secondary schools in Yenagoa metropolis of Bayelsa State. Out of the total sample, 144 were boys, while remaining 156 were girls. Three instruments were used for the study, such as student self-efficacy questionnaire, self-concept inventory and per-influence questionnaire. Data were analyzed using step-wise multiple regression procedure to examine the predictive effect of the three variables on the academic performance. The results indicated that the three variables were effective in predicting studentsô academic performance. Base on the findings, it was suggested that school counseling psychologists should assist students in transition to develop self-efficacy, self-concept and positive peer relations.

Studies on Self-efficacy Beliefs and Achievement

Apart from theoretical evidences, the relevant literature holds practical evidences of strong effect of self-efficacy beliefs on academic achievement of students. Even though self-

efficacy is examined with much greater depth in therapeutic context, recent studies show that self-efficacy holds significant power for predicting and explaining academic performance in various domains, (Zimmerman, Bandura & Martnez-pons, 1992). Perceived self-efficacy and performance. Early studies focused on self-efficacy in education context such as observing students to enhance their behavior in phobic situation (Bandura, Adam & Beyer, 1997). It is in the 1980ôs that self-efficacy concerning academic performances began to be investigated with great depth.

Ayotala and Adedeji (2009) carried out a research to investigate the relationship between gender, age, general mental ability, anxiety, and mathematics self-efficacy and mathematics achievement among secondary school students in Oyo, State, Nigeria. The study adopted a descriptive survey research design using (1,099) one thousand and ninety nine, senior secondary two (SS2) students. Data were collected using general mental ability test (GMAT), mathematics anxiety scale (MAS), mathematics self-efficacy scale (MSES) and mathematics achievement test (MAT). Data collected were analyzed with stepwise multiple regression statistical procedure and results revealed among other showed that mathematics self-efficacy showed highest correlation with mathematics achievement of students. It was therefore recommended that educational stakeholders and curriculum planners should design programmes that will enhance studentsô mathematics self-efficacy in other to improve their achievement.

Xing and Harris (2005) conducted a study on the effect of mathematics self-efficacy on mathematics achievement of high school students in. The study adopted a pretest posttest experimental research design. Mathematics self-efficacy scale and mathematics achievement test were used to collect data from 630 high school students. Data analyzed using descriptive and inferential statistics showed among others, that math self-efficacy significantly influenced the studentôs achievement in math. Consequently, they recommended

that instruction should be geared towards improving studentsô self-efficacy. This study was carried out on high school students, so it was not established as to whether effect of math self-efficacy on achievement exists among pupils in primary school. Also it did not specified the approach used in teaching the experimental group and control group.

Yazachew (2013) investigate the level of studentsô self-efficacy, gender difference in self-efficacy and achievement and also relationships between self-efficacy and achievement for second year students in the fall of 2012 in Analytical Chemistry I (ACI) at Debre Markos College of Teacher Education (DMCTE), Ethiopia. The study was guided by four research questions and four hypotheses. The self-efficacy survey and the ACI achievement test were completed by 100 students. The self-efficacy survey data were gathered by Likert scale questionnaire. By using inferential statistics (t-test), difference of self-efficacy and achievement in gender is calculated and by using Pearson correlation, the relationships between self-efficacy and achievement were investigated. The analysis of the data indicated that studentsô level of self-efficacy is medium (50.08), and there is no significant difference in their self-efficacy between sexes ($t(98) = 0.161$, $p > 0.1$), but there is a statistically significant difference in achievement between sexes ($t(98) = 0.68$, $p < 0.1$) and also a significant relationship exists between self-efficacy and achievement ($r=0.385$, at 0.01 level with 98 degree of freedom). Based on these results, it is believed that male students perform better than females in science subject.

Henry and Jan Van (2015) explore the sources of variability in Mathematics achievement of Ugandan students at the student, classroom and school level in Uganda. The Mathematics score and questionnaire responses of 4,819 first-year secondary school students (Grade Seven, about 14-15 years old) from 78 classrooms of 49 schools were analyzed. A three-level linear model was used. The results indicate that out of the total variance in Mathematics achievement 68.8%, 14.2% and 17.0% are situated at student, classroom and

school level, respectively. Of all the considered explanatory variables at the three levels, i.e. socio-economic status, gender, prior Mathematics achievement, parental support, peer influence, class mean of prior Mathematics achievement and of studentsô perception of good classroom assessment, school mean of class climate (class mean of attitude toward mathematics) and of parental support were significant predictors of Mathematics achievement.

Studies on Gender and Academic Self-efficacy

Right from creation**,** gender issues have remained controversial, such that even at the present movement for gender equality in the country, there still exist a lot of controversies as to whether academics achievements in general and math and sciences achievements in particular depend on gender (Okeke, 2007). However, a good number of studies have been carried out on the influence of gender on mathematics achievement, and cognition in general. Harbor-Peters (2001), affirms that gender issues in mathematics has been a source of aversion: that mathematics has been male stereotyped since it was regarded as abstract difficult and has attributes that attributes that attract boys.

Rudina (2013) carried out a study on gender differences in self-efficacy and academic performance among Albanian students from two major universities in Tirana, Albania. The data was collected from 180 students (102 females and 78 males) selected from first, second and third level studies. Both universities and participants were selected randomly. A questionnaire was used to measure self-efficacy and the grade point average GPA of the first semester to measure the academic performance of the participants. The data was analyzed using descriptive and inferential statistics. The Pearson correlation coefficient was used to see the relationship between self-efficacy and academic performance. T-test was used to compare male and female participants in self-efficacy and academic performance. The results of the study showed that there was a significant difference between males and

females in self-efficacy. There was no difference between males and females in academic performance. Also, a significant relationship was found between the studentsô self-efficacy and academic performance. From the findings, it was recommended that different authorities as lecturer or counseling services at the universities have to improve studentsô self -efficacy and to support them to face academic requirements with high level of self-esteem, as this will help students to achieve their academic goal.

Igbo, Onu and Obiyo (2015) carried a research on the impact of gender stereotype on Secondary school studentsô self-concept and academic achievement. The study was guided by four purposes, four research questions, and four hypotheses. The study adopted ex- post-facto design. The research sample was drawn from eight government/public senior secondary schools in Udi education zone of Enugu State. Nine schools were randomly selected from the 227 schools. A total of 342 senior secondary II school (SSII) students made up the sample of the study. A 20-item studentsô stereotype self-concept questionnaire (SSSCQ) was adapted from Marshôs Self Descriptive Questionnaire II (SDQII), and a 10-item studentsô mathematics achievement test (SMAT) was developed by the researcher. The instruments were face and content validated and used for the collection of data. In analyzing the data, mean and standard deviation were used in answering the research questions while a *t* test was used in testing the four hypotheses. The findings of the study indicate that gender stereotype has significant influence on studentsô self-concept and academic achievement in favor of the male students. On the other hand, school location has significant influence on academic achievement of students but has no significant influence on studentsô self-concept. This showed that maleôs achievement in math is greater compared to females.

Philip, Jackson, Benjamin & Joyce (2013) carried a research on Effects of Students Gender on Mathematics Performance in Primary Schools in Keiyo South District. The study sought to find out the relationship gender of students and mathematics performance.

Descriptive survey design was used in the study to investigate the attitudes of primary school learners towards mathematics. Data was collected by use of questionnaires, interview schedules and class examination administered previously. The accessible population was teachers of Mathematics and Standard Eight learners from selected primary schools in Keiyo South District, Kenya. Sample study comprised of 300 learners (150 male students and 150 female students) and all teachers of Mathematics from the sampled schools in Keiyo South District, Kenya. Stratified random sampling was used to categorize schools in either boarding or day schools. Simple random sampling was used to select 50 schools from 119 primary schools and 5 male students and 5 female students from each selected Standard Eight class. The study used purposive sampling technique to select Mathematics Teachers. Simple random sampling technique was used to select Mathematics teachers for interview. Data was collected using questionnaire and interview schedule. It was established that majority of the students (boys and girls) had a positive attitude towards learning of mathematics. However, when comparing the attitudes of boys and girls, the results demonstrated that boys were more inclined to positive attitudes than girls.

Jabor, Machtmes, Kengu, Buntat, and Safarin (2011) conducted a study on Influence of Age and Gender on the studentsô Achievement in Mathematics in United States. The sample of the study comprised 26000 students from public and private schools in US. Data was a disk containing data sets from National Assessment of Educational Progress (NAEP 2005). The study adopted a descriptive survey design, data was analyzed using descriptive statistics and a t-test at 0.05 level of significance. The study revealed among others that there was statistically significant difference in mathematics GPA scores between males and females in favour of females. This shows that females are good in math like males.

Similarly, Rajesh and Roshan (2006) carried a study on the role of self-efficacy and gender differences among the adolescents as revealed by intelligence test. A random sample

of 200 students (100 Boys & 100 Girls) studying in I, II and III year of under-graduation was selected from different colleges of the city of Chandigarh. Self-efficacy scale developed by Jerusalem and Schwarzer was used to classify subjects. General Mental Ability Test developed by Jalota was used to have the dependent variable scores. Analysis of variance was applied and the F-ratio revealed significant effect of self-efficacy. Significant gender differences were also found, where female scored higher than their male counterparts. No interaction was found in self-efficacy and gender.

Summary of Review of Literature

The reviewed literature in this study has helped the researcher to provide clear information on the area of study. Although different definitions of comparative grading were given, but agreement in those definitions was that comparative grading is a type of grading where students are assessed relative to members of test takers. mathematics self-efficacy was agreed to be individualôs conviction about his or her capabilities while mathematics achievement is viewed as a process and a product which expresses the act, measure, extent and the success or failure of goal accomplishment in mathematics. Academic self-efficacy was seen as a studentôs judgment of his or her own capability to organize and perform study related courses of action necessary to reach selected types of academic performance, for example to pass an exam or learn a course- content. Comparative grading and self-efficacy have been found to have reciprocal effects with achievement. This type of relationship could work intermittently to put the student in continuous enhancement in achievement and problem-solving.

Two theories are very significant to this study: Banduraôs social cognitive theory and Vroom expectancy theory. It was discovered that these theories provide the basis for the interaction among comparative grading in mathematics, academic self-self-efficacy, and achievement ,as well as the string that bind them together in learning condition. But the

study is anchored on comparative grading which holds that test takers are judged relative to their individual performance.

In the empirical review, the main focus was studies on comparative grading, academic self-efficacy, self-efficacy and achievement and gender as a factor in academic self-efficacy and achievement. Each of the variables was revealed to have reciprocal effect on one another. Effect of gender on comparative grading, mathematics achievement and academic self-efficacy was seen to be controversial. Many studies revealed that no significant different in mathematics achievement, comparative grading and academic self-efficacy of male and female students. Some showed significant differences in favour of males while other was in favour of females. Finally, evidence from the reviewed studies suggest that CG is a grading system which has the potential of enhancing/ boosting studentsô academic self-efficacy in mathematics and at the same time improved achievement among students having learning difficulties in mathematics and other science subjects.

From the reviewed literature, it was discovered that in Nigeria, students suffer the problems of poor achievement and lack of study skills in math and there is a general deficiency of empirical studies in this area of study. The extent to which CG in math would improve the math achievement and academic self-efficacy of secondary school students in Nigeria who operate in different Scio-cultural environment needs to be investigated. Again, the extent to which CG in math could be effective in bridging the gender gap in math, studentsô self-efficacy and studentsô academic self-efficacy and achievement need to be established. It is the need to fill this gap that motivated the researcher to embark on this study.

CHAPTER THREE

RESEARCH METHOD

The research methodology for carrying out this study is treated under the following sub-headings: Design of the study, Area of the study, Population of the study, Sample and sampling technique, Instrument for data collection, Validation of the instrument, and Reliability of the instrument, Experimental procedures control of extraneous variables and Method of Data Analysis.

Design of the Study

This study will adopt quasi-experimental design. The non-randomized control group, that is pretest- posttest design. According to Ali (2006) non-randomized control group, is a type of quasi-experimental design in which participants are not randomly assigned to groups. Rather, the researcher has to use groups already in existence like intact class. This is considered appropriate for the study because intact class will be used. Pretest will be administered at the beginning of the study and the pretest data used for finding out whether the subject in the different groups are equivalent or not.

At the end of the study, using an analysis of covariance technique, the researcher will be able to compensate for the initial lack of equivalence between groups. This will establish equality of baseline pretest data, before the initiation of the study, thereby establishing the covariates between the pretest and posttest, and finally determines whether there is any significant difference between groups based on the gain scores. This is to be presented as follows:

Figure 3: Quasi-Experimental Design

Groups	Pretest	Treatment	Posttest
Treatment	Q_1	X_1	Q_2
Control	Q_1	X_2	Q_2

The symbols are defined as:

X_1=Treatment (Criterion grading system)

Q_1=Pretest

Q_2= Posttest

X_2=Control (Norm-referenced grading system)

Area of the Study

The study was carried out in Aba education zone of Abia State. There are three education zones in Abia State - Umuahia education zone, Ohafia education zone and Aba education zone, and there are 17 local government areas in Abia State (Hoiberg, 2010). There are 29 governments owned secondary schools in Aba. Aba was divided into two local government areas - Aba North and Aba South. The reason for choosing this area is that, over some decades, there has been consistence poor performance in mathematics among secondary school students in Aba North local government area. Again, there is this assumption that males are better than females in everything that concerns academics. Culturally in this area, females are therefore seen as lesser specie when it comes to subjects such as science and mathematics. Aba is a commercial city where students combine academics work with

business which at the end of the day, students score low grades in their exams. So in order for students to maintain their academic self-efficacy they find means of upgrading their grades either by cash or kind.

Population of the study

The population for the study comprises all 2014/2015 SS1 public secondary schools students in Aba education zone of Abia State. As the time of field survey, there are twenty-nine (29) such schools with a population of three thousand two hundred and thirty-eight (3,238), comprising 1388 male and 1850 female students, (Source: Secondary Education Management Board, Aba Education Zone).

Sample and Sampling Technique

The sample size of this study was 200 SS1 students drawn from (four) 4 Government-owned coeducation secondary schools out of 29 comprehensive schools in the population; this will be drawn through multi-stage sampling technique.

First, the researcher stratified the secondary schools into single sex schools and coeducational schools**.** There are 12 single sex schools and 17 coeducational schools in Aba North Local Government Area (Research and Statistics Unit, Aba Education Zonal office). Simple random sampling technique was used to draw four secondary schools out of the 17 co-educational schools through balloting without replacement. The researcher sampled only coeducational schools in order to take care of the gender variable. These four schools were randomly selected from the population by the researcher who wrote down the names of the 29 schools on pieces of paper and asked a student to pick 4 schools out of the 29 schools. Each of these schools comprises SS1 students, and these schools were randomly assigned to experimental and control groups.

Secondly, the researcher sampled one intact class from each of the sampled schools through simple random sampling technique. These four intact classes were randomly assigned to treatment and control condition through simple random sampling procedure. two (2) schools was drawn from each group and students from each school were stratified according to gender. This gave one hundred (100) students from each of the schools in the group, 50 students (25 males and 25 females) will be randomly sampled. Therefore, this implies that fifty (50) students were sampled from each of the four schools selected. Finally, in each school, two intact classes were randomly drawn while the number of students in each class was collected from the class register.

Instrument for Data Collection

Two instruments were used in the collection of data for the study. First, Studentsô Academic Self-efficacy Beliefs Questionnaire (SASEBQ) which is adapted from generalized self-efficacy scale by Schwarz and Jerusalem (1995) was used by the researcher. Secondly, Mathematics Achievement Test (MAT) adopted from Junior WAEC, which is now known as BECE (2006, 2013 & 2014) past question papers were used.

The SASEBQ is made up of twenty (20) items which will be structured on a 4 point rating scale of strongly agree (SA), Agree (A), Disagree (D), and Strongly Disagree (SD), designed to measure studentsô academic self-efficacy. This is made of both positively skewed and negatively skewed items. Positively skewed was marked in order of: SA = 4 points, A =3 points, D= 2 points and SD = 1 point. While negatively skewed items was scored in order of; SA = 1point, A = 2 points, D = 3 points, and SD = 4 points. It contained two sections, A and B. Section óAô seeks to elicit responses regarding studentsô personal data, while section óBô elicits response regarding studentsô academic self-efficacy. While the MAT was made up of 24 essay questions designed to measure studentsô understanding of the content chosen for

the study, there were two forms; the form 1 of the instrument was developed to measure studentôs achievement in mathematics. It comprised 24 essay questions constructed for SS1 and these questions were adopted from BECE past questions. The form 2 of the instrument was the reshuffling of form 1 version. The scoring of this instrument was in percentage, that is, 100%. Students were given two and half hours to solve the problems and questions 2, 11, 12 and 13 carry 5 marks each while the rest of the questions carry 4 marks each.

Validation of the Instrument

The instrument was subjected to face validity to determine its adequacy and appropriateness for the study. The instrument was presented to three experts in Faculty of Education, one in Measurement and Evaluation, and two from Educational Psychology all in the University of Nigeria, Nsukka. The Mathematics Achievement Test instrument, is standard questions adapted from BECE past question papers and therefore, were not required for further validation.

Reliability of the Instrument

In order to ascertain the reliability of the instrument for the study, 30 copies of the instrument were subjected to pretest using two schools outside the study area; the result that was obtained after the pretesting was subjected to the test of internal consistency using Cronbach Alpha procedure to measure its reliability. The test yielded a coefficient of 0.85, indicating that the instrument was quiet reliable for the study.

Experimental Procedure

Before the initiation of the training, the researcher sought for the co-operation of the principals of the schools involved in the research to enable her in her research programme into the school schedule without disrupting the later. This was achieved by explaining to the

principals, the purpose and the benefits of the study that could be derived if properly done. The principals then introduced the researcher to the mathematics teachers who served as the research assistants. Then the researcher explained the purpose and important of the research and requested for their cooperation. The researcher and the teachers scheduled for the training, after that training began.

The researcher was not involved directly in the execution of the treatment programmes rather gave the validated lesson plans to the trained mathematics teachers who served as research assistants in both treatment and control schools. The teachers in the treatment classes received training separately from those teachers in the control groups before involving them in teaching the students. The reason for doing that was to ensure that the teachers in the treatment groups acquire the necessary competencies for implementing the programme (treatment and control conditions). The researcher took another measure to determine the extent of the mastery of the required skills by the research assistants by using them to teach other subject outside the study area, as trial testing and that was done before teaching the main sample students.

Before the commencement of the actual treatments, the two instruments (ASEBQ and MAT) were administered to the subjects (pre-testing), both treatment and control groups. These pretest scores were used as covariate to the studentsô post-test scores. The mathematics teachers administered the tests under the guidance of the researcher.

The experiment lasted for 8 weeks; each week has a different topic that lasted for 35 minutes. Both experimental and control groups were pre-tested before treatment. The BECE past question papers (2006, 2013 & 2014) were used to evaluate the two groups. Reason for using BECE 2006, 2013 and 2014 was because they were standard questions and again it has same syllabus. The researcher incorporated the assistance of the math teachers to teach the

two groups using the criterion system of grading for control group. Example any student that scores from 70ī 100 is óAô while 60-69 B, and so on. While the experimental group was assessed using comparative (norm-referenced) grading system to assess students, by finding the average score of the studentsô test scores. For instance, if the average score is 45, any student that scores 45% and above passed. The math teacher marked studentsô papers using norm-referenced and criterion referenced (taking into consideration the steps) system of grading for each group while the researcher maintained class orderliness.

The same scheme was used to teach the two groups but method of grading differed. At the end of the treatment, a common post-test was administered to the two groups. The scripts were collected, marked and scores recorded according to the grading system used. The data was analyzed based on these scores and comparison was made to know which grading system boosts studentsô academic self-efficacy: That is, whether norm-referenced or criterion referenced. The researcher used direct delivery method to administer the instrument to the students. The researcher incorporates the assistance of the teachers who were trained on how to use the two methods and other details so as to ensure proper classroom control. The following are the lesson notes for the experiment in appendix c.

Control of Extraneous Variables

The researchers during the research took some measures to minimize the mitigation threats to the research. The measures were as follows:

Pretest-posttest: pretest posttest was administered before the experiment. That enabled the researcher to attribute the additional posttest score to the effect of treatment. Pretest posttest equally allowed the researcher to establish the homogeneity of the sample.

The use of intact class: The use of intact classes for both experimental and control groups was to remove the threat of selection bias. In addition took care of Hawthorne effect which results when the students are aware that they are engaged in an experiment.

Researcher's bias and Teacher's factor: In order to eliminate researcherôs bias, the researcher directly involved in teaching the students, but, each school was taught by their normal mathematics teachers. The students were not conscious that a research was in progress. Likewise to remove the teacher factor, the same teacher was not to teach the two groups (experimental and control groups) in all the schools. But each group was taught by their school mathematics teachers. Hence any difference in posttest cannot be as a result of difference in teacher-researcher personality or other such construct or traits.

Inter group variables: For the fact that intact classes were used for this study, it means that initial equivalence would not be assured for the research subject in the groups. In order to eliminate the errors of non-equivalence arising from the non-randomization of the subject, the researcher used the Analysis of Covariance (ANCOVA). This invariably was in no doubt compensated for the non-equivalence among the research subject.

Subject interaction: The researcher did not select treatment and control groups from the same school to ensure that the students in the treatment and control groups do not mix up at all. This helped to reduce the error that might arise from interaction and exchange of ideas among research subject from the two groups.

Method of Data Analysis

The data collected by administering the pretest-posttest instruments were analyzed in line with each research question and hypothesis. Descriptive statistics like means and standard deviation were used in answering the research questions. Analysis of Covariance (ANCOVA)

was used to test the hypotheses at p’ 0.05 level of significance. That was used to determine if there was a significant difference in the mean score of the groups, and the data was presented in the table**.** In making decisions on the research questions regarding the effect of comparative grading in mathematics and academic self-efficacy beliefs from SASEBQ and MAT, responses were grouped into high and low academic self-efficacy, depending on the level of dispersion in the mean. This in order word means that if any mean ranging from 2.5 and above is high, while any mean below 2.5 is low. In the hypotheses, when calculated if the calculated value is greater than the critical value, the null hypotheses was rejected, on the contrary, the hypotheses was accepted.

CHAPTER FOUR

RESULTS

This chapter presents the analysis of the data in accordance with the research questions and the hypotheses that guided the study.

Research Question One: What are the mean achievement scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading?

Table 1: ***Mean and standard deviation of the achievement mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading***

Group	Pre-test			Post-test		
	N	Mean	SD	Mean	SD	Mean Gain
Experimental	100	30.68	15.05	48.81	20.48	18.13
Control	100	29.50	14.21	37.09	15.67	7.59

Table 1 shows that the students that were exposed to comparative grading had mean achievement score of 48.81 with a standard deviation of 20.48 at the post-test while those that were exposed to criterion referenced grading had mean achievement score of 37.09 with a standard deviation of 15.67. Mean gain scores of 18.13 and 7.59 for the two groups respectively imply that the students who were exposed to comparative grading achieved higher than their counterparts.

Research Question Two: What are the academic self-efficacy belief mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading?

Table 2: ***Mean and standard deviation of the academic self-efficacy belief mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading***

Group	Pre-test			Post-test		
	N	Mean	SD	Mean	SD	Mean Gain
Experimental	100	2.24	.22	3.35	.43	1.11
Control	100	2.28	.24	2.91	.74	0.63

Table 2 shows that the students that were exposed to comparative grading had mean self-efficacy belief of 3.35 with a standard deviation of 0.43 at the post-test while those that were exposed to criterion referenced grading had mean self-efficacy belief of 2.91 with a standard deviation of 0.74. Mean gain scores of 1.11 and 0.63 for the two groups respectively imply that the students who were exposed to comparative grading had higher self efficacy beliefs than their counterparts.

Research Question Three: What are the achievement mean scores of male and female students in mathematics?

Table 3: ***Mean and standard deviation of the achievement mean scores of male and female students in mathematics***

Gender	Pre-test			Post-test		
	N	Mean	SD	Mean	SD	Mean Gain
Male	100	29.45	14.49	42.13	18.60	12.68
Female	100	30.87	14.81	41.96	19.79	11.09

Table 3 reveals the achievement mean scores of male and female students in mathematics. It shows that male students had post-test mean achievement score of 42.13 with a standard deviation of 18.60 while their female counterparts had post-test mean achievement score of 43.96 with a standard deviation of 19.79. Mean gain scores of 12.68 and11.09 for the male

and female students respectively may have indicated that male students achieved higher than their female counterparts.

Research Question Four: What is the academic self-efficacy of mean scores of male and female students in mathematics?

Table 4: ***Mean and standard deviation of the academic self-efficacy mean scores of male and female students in mathematics***

Gender	Pre-test			Post-test		
	N	Mean	SD	Mean	SD	Mean Gain
Male	100	2.27	.22	3.15	.62	.88
Female	100	2.26	.24	3.10	.67	.84

Table 4 reveals the mean self-efficacy belief scores of male and female students in mathematics. The analysis shows that male students had post self-efficacy belief mean score of 3.15 with a standard deviation of 0.62 while their female counterparts had post self-efficacy belief mean score of 3.10 with a standard deviation of 0.67. Mean self-efficacy belief gain scores of 0.88 and 0.84 for the male and female students respectively may have indicated that male students had higher self-efficacy belief score than their female counterparts.

Hypothesis One: There is no significant difference between the achievements mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading.

Table 5: ***Analysis of Covariance of the influence of comparative grading on students' achievement in mathematics***

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8289.414[a]	4	2072.353	6.271	.000
Intercept	70068.330	1	70068.330	212.045	.000
Pre-test	2.425	1	2.425	.007	.932
Treatment	7724.713	1	7724.713	23.377	.000
Gender	607.255	1	607.255	1.838	.177
Treatment* Gender	848.663	1	848.663	2.568	.111
Error	64436.086	195	330.441		
Total	441666.000	200			
Corrected Total	72725.500	199			

a. R Squared = .114 (Adjusted R Squared = .096)

The analysis of data in Table 5 shows that the probability associated with the calculated value of F (23.277) for the effect of comparative grading on studentsô achievement in mathematics is 0.000. Since the probability value of .000 is less than the .05 level of significance ($p < .05$), the null hypothesis was rejected. Thus, there is a significant difference between the achievement mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading in favour of those exposed to comparative grading.

Hypothesis Two: There is no significant difference between the academic self-efficacy mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading.

Table 6: ***Analysis of Covariance of the influence of comparative grading on students' academic self-efficacy in mathematics***

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9.698[a]	4	2.424	6.444	.000
Intercept	22.903	1	22.903	60.873	.000
Pre-self Efficacy	.066	1	.066	.176	.676
Treatment	9.251	1	9.251	24.589	.000
Gender	.001	1	.001	.004	.950
Treatment * Gender	.154	1	.154	.409	.523
Error	73.366	195	.376		
Total	2047.455	200			
Corrected Total	83.064	199			

a. R Squared = .117 (Adjusted R Squared = .099)

Table 6 shows that the calculated value of F (24.589) for the effect of comparative grading on studentsô self-efficacy beliefs in mathematics is 0.000. Thus, there is a significant difference between the academic self-efficacy belief mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading in favour of the those exposed to comparative grading. This is for the fact that the probability value of 0.000 is less than the 0.05 level of significance ($p < .05$).

Hypothesis Three: There is no significant difference between the achievement mean scores of male and female students in mathematics.

Table 15 shows that the probability associated with the calculated value of F (1.838) for the influence of gender on studentsô achievement in mathematics is 0.177. Since the probability value of 0.177 is greater than 0.05 level of significance ($p > .05$), the null hypothesis was accepted. Thus, there is no significant difference between the achievement mean scores of male and female students in mathematics.

Hypothesis Four: There is no significant difference between the academic self-efficacy belief mean scores of male and female students in mathematics.

Data analysis in Table 6 reveals that the probability associated the calculated value of F (0.004) for the influence of gender on studentsô academic self-efficacy beliefs is 0.950. Since the probability value of 0.950 is greater than the 0.05 level of significance, the null hypothesis was accepted. Hence, there is no significant difference between the academic self-efficacy belief mean scores of male and female students in mathematics.

Summary of Findings

The following are the findings of the study;

1. Students who were exposed to comparative grading achieved higher than those exposed to criterion referenced grading. Further analysis showed that there is a significant difference between the achievements means scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading in favour of those exposed to comparative grading.
2. Students who were exposed to comparative grading had higher academic self-efficacy beliefs than their counterparts who were exposed to criterion referenced grading. It was further found that there is a significant difference between the academic self-efficacy beliefs mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading in favour of those exposed to comparative grading.

3. Male students achieved higher than their female counterparts. However it was observed that there is no significant difference between the achievements means scores of male and female students in mathematics.

. 4. Male students had higher self-efficacy belief score than their female counterparts. Further analysis showed that there is no significant difference between the academic self-efficacy beliefs means scores of male and female students in mathematics.

CHAPTER FIVE

DISCUSSION, CONCLUSION AND SUMMARY

The chapter presents the discussion of findings; conclusions reached from the findings of the study; educational implications of the study; recommendations; limitations of the study and suggestions for further research and the summary of the study.

Discussion of Findings

The discussion of the findings was done under the following subheadings.

- Effect of comparative grading on the academic achievement of students in mathematics
- Effect of comparative grading on the academic self-efficacy beliefs of students in mathematics
- Influence of Gender on the academic achievement of students in mathematics
- Influence of Gender on the academic self-efficacy beliefs of students in mathematics

Effect of comparative grading on the academic achievement of students in mathematics

The findings of the study revealed that students who were exposed to comparative grading achieved higher than those exposed to criterion referenced grading. Further analysis showed that there is a significant difference between the achievements means scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading in favour of those exposed to comparative grading. This finding is in line with the findings of Wilburn and Felps (2000) and Emmert and Wilburn (2001). According to Wilburn and Felps (2000) and Emmert and Wilburn (2001), the overall middle school students obtained significantly higher achievement scores in mathematics when evaluated using a comparative grading method than when evaluated using criterion-referenced method.

Effect of comparative grading on the academic self-efficacy beliefs of students in mathematics

The results of the study revealed that students who were exposed to comparative grading had higher academic self-efficacy beliefs than their counterparts who were exposed to criterion referenced grading. It was further found that there is a significant difference between the academic self-efficacy beliefs mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading in favour of those exposed to comparative grading. In line with the findings of this study, Wilburn and Felps (2000) found that students evaluated by comparative grading method demonstrated significantly more academic self-efficacy beliefs in the subject under study than did those students evaluated by criterion referenced method.

Influence of Gender on the academic achievement of students in mathematics

The findings of the study revealed that male students achieved higher mathematics test than their female counterparts. However, it was observed that there is no significant difference between the achievements means scores of male and female students in mathematics. The findings of this study agree with the findings of Okeke (2013) and Okonkwo (2014). Okeke found that project-based method favours both male and female students alike in Government curriculum instruction. Okonkwo (2014) found that there is no significant influence of gender on studentsô achievement in Government in secondary schools. However, this finding is contrary to the findings of Ezanya (2004); Lynch and Paterson (2002), and Kolawole (2008). These studies showed that gender is significant in chemistry achievement, science process skills and mathematics in favour of male students.

Influence of Gender on the academic self-efficacy beliefs of students in mathematics

The result of the study showed that male students had higher self-efficacy beliefs score than their female counterparts. Further analysis showed that there is no significant

difference between the academic self-efficacy beliefs means scores of male and female students in mathematics. The findings of the study are buttressed by Booth and Brinkerhoof (2013) who maintained that there is no gender influence on academic self-efficacy beliefs of students in biology.

Conclusion

This study sought to determine whether students working under a comparative approach to grading or students under a criterion-referenced method that allows grades to be distributed according to relative performance and improvement in regard to predetermined performance standards would reveal greater achievement gain scores. The findings of this study led to the following conclusions.

1) Students who were exposed to comparative grading achieved significantly higher than those exposed to criterion referenced grading.

2) Students who were exposed to comparative grading had significantly higher academic self-efficacy beliefs than their counterparts who were exposed to criterion referenced grading.

3) There was no significant difference between the achievement mean scores of male and female students in mathematics.

4) There was no significant difference between the self-efficacy belief scores of male and female students in mathematics.

Educational Implications of the Findings

The implications of this study in regard to the effect of comparative grading on achievement may be summarized as follows:

(1) The criterion referenced grading system restricts the academic achievement of most students.

(2) A comparative grading approach significantly increases the academic ability of students when compared to criterion referenced method of grading.

(3) Schools must begin to individualize the evaluation segment of the teaching-learning evaluation process to best fit the academic grade level and abilities of each group of students and/or individuals.

(4) The use of comparative evaluation system is of benefits both high and low achieving students than does the criterion referenced grading.

Recommendations

Based on the findings of the study, the following recommendations were made by the researcher;

1. School authorities should encourage mathematics teachers to adopt comparative grading system in the evaluation of students.
2. Teachers of mathematics should endeavour to use comparative grading approach in the evaluation of the students.
3. There should be no gender bias in the teaching and learning of mathematics since both male and female students were found to have achieved equally in the mathematics test.

Limitations of the Study

The findings of this study may have been affected by the following factors;

1. Only few schools in the study area were used for the study. The sample of the study may have not been good enough to represent the whole schools in the study area.
2. The content scope for the study was limited to basic mathematical operations.

Suggestions for Further Studies

In the light of the above limiting factors, the researcher proffered the following suggestions for further studies;

1. The study can be replicated by future researchers in which large sample size will be used for the sake of generalizability of the findings.

2. The study can also be replicated using various contents of mathematics.

Summary of the Study

The study investigated the effect of comparative grading on the achievement and academic self-efficacy of students in mathematics. Four research questions and four null hypotheses guided the study. The study adopted quasi experimental research design specifically, pretest-posttest non equivalent control group design. A sample of 200 mathematics students was used for the study. Mathematics achievement test and academic self-efficacy beliefs questionnaire were used as instruments for data collection. Mean and standard deviation were used to answer the research questions while ANCOVA was used to test the hypotheses at 0.05 level of significance. The following are the findings of the study;

1. Students who were exposed to comparative grading achieved higher than those exposed to criterion referenced grading. Further analysis showed that there is a significant difference between the achievements means scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading in favour of those exposed to comparative grading.
2. Students who were exposed to comparative grading had higher academic self-efficacy beliefs than their counterparts who were exposed to criterion referenced grading. It was further found that there is a significant difference between the academic self-efficacy beliefs mean scores of students exposed to comparative grading in mathematics and those exposed to criterion referenced grading in favour of those exposed to comparative grading.

3. Male students achieved higher than their female counterparts. However it was observed that there is no significant difference between the achievements mean scores of male and female students in mathematics.

. 4. Male students had higher self-efficacy belief score than their female counterparts. Further analysis showed that there is no significant differences between the academic self-efficacy beliefs mean scores of male and female students in mathematics.

Based on the findings of the study, conclusions were drawn from where implications were heighted and recommendations made. Besides, limitations of the study were stated from where suggestions for further studies were made.

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Appendix A

University of Nigeria, Nsukka,
Faculty of Education,
Department of Educational Foundations,
(Educational Psychology)

Dear Respondent,

I am a student of the above department and university. Currently, I am conducting a research on **Effects of comparative Grading in Mathematics on Students' Academic Self-efficacy Beliefs and Achievement in Aba Education Zone of Abia State.**

The researcher is soliciting for your help to fill this questionnaire to enable me conduct the research, I assume that the information provided will be treated with utmost confidentiality and used strictly for the purpose of the research.

Thanks for your anticipated co-operation.

Yours faithfully,

Uduka Onyighi Kalu

Appendix B

STUDENTS' ACADEMIC SELF-EFFICACY BELIEFS QUESTIONNAIRE (SASEBQ).

Instruction: Tick (ã) against the response of your choice.

Keys: SA ï Strongly Agree

A - Agree

D ï Disagree

SD ï Strongly Disagree

Section A: Personal Data

Name of schoolé é

Type of School: Boys ☐ Girls ☐ Mixed ☐

Sex: Male ☐ Female ☐

S/N	Items	SA	A	D	SD
1	I am confident that I can make nice grade in math				
2	I always have good grade in math examine				
3	I can always solve many mathematics problems in the class				
4	Whenever I fail in math examine it discourages me				
5	It is easy for me to read for my examination				
6	Whenever I encounter difficult questions in math examine, I try my best				
7	I have never been discouraged as a result of low grade in math				

8	When I get low grade in math exam, it makes me to put in more efforts				
9	I believe I can always make good grades in math examination				
10	I can usually think of a solution when I face difficult questions in math				
11	My friends in the class are all better than I am in math				
12	I adjust my study habit when I make low grades in math				
13	I always have confidence in my abilities in math				
14	Most times I solve difficult problems in math on my own				
15	I can solve most math questions in the class if I really try				
16	I am always a failure when it comes to grading in math				
17	I do not think I have once attempted any difficult question in the class				
18	I rely on my friends whenever I encounter difficult problems in math				
19	Sometimes, I think that difficult problems in math is for some group of students				
20	I am always afraid to face difficult questions in the class				

Appendix C

Lesson Note for the Experiment

The following are the lesson notes for the experiment:

Proposed lesson note for week one

Subject; General Mathematics

Topic: Number Base System

Class; SS1

Average Age: 14 years

Time: 35 minutes

Date:

Specific Objectives: By the end of the lessons, students should be able to:

i. Convert numbers from other bases to base 10

ii. Convert decimal fraction from other bases to base 10.

iii. Convert from one base to another base.

iv. Perform basic operation on number bases (exception of base 2).

v. Apply number system to computer programming.

Entry Behaviour: The teacher starts the lesson by asking the students questions based on their previous topic.

Instructional Materials: Use of chalkboard, course book and Nigerian currency.

Instructional Procedure:

Content	Teacherôs performance Activity	Students performance Activity	Instructional Techniques
Introduction	The teacher introduces the lesson by asking students questions based on their previous lesson.	The students respond positively to the teacherôs question.	The teacher set induces students through probing questions.

Definition	The teacher defines number systems as a way of representing numbers.	They listen as the teacher defines number system and repeat after the teacher.	The use of explanation and oral drill.
Types	The teacher explains to the students that there are types of number system ï base2,5,7,8,9 and 10	They listen as the teacher explains the various types of number system.	The use of oral drill and repetition.
Worked examples	The teacher works some examples on the chalkboard, telling them that there are basically two methods of converting numbers from other bases to base 10. 1. Power expansion ï multiplying out the number using their place values. Convert 1101012 to 10. Solution: $1101012 = 1\times2^5 + 1\times2^4 + 0\times2^3 + 1\times2^2 + 0\times2^1 + 1\times2^0$ $=1\times32+ 1\times16+0\times8+1\times4+0\times2+1\times1$ $=32+16+0+4+0+1=53_{10}$	They listen as the teacher solves the problem on the board, ask questions where they are not following.	Use of explanation and illustration.
Evaluation	The teacher evaluates students with the following questions: a. Convert the following to base 10 using expanded notation, 4261_8 ,3562_7 b. Express 241.23_8 in base 10. c. Convert 11.11_2 to base 10 (d) Convert 11101_{two} to base 10. e. Find the value of$(101_{two})^3$	They follow the teachersô examples and solve the problems given by the teacher.	Use of oral drill and marking and correction.
Summary	The teacher will give class work, mark their exercise and rank the students performances.	The students will know how far they have understood the lesson from their individual scores.	The use of reinforcement (both positive and negative).

Lesson Note on General Mathematics for week two & three

Topic: Proportion

Class; SS1

Average Age: 14years

Duration: 35 minutes

Date:

Specific Objectives: By the end of the lesson, students should be able to:

1. Explain the meaning of direct proportion.
2. Identify direct proportions by ratios.
3. Solve problems involving inverse proportion.
4. Distinguish between compound interest and simple interest.

Entry Behaviour: The teacher starts the lesson by asking questions based on their previous work.

Instructional Materials; Use of chalks and chalkboard with relevant textbooks.

Instructional Procedure;

Content Development	Teacherôs Activity	Studentsô Activity	Instructional Techniques
Definition and explanation of proportion	The teacher explains to the students that proportion is a name given to a statement that two ratios are equal. It can be written in two ways: two equal fractions a/b=c/d or using a colon, a:b=c:d. So, when two ratios are equal, then the cross product of the ratio are equal. That is, for the proportion, a:b= c:d,a×d=b × c. Expression in this form is called direct variations or direct proportions.	The teacher writes this on the chalkboard and asks students to read aloud what she has written	Use of repetition
Worked examples	The teacher works some examples thus: The area A of a rectangle varies directly as the square of its length L. If the length is 6cm when the area is 144cm^2 ,find its area when the length is 8cm Solution: since A **a** l^2 then A=kl^2 , where k is the constant of	Students listen as the teacher explains how the problems are	Use of explanation and questioning

	proportionality. That is $k=A/l^2 =144/6^2 =144/36= 4$. When l=8, we substitute in the expression for A to have $A=4\times 8^2=256cm^2$	solved. They ask questions where they do not understand and contribute by answering questions	
Simple Interest	The teacher explains to them that simple interest is the change paid on the initial or basic sum saved, lent or borrowed, it can be calculated by using this formula - I= PTR/100, where I=simple interest, P=Principal, R= Rate and T= Time. Example 1:Find the simple interest on #250 for 5 years at 8% per annum? Solution: P=#250,R=8%,T=5 Therefore, I= PTR/100 = #250 × 8 × 8/100 =#100 Example 2. Find the amount of #720 in 31/2years at 6% per annum. Solution; P=#720,R=6%, T= 31/2, I=? Therefore, I =#720 ×6 ×31/2/100 =#720 × 6 ×7/100×2 =#36 × 3×7/5=756/5=151.2 Amount= Principal + interest I=#151.20, P= #720.00 = #(151.20720.00)=#871.20	They listen very attentively to the teacher, ask questions and supply answers to questions asked by the teacher.	Use of illustration, explanation and examples
Compound Interest	The teacher explains to students that compound interest arises when interest is added to the principal of a deposit or loan,	They listen and copy down note	Use of explanation and examples.

	so that, from that moment on, the interest that has been added also earns interest. This addition of interest to the principal is called compounding. Example, what is the compound interest at 5% per annum on #4,000 for 4 years? Solution: For 1st year= #4,000 rate of interest = 5% therefore interest in 1 year= 5/100 x #4000 = #320. At the end of 1st year P+I=4000+200, principal for 2nd Year now becomes 4200, and so on till the 4th year. Interest for the 4th year =5/100×4,630.50/123,152.50/100=#231.525 =#231.53 to the nearest kobo. Therefore, amount at end of 4th year = 4,630.50 + 231.53 = # 4,862.03 to the nearest kobo. Therefore, compound interest for 4 years = (4,862.03 ī 4000) = #862.03 to the nearest kobo.		
Inverse proportion	The teacher explains to the students that when the number of a variable x increases, the number of y decreases, this type of proportion is called an inverse proportion. Example, if a piece **is** of length 12cm, find the number of pieces using chart on the chalkboard. Solution: Let the number of pieces be n. We compare the number of pieces n and a length of 20cm, we have n/3 = 1/12/20= cross multiply, we have n/3=20/12, 12n=60, n=5. The ratio of any two number of pieces is equal to the	They follow the teacherôs examples and solve the problems given by the teacher	Use of explanation and examples

	reciprocal of the ratio of corresponding length. For a length of 12cm, the thread will be cut into 12 equal pieces. Alternatively, this can be verified from the reciprocal(or inverse relation), n=k/l, n=3 when l=20,find n when l=12; 3=k/20 or k=60, therefore n=60/l=60/12=5.		
Evaluation	The teacher evaluates the students by giving them the following problems to solve.(a) It took 4 men 6 days to dug a sock away pit of a building. How many men will do the same job in (a) 2 days (b) 12 days? (2).Udoka rented 100 chairs at the rate of #300 each, per day; 300 plates at the rate of #1.20 each, per day;150 spoons at the rate of 65k each, per day and 4 canopies at #500 each per day .If these items were rented for 3 days by , what is the total amount paid by Udoka for renting the items? (3) A man invested #250.60 at the rate of 15% for twenty years. Find its simple interest	They ask questions where they do not understand and do some exercises.	Use of evaluation and supervision
Summary	The teacher end the lesson by monitoring students as they work, do the marking and correction on the board.	Students submit their work for marking and do correction where necessary	Use of oral drill and supervision

Lesson Note on General Mathematics for week four

Topic: Fraction and Ratio

Class; SS1

Average Age; 14 years

Duration; 35 minutes

Date;

Specific Objectives: By the end of the lesson students should be able to;

1. Define fraction and ratio
2. Solve problems on fractions and ratios
3. Relate ratio to real live problem.
4. Apply fraction in everyday life problem.
5. Change fractions to percentages

Entry Behaviour: The teacher starts the lesson by asking the students questions based on previous topic.

Instructional Materials; Use of orange, course book and chalkboard.

Content Development	Teacherôs Activity	Studentsô Activity	Instructional Techniques
Definition of fraction and ratio.	The teacher defines fraction as a number with numerator and denominator, it is a part of a whole e.g 1/2 ,3/4, 4/5 and so on. Ratio on the other hand is a way of comparison. It allows us to compare the magnitude of two things that are related. Ratio can be expressed as a fraction. The first	Students listen as the teacher explains and take down note.	Use of explanation and repetition.

	number of a ratio becomes the numerator while the second number of the ratio is the denominator, e.g,3:2 =3/2; 6:4= 6/4 etc		
Conversion of fractions to decimals	The teacher explains to them on how to convert fractions to decimals, eg, Express the fractions in decimals (a)3/4 (b)3/8 (c)5/6 Solution: 3/4 =0.75 (b)3/8= 0.375 (c)5/6= 0.833, here we convert fractions to decimals, eg, Express the fractions in decimals (a)3/4 (b)3/8 (c)5/6 Solution: 3/4 =0.75 (b)3/8= 0.375 (c)5/6= 0.833, here we keep on getting 3, hence this type of decimal is called recurring decimal.	They listen to the teacher and contribute by answering questions.	Use of explanation and examples.
Conversion of fractions to percentages	The teacher explains to students that to convert a fraction to percentage, multiply fraction by 100% and	They listen to the teacher and copy down note.	Use of explanation and questioning.

	simplify, example, write these fractions as percentages (a3/5) (b) 2/3 (43/50). Solution: (a) 3/5 =3/5×100/1=60% (b) 2/3 =2/3×100/1=66% (c) 43/50=43/50×100/1 =86%		
Worked examples on ratio	The teacher works some examples on the chalkboard. What is the ratio of 4 months to 1 year? Solution: 4 months $\frac{4 \text{ months}}{1 \text{ year}} = \frac{4 \text{ months}}{12 \text{months}}$ 1/3 = 1:3. Example 2 The ratio of cement to sand in a mixture is 2:5. If there are 8 bags of cement in the mixture, find the amount of sand in the mixture. Solution: Ratio of cement to sand in the mixture = 2:5, therefore, if there are2 bags of cement, there will be 5 bags of sand. If there are 8 bags of cement, i.e. 2 bags × 4,there	They copy down note and answer questions.	Explanation and questioning.

	will be(5 bags ×4) =20 bags of sand.		
Evaluation	The teacher evaluates students by giving them assignment. (1)Arrange the following fractions in descending order of magnitude 5/9, 7/15, 11/20, 3/8. (2)Arrange in ascending order of magnitude 3/4, 1/4, 2/5,2/3 (3)Express 3/8 as a percentage.	They follow the teacherôs example and solve the given problems.	Use of evaluation and supervision.
Summary	The teacher ends the lesson by marking studentsôwork, and calls out students to do correction by themselves.	Students submit their work for marking, and do their corrections where necessary.	Use of correction and oral drill.

Lesson Note on General Mathematics for week 5 & 6

Class: SS1

Topic: Algebra

Average Age: 14 years

Duration:35 minutes

Date;

Specific Objectives: By the end of the lesson, students should be able to:

1. Factorize simple algebraic expression.
2. Expand a given algebraic expression.
3. Develop interest in factorization through the use of quadratic equation box.

Entry Behaviour; The students have learnt expressions involving brackets and fractions.

Instructional Materials: Use of explanation, questioning, examples and course book.

Content Development	Teacherôs Activities	Studentsô Activities	Instructional Techniques
Definition and expansion of algebraic expression	The teacher defines algebra as a branch of mathematics that substitutes letters for numbers. Giving the expression (x+2)(xī 5) means (x+2)× (xī 5). The product of the two binomial (x+20) and (xī 5) is found by multiplying each term in the first binomial by each term in the second binomial. Example 1. Find the product of (x+2) and (xī 5), solution: (x+2)(xī 5)=x(x5)×2(xī 5) =x^2 ī 5x × 2xī 10 = x^2 ï 3x ī 10 Example2 Expand(xī 3m)(cī 4m) =2c(cī 4m)ī 3m(c-4m) =2c^2 ī 8cm ī 3cm +12m^2 =2c^2 ï 11cm2c^2 ï 11cm + 12m	Students listen, answer questions and take down note	Use of explanation and repetition.
Coefficient of term	The teacher works some examples thus, remove brackets from the following (a)3y(x + z) (b) 4x(a + b) Solution: (a)3y(x+ z) =3y	They listen and copy down note	Use of explanation and examples.

	× x+ 3y × z=3yx × 3yz (b) 4x(a + b) =4x × a × 4x × b =4ax × 4bx. Simplify 2(4r + 3s)ī 3(2r+3s) = 8r+6sī 6rī 9s =8rī 6r+6s ī 9s=2rī 3s		
Factorization	The teacher explains to them that the difference of the squares of two quantities is equal to the product of their sum and their difference ï (x+y)(xy) =x^2 ï xy+xy-y^2 = x^2ï y^2 Example, factorize the following (a)x^2 ï a^2 (b)x^2 ī 9, solution: (a)x^2 ï a^2 =(x-a)(x+a) b)x^2 ī 9=x^2ī 3^2 =(xī 3)(x+3)	They listen as the teacher explains and answer questions	Use of explanation and examples.
Evaluation	The teacher evaluates students by giving them take home assignment such as (a)Simplify $(1/2)^{-3}$ (b)Expand the expression$(x-3)^2$ (c) Factorise2d^3 + d^2 (3dī 1) (d)Factorize 4ī $4x^2$ (e)Factorize $9x^2$ ī 25	Students listen to the teacher and participate by asking and answering questions.	Use of evaluation.
Summary	The teacher summarizes the lesson by asking a student to solve a	They listen and supply answers to their fellow	Use of explanation and questioning.

	problem on the chalkboard.	students as the student solves the problem.	

Lesson Note on General Mathematics for week 7

Topic; Simple equations

Class; SS1

Average Age: 14 years.

Duration; 35 minutes

Specific Objectives; By the end of the lesson, students should be able to:

1. Solve simple algebraic questions.
2. Solve problems on simple equations.
3. Solve simple equations bu collecting like terms

Instructional Materials; Use of word charts displaying processes involved in the equations, flash cards

Instructional Procedures;

Content Development	Teacherôs Activity	Studentsô Activity	Instructional Techniques
Linear equation	The teacher gives examples of linear equation like: 3x + 9=0 4x ī 2=2x + 5 5 (x + 3) =4, and explains why they are called linear equations because they are plotted on a graph sheet and the line in often on a straight, hence, a linear equation is an	They listen to the teacher as he explains the terms, solve some examples and ask questions where they are not cleared.	Use of explanation and illustrations

	equation which contains only term in one variable and constants, and highest power of the variable is 1. E.g., Solve 3x + 9 =0 =3x/3 =ī 9/3= x=ī 3 Example 2; 5(x+3)=4 Clear the bracket first and collect the like terms, 5x + 15=4, 5x=4ī 15 5x=ī 11, x=ī 11/5		
Word problems leading to linear equations	He solves some word problems on linear equation, e. g; A mother is three times as old as her daughter. In ten yearsô time, she will be twice as old. How old is the mother now. Solution; Let the daughterôs age be x, then the motherôs age will be 3x in 10 yearsô time Mother=3x+10, daughter= x+ 10, but 3x + 10 is twice x +10, 3x + 10=2(x	Students listen as the teacher explains and answer question	Use of explanation and questioning

	+10),3x + 10=2x+20 3x ī 2x=20 +10 X =10. Hence, daughterôs age=10yrs Motherôs age = 10 ×3 =30 years		
Evaluation	The teacher evaluates students by asking them to solve the following; Evaluate: a.2y + 3=3yī 8 b.3/4x-1/3x =2/3 c. x/4-x=7 d. If1/2x ī 3= 1ī 1/2x, Find the value of x^2 (3) A man is ten times the age of his daughter. His daughter is five years older than their third son who is five years older. What was the manôs age four years ago? (4)Solve the equation 2x+4/3=3x+1/2 (5) Solve the simultaneous equations 3x+2y=12, 5xī 3y=1 (6)Solve the equation 6/x+3=11/xī 2 (7)Solve	They follow the teacherôs example and work on their own.	Use of evaluation.

	simultaneously to obtain m and r, 5m+2r=21é é (1) ī 10mī r =ī 18é .(2)		
Summary	She summarizes the lesson by marking and scoring students	They check and correct their work	Use of explanation and illustration

Lesson Note on General Mathematics for week 8

Topic; Standard form and Indices

Class ;SS1

Average Age; 14 years

Duration; 35 minutes

Date;

Specific Objectives: By the end of the lesson students should be able to;

1. Express any whole number in standard form
2. Express any decimal number in standard form.
3. Perform basic arithmetic operations on any number expressed in standard form.
4. State and apply the laws of indices.
5. Solve some exponential equations.

Entry Behaviour: The teacher starts the lesson by asking the students questions based on previous topic.

Instructional Materials; Use of charts of (a) standard form, (b) indices (c) solution chart on indicial equations.

Content Development	Teacherôs Activity	Studentsô Activity	Instructional Techniques
Definition	The teacher explains to them that an index of a number is the power to which that number is raised e.g , y × y × y × y=y4 óyô is the base while ó4ô is the	Students listen as the teacher explains and take down note.	Use of explanation and repetition.

	index or power. The teacher explains how larger numbers are in terms of powers of 10. Example, $1=10^0$;$10=10=10^1$;$100=10\times10=10^2$ .....$10,000=10\times10\times10\times10=10^4$		
Indices	The teacher explains to students that in a situation where a certain number is used to multiply itself several times; for instance 3 ×3 ×3×3. A short way of writing this in mathematics is usually referred to as the index form. So in index form,3×3×3×3 will be written as 3^4 . In this form, 4 is called the index or power while 3 is called the base. The index or power tells us how many times the base is multiplied by itself. Expand the following as a whole number(a)2^6 (b)3^7 (c)5^3 Solution: 2^6 $=2\times2\times2\times2\times2\times2=64$ (b)$7^3 = 7\times7\times7=343$ (c)$5^3 =5\times5\times5=125$	They listen to the teacher and contribute by answering questions.	Use of explanation
Index of numbers and standard form	The teacher explains to them using the chart. Ordinary numbers such as 100,1000,10000,100000, 0.0001, 0.056 have powers like 2,3,4,5,-4,-2 and their	They listen to the teacher and copy down note.	Use of explanation and questioning.

	standard form are 1.0 $x10^2$, 1.0 $x10^3$ etc.		
Laws of indices	The teacher explains to students that there are two laws of indices ï multiplication law $a^x x\ a^y = a^{x+y}$ if the base are the same add the powers (indices), e.g, $3^2 x3^4 = 3^6$ Division law $a^x \div a^{yx} = a^{x-y}$. The division law states that when division is involved, subtract the powers provided that the base is the same.	They copy down note and answer questions.	Explanation and questioning.
Exponential(indicial) equation	The teacher explains to them that where equations are involved, they should solve by expressing both sides of the equation in the same base and equate the powers, e.g, $2^x = 8$,$2^x = 2^3$, x=3	They copy down examples and ask questions where it is necessary	Use of explanation and questioning.
Decimal numbers	The teacher explains to them that decimal numbers can be expressed in terms of powers of 10, and in this case, the powers are negative, thus; $0.1=1/10=1/10=10^{ī\,1}$,$0.001=1/1000=1/10^3=10^{ī\,3}$		.
Whole numbers in standard form	The teacher explains to the students that when a number is written in the form $A\times10^n$ where A is a number between 1 and 10, and n is either	They contribute by answering questions and copy down note.	.Use of explanation and questioning.

	positive or negative, it is in standard form. Example, express the following in standard form (1)5,000,000 $=5\times10^{6}$ (2) 7,200,000,000$=7.2\times10^{9}$ and so on		
Basic operations on numbers in standard form	The teacher makes the students know that expressions involving standard notation can be evaluated. This means that numbers in standard form can be multiplied, divided, added and subtracted. Example, evaluate the following, leaving your answers in standard form.(a) $(2.51\times10^{6})\times(7.63\times10^{5})$, (b) $(4.08\times10^{\bar{1}\,8})\div(3\times10^{6})$ Solution: $(2.51\times10^{6})\times(7.63\times10^{5})$ $=2{,}51\times7.63\times10^{(6+5)}$ $=19.1513\times10^{11}$ $=1.91513\times10^{1}\times10^{11}$ $=1.91513\times10^{12}$ (b)$(4.08\times10^{\bar{1}\,8})\div(3\times10^{6})$ $=4.08/3\times10^{\bar{1}\,8\bar{1}\,6}$ $=1.36\times10^{\bar{1}\,14}$	They listen to the teacher, ask and answer questions.	.Explanation and use of example.
Evaluation	The teacher evaluates students by giving them problems to solve. Simplify the following: (1a)$2a^{-2}$ x $(3a)^{4}$ (b)$0.125^{-1/3}$	They follow the teacherôs examples and solve the problems on the	Use of evaluation and oral drill

	(c) $2x^{\frac{1}{2}} \times 3x^{-5/2}$ If $3^{2x} = 27$, what is x? (2) Express the following in standard form: (a) 32.5 (b) 62300 (3) Evaluate the following leaving your answer in standard form. (a) $(5.2\times10^{9}) \times (1.3\times10^{\bar{1}6})$ (b) $(7.5\times10^{7} \div (8.7 \times 10^{\bar{1}6})$	chalkboard.	
Summary	The teacher ends the lesson by giving them take home assignment, mark and score their class work.	They assess themselves as the teacher marks their work and know the area to work	Oral drill and questioning

Appendix D

Solutions to the problems given to the students.

(1) What is the value of V In the equation $5v^2$ ī 40v + 75=0?

Solution: $5v^2$ ī 40v +75=0, dividing both sides by 5, $5v^2/5$ -40v/5 + 75/5 =0

v^2 ī 8v +15 =0, (v^2 ī 3v)ī (5v +15)=0; v (vī 3) ï 5(v ī 3)=0 ,(v ī 3)(V ī 5)=0

V ï 3 =0 or v ï 5=0 ; V=3 or v =5 Ans.

(2) Udoka rented 100 chairs at the rate of #300 each, per day; 300 plates at the rate of #1.20 each per day; 150 spoons at the rate of 65k each, per day and 4 canopies at #1500 each per day, if these items were rented for 3 days, what is the total amount paid by Udoka for renting the items?

Solution: 100 chairs @ #300 each =100 × #300 = #30,000

300 plates @ #1.20 each = 300 × #1.20 = #360

150 spoons @ 65k each = 150 × 65k =9750k,change 9750k to naira = #97.50k

4 canopies @ #1500 each =4 × #1500 = #6000

Total amount spent per day = #30,000 + #360 + #97.50 + #6000 = #36,457.50k

Therefore, total amount spent for 3 days =3 × #36,457.50k = #109,372.50k. Ans

(3) Simplify 10111two -110two + 111two leaving your answer in base ten.

Solution: Change them to base 10, thus:

$10112 = (1\times2^4) + (0\times2^3) + (1\times2^2) + (1\times2^1) + (1\times2^0)$

$= (1\times16) + (0\times8) + (1\times4) + (1\times2) + (1\times1) = 16 + 0 + 4 + 2 + 1 = 23_{10}$

$110_2 (1 \text{ x } 2^2) + (1 \times 2^1) + (0 \times 2^0)$

$= (1\times4) + (1\times2) + (0 \text{ x } 1) = 4 + 2 + 0 = 610$

$111_2 = (1 \times 2^2) + (1 \times 2^1) + (1\times2^0)$

$= 4 + 2 + 1 = 7_{10}$, therefore, $10111_{two} - 110_{two} + 111_{two} = 23-6+7 = 23+7$ ï 6=30 ī 6=24_{10}

(4) A man is ten times the age of his daughter. His daughter is five years older than their third son who is five years old. What was the manôs age for four years ago?

Solution: The daughter is 5 years older than the third son who is 5 years old, i.e 5+5.

The manôs age is 10 times the age of his daughter, i.e, 10(5+5)

As at four years ago, the manôs age was 10 (5+5) ï 4 =(10 x 10) ï 4=100ï 4 =96 years.

(5) A man invested #250.60 at the rate of 15% for twenty years. Find its simple interest.

Solution: SI=PTR/100= $\frac{250.60 \times 20 \times 15}{100}$

I = $\frac{25060 \times 20 \times 15}{100 \times 100}$ = $\frac{1253 \times 3}{5}$ = $\frac{3759}{5}$ = #751.80 .

(6) If 8x ï 4 = 6x ï 10, find the value of 5x.

Solution: 8x ï 4 =6x ï 10, collect like terms, which is, 8x ï 6x = ï 10 ÷4 = 2x = ï 6

Divide both sides by 2, $\frac{2x}{2} = \frac{6}{2}$, x = ï 3, therefore 5x =5 × x = 5x ï 3 = ï 15 .

(b) Given that $2^x = 64$, what is the value of x?

Solution: Let them be of the same base (base 2) = $2^x = 2^6$, x = 6

(7) If 1/2x ï 3 =1 ï 1/2x, find the value of x^2

Solution: 1/2x ï 3= 1 ï 1/2x = ½ × x ï 3 = 1 ï 1/2 × x

=x/2 ï 3 =1ï x/2, the L.c.m =2

Multiply each term by the 2(which is the L.c.m)

2 × x/2 ï 2 ×3 =2×1 ï 2 × x/2= x ï 6 =2 ï x, collect like terms,

x + x =2+6

2x = 8, divide both sides by 2,

$\frac{2x}{2} = \frac{8}{2}$, x = 4, therefore the value of x^2

$x^2 = 4^2 = 4 \times 4 = 16$.

(8) Convert 11101_{two} to base ten

Solution: $11101_2 = (1\times2^4) + (1\times2^3) + (1\times2^2) + (0\times2^1) + (1\times2^0)$ + 8 + 4 + 0

=(1x16) + (1x8) + (1x4) + (0x2) + (1x1)

=16+ 8 + 4 + 0 + 1 = 29_{10}

(9) Factorize $2d^3 + d^2(3d - 1)$

Solution: Open the bracket by multiplying out,

$= 2d^3 + 3d^3 - d^2 = 5d^3 - d^2 = d^2(5d - 1)$ answer.

(10) Three boys Obi, Peter, John won #210 on the football pools. If they share this amount in the ratio 2:3:5 respectively, how much will Peter receive?

Solution: Obi: Peter: John

1: 2: 4

Sum of ratio = 1 + 2 + 4 =7; amount =#210

Peterôs share = 2/7 × #210 /1 = #60, therefore, Peterôs share = #60

(11) Solve simultaneously to obtain m and r,

$5m+ 2r =21$ é (a), $-10m - r = -18$ é (b)

Solution: $5m =21 - 2r$ é .(1), $m = \frac{21 - 2r}{5}$ é .(2)

$-10(21-2r) - r = -18$, L.c.m =5 , multiply both sides by 5

$\frac{-10(21-2r)}{5} - r = -18$

$5x - 10(21 - 2r) - 5\times r = -18\times 5; -10$ ()

$-10(21 - 2r) - 5\times r = -18\times5 = -210+ 20r - 5r = -90$

$20r - 5r = -90+210 = 15r/15 = 120/15 = 8$

From equation (iii) substitute for r as 8, therefore, $m=\frac{21-2r}{5}$ $=m= \frac{21-2(8)}{5} =m=\frac{21-16}{5}$

M=5/5 =1 therefore=1, r= 8

(12) Convert (a) 4261_8 (b)3561_7 to base 10 using expanded notation.

Solution: (a)$4261_8 = 4^3 2^2 6^1 1^0$

$=4\times8^3 + 2\times8^2 + 6\times8^1 + 1\times8^0 = 4\times8\times8\times8 + 2\times8\times8 + 6\times8 + 1\times1 = 2048+128+48+1 = 2225_{10}$

(b)$3562_7 = 3^3 5^2 6^1 2^0 = 3\times7^3 + 5\times7^2 + 6\times7^1 + 2\times7^0 =$

$3\times343 + 5\times49 + 42 + 2 = 1029 + 245 + 42 + 2 = 1318_{10}$

(13) Express241.23_8 in base 10.

Solution, $2^2 4^1 1^0 .2\times8^{-1} + 3\times8^{-2} = 2\times8^2 + 4\times8^1 + 1\times8^0 + 2\times1/8_4 + 3\times1/8_2 = 128+32+1+1/4+3/64$

64

$=128+32+1+16+3 = 161\ 19/64_{10}$

(b) Find the value of $(101_{two})^3$.

Solution: $(101_2)^3 = 1^2 0^1 1^0 = 1\times2^2 + 0\times2^1 + 1\times2^0 = 4+0+1 = 5^3 = 5\times5\times5 = 125$

(c) The cost of posting a parcel weighing 1kg is #40.80. How much will it cost to post a parcel that weighs 10kg? Solution: 1kg= #40.80, therefore,10kg = #40.80 × 10 = #408.00

(14) Arrange the following fractions in descending order of magnitude 5/9, 7/15, 11/20, 3/8.

Solution: First, find the L.c .m of the fractions, then

5/9, 7/15, 11/20, 3/8

200, 168, 198, 135

360 Therefore, 5/9, 11/20, 7/15, 3/8

(b) Arrange in ascending order of magnitude 3/4, 1/4, 2/5 , 2/3

Solution: The L.c.m for the above fractions is 60.

Therefore, 3/4 ,1/4 , 2/5 , 2/3 = 1/4 , 2/4 , 2/3 , 3/4

$$\frac{45,\ 15,\ 24,\ 40}{60}$$

(15) Solve the simultaneous equation, 3x + 2y =12é é (i), 5x ï 3y = 1é é (ii)

Solution: This is solve by elimination method,

hence, 3x +2y =12 é (i) × 3 ; 5x ï 3y = 1 é .(ii) × 2

=9x+ 6y =36é ..(iii) 10x ï 6y = 2 é ..(4)

19x = 38 =19x/19 = 38/19 = 2

Substitute x = 2 in equation (2) , 3(2) + 2y =12

6 + 2y =2 =2y =12ï 6; 2y = 6 therefore y = 6/2 =3

Therefore =2, y =3

(16) Solve the equation $\frac{2x + 4}{3} = \frac{3x + 1}{2}$

Solution; First. Cross multiply the equation = $\frac{2x +4}{3} = \frac{3x + 1}{2}$ =4x + 8 =9x +3

Then collect like terms together , 4c + 8 =9x + 3 = 8ï 3 = 9x ï 4x =5x, solving for x, we divide both side by 5, that is , x = 5/5 x = 1

(17) (a) Express 3/8 as a percentage. Solution: 3/8 ×100% = 300%/8 = 371/4%

(b) Factorize the expression 4 ï $4x^{2.}$ Solution: 4 ï $4x^2$ = 4(1 ï x^2).

(c) If 1/2 (4x ï 8) = 8, what is x? Solution: Open the bracket by multiplying by 1/2

1/2 (4x ï 8) = 8; 2x ï 4 =8, collect like terms, 2x = 8 + 4 =2x = 12,

Therefore, x = 12/2=6, x= 6

(18) Solve the equation 5 (xï 7) = 7 ï 2x. Solution: Open the bracket by multiplying with 5.

5 (x ï 7) = 7 ï 2x = 5x ï 35 = 7 ï 2x, collect like terms.

5x + 2x = 7 + 35

7x =42, x = 42/7 =6, therefore x = 6

(19) Convert 11.11_2 to base 10.

Solution: $1^1 1^0 . 1^{ï\ 1} 1^{ï\ 2} = 1\times2^1 + 1\times2^0 + 1\times2^{ï\ 1} + 1\times 2^{ï\ 2}$

$= 2 +1 + 1/2^1 +1/2^2 = 3 + 1/2 + 1/4 = 3\ 4/3$ or 3.75_{10}

$$\frac{2 + 1}{4}$$

(b) Covert 11101_{two} to base 10.

Solution: $1^4 1^3 1^2 0^1 1^0 = 1\times 2^4 + 1\times 2^3 + 1\times 2^2 + 0\times 2^1 + 1\times 2^0$

$= 16 + 8 + 4 + 0 + 1 = 29_{10}$

(20) Write 482,000 in standard form.

Solution: $482{,}000 = 4.82 \times 10^3$

(21) Find the simple interest on #3,900.00 in 41/2 years at 21/4% per annum.

(22) Kalu, Mba and Chijioke shared the sum of #8,370 in the ratio4;5;6 respectively. How much is Chijiokeôs share greater than Kaluôs share?

Solution: Sum of ratio = 4=5+6 =15; Chijiokeôs share = 6/15 × #8,370/1

= #~~50,220/15~~ = #3,348; Kaluôs share = 4/15 × # 8370/1 =#33480/15 = #2232

Therefore, Chijiokeôs share is greater by # (3,348 ï 2,232) = #1,116.00

(23) Express the following in standard form: (a) 32.5 (b)62300

Solution: (a) 32.5 =$3.25 \times 10^{+1}$ (b) 62300 = 6.2300= $6.23 \times 10^{+4}$

(24) Evaluate the following leaving your answer in standard form:

(a) $(5.2 \times 10^9) \times (1.3 \times 10^{\bar{1}\,6)}$, (b) $(7.5 \times 10^7) \div (8.7 \times 10^{\bar{1}\,6})$

Solution: (a) $(5.2 \times 10^9) \times (1.3 \times 10^{\bar{1}\,6})$

$= (5.2 \times 1.3) \times (10^9 \times 10^{\bar{1}\,6}) = 6.76 \times 10^{9+(\bar{1}\,6)} = 6.76 \times 10^3$

(b) $(7.5 \times 10^7) \div (8.7 \times 10^{\bar{1}\,6}) = (7.5/8.7) \times 10^7 / 10^{\bar{1}\,6} = 0.8620 \times 10^{\bar{1}\,1} \times 10^{7\bar{1}\ (\bar{1}\,6)}$

$= 8.62 \times 10^1 \times 10^{13} = 8.62 \times 10^{12}$

Questions 2, 11, 12 and 13 carry 5 marks each while the rest of the questions carry 4 marks each.

Appendix E

Reliability

[DataSet1] C:\Users\AKOBI\Documents\My Doc\Uduka Reliability.sav

Scale: Overall Reliability

Case Processing Summary

		N	%
Cases	Valid	30	100.0
	Excluded	0	.0
	Total	30	100.0

a. List wise deletion based on all variables in the procedure.

Reliability Statistics

Cronbach's Alpha	N of Items
.847	20

APPENDIX F TEST BLUEPRINT FOR MATHEMATICS ACHIEVEMENT TEST

CONTENT AREA	KNOWLEDGE 25%	COMPREHENSION 15%	APPLICATION 20%	ANALYSIS 15%	SYNTHESIS 10%	EVALUATION 10%	TOTAL
Number Base system 10%	*1*	1	1	1	_	_	4
Proportion 25%	1	1	1	1	_	_	4
Fraction & Ratio 20%	1	1	1	1	_	_	4
Algebra 15%	1	1	1	1	_	_	4
Simple Equation 15%	1	1	1	1	_	_	4
Standard form & Indices 10%	1	1	1	1	_	_	4
% weightage	6	6	6	6	_	_	24

Univariate Analysis of Variance

[DataSet0] C:\Users\ubamakachris\Documents\Uduaka's Work.sav

Between-Subjects Factors

		Value Label	N
Group	1.00	Experimental	100
	2.00	Control	100

Descriptive Statistics

Dependent Variable: Posttest

Group	Mean	Std. Deviation	N
Experimental	48.8100	20.48488	100
Control	37.0900	15.67156	100
Total	42.9500	19.11687	200

Tests of Between-Subjects Effects

Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	6873.023[a]	2	3436.511	10.280	.000
Intercept	68995.514	1	68995.514	206.403	.000
Pretest	5.103	1	5.103	.015	.902
Group	6841.547	1	6841.547	20.467	.000
Error	65852.477	197	334.277		
Total	441666.000	200			
Corrected Total	72725.500	199			

a. R Squared = .095 (Adjusted R Squared = .085)

```
UNIANOVA Pretest BY Group WITH Posttest
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /PRINT=DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=Posttest Group.
```


Univariate Analysis of Variance

[DataSet0] C:\Users\ubamakachris\Documents\Uduaka's Work.sav

Between-Subjects Factors

		Value Label	N
Group	1.00	Experimental	100
	2.00	Control	100

Descriptive Statistics

Dependent Variable: Pretest

Group	Mean	Std. Deviation	N
Experimental	30.6800	15.05940	100
Control	29.5000	14.21374	100
Total	30.0900	14.61781	200

Tests of Between-Subjects Effects

Dependent Variable: Pretest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	72.909[a]	2	36.455	.169	.844
Intercept	26877.335	1	26877.335	124.733	.000
Posttest	3.289	1	3.289	.015	.902
Group	54.505	1	54.505	.253	.616
Error	42449.471	197	215.480		
Total	223604.000	200			
Corrected Total	42522.380	199			

a. R Squared = .002 (Adjusted R Squared = -.008)

```
UNIANOVA Pretest BY Gender WITH Posttest
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /PRINT=DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=Posttest Gender.
```

Univariate Analysis of Variance

```
[DataSet0] C:\Users\ubamakachris\Documents\Uduaka's Work.sav
```

Between-Subjects Factors

		Value Label	N
Gender	1.00	Male	111
	2.00	Female	89

Descriptive Statistics

Dependent Variable: Pretest

Gender	Mean	Std. Deviation	N
Male	29.4595	14.49500	111
Female	30.8764	14.81386	89
Total	30.0900	14.61781	200

Tests of Between-Subjects Effects

Dependent Variable: Pretest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	113.757[a]	2	56.879	.264	.768
Intercept	28547.115	1	28547.115	132.609	.000
Posttest	14.585	1	14.585	.068	.795
Gender	95.353	1	95.353	.443	.506
Error	42408.623	197	215.272		
Total	223604.000	200			
Corrected Total	42522.380	199			

a. R Squared = .003 (Adjusted R Squared = -.007)

```
UNIANOVA Posttest BY Gender WITH Pretest
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /PRINT=DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=Pretest Gender.
```

Univariate Analysis of Variance

```
[DataSet0] C:\Users\ubamakachris\Documents\Uduaka's Work.sav
```

Between-Subjects Factors

		Value Label	N
Gender	1.00	Male	111
	2.00	Female	89

Descriptive Statistics

Dependent Variable: Posttest

Gender	Mean	Std. Deviation	N
Male	42.1351	18.60815	111
Female	43.9663	19.79179	89
Total	42.9500	19.11687	200

Tests of Between-Subjects Effects

Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	190.574[a]	2	95.287	.259	.772
Intercept	67545.316	1	67545.316	183.449	.000
Pretest	24.946	1	24.946	.068	.795
Gender	159.099	1	159.099	.432	.512
Error	72534.926	197	368.198		
Total	441666.000	200			
Corrected Total	72725.500	199			

a. R Squared = .003 (Adjusted R Squared = -.008)

```
UNIANOVA PostselfEfficacy BY Group WITH PreselfEfficacy
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /PRINT=DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=PreselfEfficacy Group.
```

Univariate Analysis of Variance

```
[DataSet0] C:\Users\ubamakachris\Documents\Uduaka's Work.sav
```

Between-Subjects Factors

		Value Label	N
Group	1.00	Experimental	100
	2.00	Control	100

Descriptive Statistics

Dependent Variable: PostselfEfficacy

Group	Mean	Std. Deviation	N
Experimental	3.3515	.43817	100
Control	2.9165	.74261	100
Total	3.1340	.64607	200

Tests of Between-Subjects Effects

Dependent Variable: PostselfEfficacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9.543[a]	2	4.771	12.785	.000
Intercept	23.192	1	23.192	62.143	.000
PreselfEfficacy	.082	1	.082	.219	.640
Group	9.239	1	9.239	24.756	.000
Error	73.521	197	.373		
Total	2047.455	200			
Corrected Total	83.064	199			

a. R Squared = .115 (Adjusted R Squared = .106)

```
UNIANOVA PreselfEfficacy BY Group WITH PostselfEfficacy
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /PRINT=DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=PostselfEfficacy Group.
```

Univariate Analysis of Variance

```
[DataSet0] C:\Users\ubamakachris\Documents\Uduaka's Work.sav
```

Between-Subjects Factors

		Value Label	N
Group	1.00	Experimental	100
	2.00	Control	100

Descriptive Statistics

Dependent Variable: PreselfEfficacy

Group	Mean	Std. Deviation	N
Experimental	2.2488	.22022	100
Control	2.2894	.24775	100
Total	2.2691	.23468	200

Tests of Between-Subjects Effects

Dependent Variable: PreselfEfficacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig
Corrected Model	.094[a]	2	.047	.856	.426
Intercept	38.518	1	38.518	698.355	.000
PostselfEfficacy	.012	1	.012	.219	.640
Group	.054	1	.054	.984	.322
Error	10.866	197	.055		
Total	1040.728	200			
Corrected Total	10.960	199			

a. R Squared = .009 (Adjusted R Squared = -.001)

```
UNIANOVA PreselfEfficacy BY Gender WITH PostselfEfficacy
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /PRINT=DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=PostselfEfficacy Gender.
```

Univariate Analysis of Variance

```
[DataSet0] C:\Users\ubamakachris\Documents\Uduaka's Work.sav
```

Between-Subjects Factors

		Value Label	N
Gender	1.00	Male	111
	2.00	Female	89

Descriptive Statistics

Dependent Variable: PreselfEfficacy

Gender	Mean	Std. Deviation	N
Male	2.2714	.22982	111
Female	2.2663	.24189	89
Total	2.2691	.23468	200

Tests of Between-Subjects Effects

Dependent Variable: PreselfEfficacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.042[a]	2	.021	.379	.685
Intercept	44.348	1	44.348	800.204	.000
PostselfEfficacy	.041	1	.041	.736	.392
Gender	.002	1	.002	.035	.853
Error	10.918	197	.055		
Total	1040.728	200			
Corrected Total	10.960	199			

a. R Squared = .004 (Adjusted R Squared = -.006)

```
UNIANOVA PostselfEfficacy BY Gender WITH PreselfEfficacy
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /PRINT=DESCRIPTIVE
  /CRITERIA=ALPHA(.05)
  /DESIGN=PreselfEfficacy Gender.
```

Univariate Analysis of Variance

```
[DataSet0] C:\Users\ubamakachris\Documents\Uduaka's Work.sav
```

Between-Subjects Factors

		Value Label	N
Gender	1.00	Male	111
	2.00	Female	89

Descriptive Statistics

Dependent Variable: PostselfEfficacy

Gender	Mean	Std. Deviation	N
Male	3.1574	.62773	111
Female	3.1048	.67067	89
Total	3.1340	.64607	200

Tests of Between-Subjects Effects

Dependent Variable: PostselfEfficacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	.445[a]	2	.223	.531	.589
Intercept	25.975	1	25.975	61.937	.000
PreselfEfficacy	.309	1	.309	.736	.392
Gender	.141	1	.141	.337	.562
Error	82.618	197	.419		
Total	2047.455	200			
Corrected Total	83.064	199			

a. R Squared = .005 (Adjusted R Squared = -.005)

```
UNIANOVA Posttest BY Group Gender WITH Pretest
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /CRITERIA=ALPHA(0.05)
  /DESIGN=Pretest Group Gender Group*Gender.
```

Univariate Analysis of Variance

```
[DataSet0] C:\Users\ubamakachris\Documents\Uduaka's Work.sav
```

Between-Subjects Factors

		Value Label	N
Group	1.00	Experimental	100
	2.00	Control	100
Gender	1.00	Male	111
	2.00	Female	89

Tests of Between-Subjects Effects

Dependent Variable: Posttest

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	8289.414[a]	4	2072.353	6.271	.000
Intercept	70068.330	1	70068.330	212.045	.000
Pretest	2.425	1	2.425	.007	.932
Group	7724.713	1	7724.713	23.377	.000
Gender	607.255	1	607.255	1.838	.177
Group * Gender	848.663	1	848.663	2.568	.111
Error	64436.086	195	330.441		
Total	441666.000	200			
Corrected Total	72725.500	199			

a. R Squared = .114 (Adjusted R Squared = .096)

```
UNIANOVA PostselfEfficacy BY Group Gender WITH PreselfEfficacy
  /METHOD=SSTYPE(3)
  /INTERCEPT=INCLUDE
  /CRITERIA=ALPHA(0.05)
  /DESIGN=PreselfEfficacy Group Gender Group*Gender.
```

Univariate Analysis of Variance

[DataSet0] C:\Users\ubamakachris\Documents\Uduaka's Work.sav

Between-Subjects Factors

		Value Label	N
Group	1.00	Experimental	100
	2.00	Control	100
Gender	1.00	Male	111
	2.00	Female	89

Tests of Between-Subjects Effects

Dependent Variable: PostselfEfficacy

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	9.698[a]	4	2.424	6.444	.000
Intercept	22.903	1	22.903	60.873	.000
PreselfEfficacy	.066	1	.066	.176	.676
Group	9.251	1	9.251	24.589	.000
Gender	.001	1	.001	.004	.950
Group * Gender	.154	1	.154	.409	.523
Error	73.366	195	.376		
Total	2047.455	200			
Corrected Total	83.064	199			

a. R Squared = .117 (Adjusted R Squared = .099)

AB. 2006/1

JU.00/AB.2006/1/F.17

ABIA STATE OF NIGERIA

MINISTRY OF EDUCATION

JUNIOR SCHOOL CERTIFICATE EXAMINATION, 2006

MATHEMATICS

Time Allowed: 2 hours

This Paper consists of 2 Sections, I and II. Section I consists of Objective Questions (Multiple Choice) while Section II consists of Essay Questions.

INSTRUCTIONS TO CANDIDATES:

PLEASE DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO. WHILE YOU AR WAITING, READ THE FOLLOWING INSTRUCTIONS CAREFULLY.

1. *Write your centre number, examination number, name, the name of your school and the subject in the spac provided on the answer sheet.*
2. *Read each question carefully before answering.*
3. *Do not waste time on any question, if you find one difficult, go on to others and finish them before you co again to the difficult one(s).*
4. *Please work completely on your own.*

Turn

SECTION I

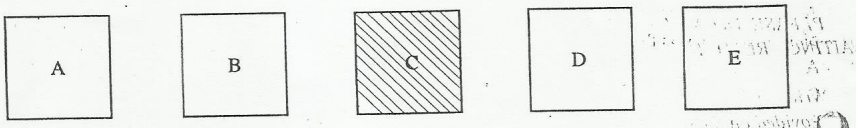
INSTRUCTIONS:

Each question is followed by 5 choices lettered A – E. Find out the correct answer to each question and shade on the answer sheet provided, the answer space which bears the same letter as the choice you have made. Give ONE answer ONLY to each question. Think carefully before you shade the answer space. If you want to change your answer, erase the first shading completely before shading another space. Use pencil throughout. An example is given below:

EXAMPLE: 180 – 125

A. 35 B. 45 C. 55
D. 65 E. 75.

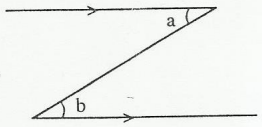
The correct answer is "55" which is lettered C, and therefore the space C has been shaded thus:



Now do questions 1 — 60 on the answer sheet supplied.

1. Mode can be defined as:
A. the item with the highest frequency
B. the highest frequency
C. the biggest number
D. the middle number
E. the last number.

2. In the diagram below, a and b are .....angles.



A. Vertically opposite B. Corresponding
C. Pointed D. Alternate
E Perpendicular.

3. Simplify $-8-(-5)-2-(-5)$
A. –20 B. 20
C. 0 D. –10
E. 10.

4. If $\frac{1}{2}(4x-8)=8$, what is x?
A. 0 B. 4
C. 6 D. 16
E. 1.

5. Find the circumference of a circle with diameter 6cm. (Leave π in your answer)
A. 8π B. 4π
C. $\frac{1}{2}\pi$ D. 2π
E. 6π.

6. A pie chart is also called a
A. Bar chart B. Circle graph
C. Histogram D. Pictogram
E. Piogram.

7. What number is represented by the Roman Numeral DCLXVI?
A. 666 B. 956
C. 606 D. 506
E. 656.

8. The lowest common multiple of $3x^2$, $6xy$ and xy^2 is

A. $6x^2y^2$ B. x^2y^2
C. $18xy$ D. $6xy$
E. $9x^2y$.

9. $S = \sqrt{\frac{L}{g}}$. Make L the subject of the formula.

A. $L = gs^2$ B. $L = \sqrt{\frac{s}{g}}$
C. $L = s^2g^2$ D. $L = (\frac{s}{g})^2$
E. $L = g^2s$.

10. An equilateral triangle of side $x$cm has a perimeter of 17.4cm. What is the value of x?

A. 52.2 B. 34.8
C. 8.6 D. 5.8
E. 7.9.

11. Evaluate $[(\sqrt{3})^2]^3$

A. 12 B. 27
C. 9 D. 6
E. 8.

12. The equation of a straight line is given by $y = Mx+c$, where M is the gradient. What is the gradient of the line $y = 2x - 3$?

A. 2 B. –3
C. –2 D. 3
E. $\frac{2}{3}$.

13. Which of the following is *NOT* true about a pentagon?

A. It has five sides
B. The sum of the interior angles is 540°
C. It has five interior angles
D. The sum of the exterior angles is 180°
E. It has five exterior angles.

14. What is the area of a parallelogram with base 16cm and perpendicular height 5cm?

A. $80cm^2$ B. $40cm^2$
C. $21cm^2$ D. $16cm^2$
E. $11cm^2$.

15. What number does the tally 𝍸 𝍸 𝍸 𝍸 𝍸 represent?

A. 24 B. 4.4
C. 14 D. 5
E. 44.

16. When 3 is subtracted from a number, the result is the same as subtracting the number from 3. What is the number?

A. 0 B. 9
C. 6 D. 3
E. 5.

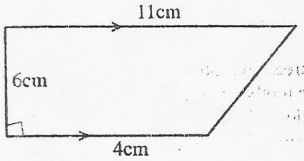
17. The cost of posting a parcel weighing 1kg is ₦40.80. How much will it cost to post a parcel that weighs 10kg?

A. ₦4.08 B. ₦4,080.00
C. ₦408.00 D. ₦40.00
E. ₦4,008.00

18. Correct 56.8° to the nearest degree.

A. 57° B. 60°
C. 55° D. 56°
E. 50°.

19. Find the area of the trapezium below.



A. $66cm^2$ B. $264cm^2$
C. $45cm^2$ D. $24cm^2$
E. $44cm^2$.

20. If $x = 3\sqrt{2}$, what is x^2?

A. $9\sqrt{2}$ B. $6\sqrt{2}$
C. 6 D. 18
E. 12.

21. Find the value of $\sqrt{1\frac{7}{9}}$

A. $\frac{3}{4}$ B. $1\frac{1}{3}$
C. $\frac{1}{4}$ D. $\frac{1}{3}$
E. $1\frac{1}{4}$.

22. If $a^2 - b^2 = (a + b)(a - b)$, hence evaluate $25^2 - 5^2$.
A. 500 B. 600
C. 700 D. 800
E. 900.

23. Express 54000 in standard form.
A. 5.4×10^4 B. 5.4×10^3
C. 5.4×10^{-2} D. 5.4×10^5
E. 5.4×10^{-4}.

24. Find the L.C.M. of 8, 9 and 12 in an index form.
A. $2^3 \times 3^2$ B. $2^2 \times 3^3$
C. 2×3 D. $2^4 \times 3$
E. 2×3^5.

25. The population of a village is 5846. Express this number to three significant figures.
A. 5850 B. 5846
C. 5840 D. 585
E. 584.

26. Mr. Uche sold an article for ₦750 instead of N1,275. Calculate his loss percentage correct to one decimal place.
A. 18.3%
B. 41.2%
C. 5.3%
D. 1.7%
E. 1.4%.

27. Three boys Peter, Udo and Eke won ₦25,000 on the football pools. If they share this amount in the ratio 2:3:5 respectively, how much does Udo receive?
A. ₦5,000
B. ₦7,500
C. ₦12,500
D. ₦17,500
E. ₦2,000.

28. A die with faces number 1 to 6 is rolled once. What is the probability of obtaining 3 or 4.
A. $\frac{1}{36}$ B. $\frac{1}{6}$
C. $\frac{1}{3}$ D. $\frac{1}{2}$
E. $\frac{2}{3}$

29. Solve the inequality $2x + 3 < 5x$
A. $x > 1$ B. $x < \frac{3}{7}$
C. $x > \frac{3}{7}$ D. $x > -1$
E. $x < 1$.

30. Write as a single fraction $\frac{1}{1-x} + \frac{2}{1+}$
A. $\frac{x+3}{1-x}2$ B. $\frac{3-x}{(1-x)^2}$
C. $\frac{3-x}{1+x}2$ D. $\frac{3-x}{(1+y)^2}$
E. $\frac{3-x}{1-x}2$.

31. What is the size of one of the exterior octagon?
A. 180 B. 90°
C. 60° D. 45°
E. 30°.

32. Solve the equation $5(x - 7) = 7 - 2x$.
A. $x = 2$ B. $x = 4$
C. $x = 6$ D. $x = 14$
E. $x = 3$.

33. The bearing of Y from X is 085°. bearing of X from Y?
A. 005° B. 095°
C. 185° D. 265°
E. 275°.

34. Factorise $am - an - xm + xn$.
A. $(m - x)(a - n)$ B. $(m -$
C. $(x - m)(x + m)$ D. $(a - n$
E. $a(n - m)$.

35. Evaluate $-7 - 2(-3)^2$
A. –25 B. –11
C. 25 D. –81
E. 11.

22. If $a^2 - b^2 = (a + b)(a - b)$, hence evaluate $25^2 - 5^2$.
A. 500 B. 600
C. 700 D. 800
E. 900.

23. Express 54000 in standard form.
A. 5.4×10^4 B. 5.4×10^3
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E. 5.4×10^{-4}.

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C. 2×3 D. $2^4 \times 3$
E. 2×3^5.

25. The population of a village is 5846. Express this number to three significant figures.
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C. 5840 D. 585
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26. Mr. Uche sold an article for ₦750 instead of N1,275. Calculate his loss percentage correct to one decimal place.
A. 18.3%
B. 41.2%
C. 5.3%
D. 1.7%
E. 1.4%.

27. Three boys Peter, Udo and Eke won ₦25,000 on the football pools. If they share this amount in the ratio 2:3:5 respectively, how much does Udo receive?
A. ₦5,000
B. ₦7,500
C. ₦12,500
D. ₦17,500
E. ₦2,000.

28. A die with faces number 1 to 6 is rolled once. What is the probability of obtaining 3 or 4.
A. $\frac{1}{36}$ B. $\frac{1}{6}$
C. $\frac{1}{3}$ D. $\frac{1}{2}$
E. $\frac{2}{3}$

29. Solve the inequality $2x + 3 < 5x$
A. $x > 1$ B. $x < \frac{3}{7}$
C. $x > \frac{3}{7}$ D. $x > -1$
E. $x < 1$.

30. Write as a single fraction $\frac{1}{1-x} + \frac{2}{1+}$
A. $\frac{x+3}{1-x}2$ B. $\frac{3-x}{(1-x)}2$
C. $\frac{3-x}{1+x}2$ D. $\frac{3-x}{(1+y)}2$
E. $\frac{3-x}{1-x}2$.

31. What is the size of one of the exterior octagon?
A. 180 B. 90°
C. 60° D. 45°
E. 30°.

32. Solve the equation $5(x - 7) = 7 - 2x$.
A. $x = 2$ B. $x = 4$
C. $x = 6$ D. $x = 14$
E. $x = 3$.

33. The bearing of Y from X is 085°. bearing of X from Y?
A. 005° B. 095°
C. 185° D. 265°
E. 275°.

34. Factorise $am - an - xm + xn$.
A. $(m - x)(a - n)$ B. $(m -$
C. $(x - m)(x + m)$ D. $(a - n$
E. $a(n - m)$.

35. Evaluate $-7 - 2(-3)^2$
A. –25 B. –11
C. 25 D. –81
E. 11.

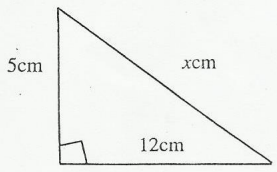
36. If x varies directly as y^2, and y = 2 when x = 12. Find x when y = 5.

A. 75 B. 48
C. 9.6 D. 30
E. 120.

37. Convert 35_{10} to a binary number.

A. 110001 B. 100011
C. 1010011 D. 110010
E. 1110001

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



A. 169 B. 13
C. 17 D. 7
E. 12.

39. A bag contains 5 red and 6 blue balls. One ball is picked at random. What is the probability that it is blue?

A. $\frac{5}{11}$ B. $\frac{5}{6}$
C. $\frac{1}{5}$ D. $\frac{6}{11}$
E. $\frac{1}{6}$.

40. If $\tan x = \frac{3}{4}$ what is the value of 1– cosx?

A. $\frac{4}{5}$ B. $\frac{1}{5}$
C. $\frac{3}{5}$ D. $\frac{2}{5}$
E. $\frac{4}{3}$.

41. What is the next term in the series: 16, 25, 34?

A. 9 B. 36
C. 43 D. 35
E. 37.

42. Simplify 3.05 + 0.201 + 12.375 and express your answer in one decimal place.

A. 15.1 B. 15.6
C. 15.7 D. 15.62
E. 15.625.

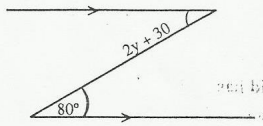
43. How many perfect squares are there in the set {1,3,4,6,9,64}?

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

44. Given that a = 3, b = –7 and c = 5, find the value of $\frac{a^3 + b}{c}$

A. 4 B. 6.8
C. –0.4 D. 5
E. 8.

45. Find the value of y in the diagram below:



A. 25° B. 50°
C. 110° D. 30°
E. 80°.

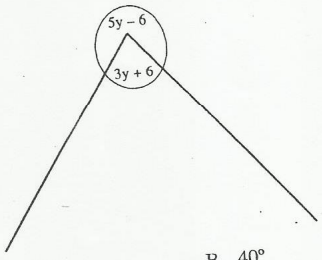
46. Arrange in ascending order of magnitude: $\frac{3}{4}, \frac{1}{4}, \frac{2}{5}, \frac{2}{3}$:

A. $\frac{1}{4}, \frac{2}{5}, \frac{2}{3}, \frac{3}{4}$
B. $\frac{3}{4}, \frac{2}{3}, \frac{2}{5}, \frac{1}{4}$
C. $\frac{2}{3}, \frac{3}{4}, \frac{1}{4}, \frac{2}{5}$
D. $\frac{2}{5}, \frac{1}{4}, \frac{3}{4}, \frac{2}{3}$
E. $\frac{1}{4}, \frac{3}{4}, \frac{2}{5}, \frac{2}{3}$.

47. The length of a rectangle is 2 times its width. I the area of the rectangle is 8cm². What is th width?

A. 6 B. 4
C. 2 D. 3
E. 5.

48. Find the value of y in the diagram below:



A. 90°
B. 40°
C. 45°
D. 360°
E. 180°.

49. The number of degrees in $\frac{1}{9}$ of a revolution is:

A. 45°
B. 40°
C. 30°
D. 20°
E. 10°.

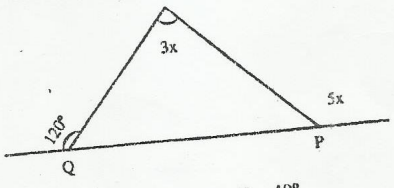
50. A cuboid has:

A. 6 faces, 12 edges and 8 vertices
B. 4 faces, 10 edges and 4 vertices
C. 6 faces, 6 edges and 6 vertices
D. 12 faces, 8 edges and 4 vertices
E. 6 faces, 4 edges and 10 vertices.

51. Ngozi is 6cm taller than Chioma. If Chioma is xcm what is Ngozi's height?

A. x – 6cm
B. x + 3cm
C. x – 2cm
D. x + 6cm
E. x – 3cm.

52. In the figure below, find the value of x



A. 30°
B. 40°
C. 24°
D. 15°
E. 60°.

53. Express $\frac{3}{8}$ as a percentage

A. 37%
B. 0.375%
C. 37.5%
D. 62.5%
E. 60%.

54. A vertical pole of height 15cm cast a the ground with an angle of elevation the length of the shadow?

A. 20.2m
B. 45m
C. 30m
D. 15m
E. 26.0m.

55. Simplify $\frac{3^3 \times 2^4}{2^3 \times 3^4}$

A. $\frac{2}{3}$
B. 2
C. 3
D. $\frac{2}{9}$
E. $\frac{1}{3}$.

56. Write 0.585 million as a whole

A. 585
B. 58
C. 58500
D. 58
E. 5850000.

57. Find Y if $y° + 40°$, $3y° + 60°$ a

A. 20°
B. 5
C. 35°
D. 1
E. 80°.

58. Factorise $9x^2 - 25$

A. $(3x + 5)(3x - 5)$
B.
C. $(3x + 5)(3x + 5)$
D.
E. $(3x + 5)(2x + 3)$.

59. A man's salary is increa ₦18,000. What is the perc

A. 120%
C. 200%
E. 300%.

60. Express 1.02km in metr

A. 1020m
C. 1200m
E. 100m.

SECTION II

INSTRUCTIONS:

Read the following questions carefully and answer the questions on the answer sheets provided.

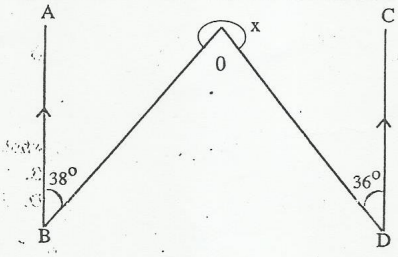
Answer ALL questions in this Section.

Remember to write your NAME and EXAMINATION NUMBER on the answer sheet and you may as for continuation sheets if required.

1. *(a)* Solve the equation

$$\frac{2x+4}{3} = \frac{3x+1}{2}$$

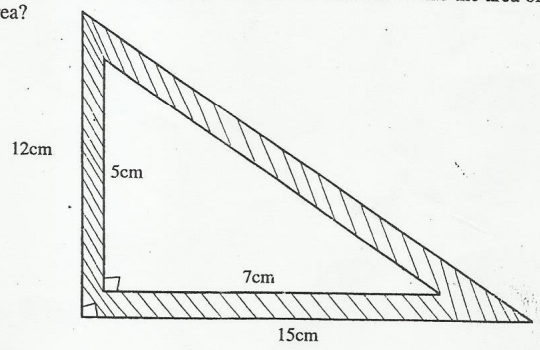
(b) In the diagram below AB//CD. Find the value of the angle marked x.



2. *(a)* Given that $V = \frac{4}{3}\pi r^3$, make r the subject of the formula. Hence, find the value of r when $V = 113\frac{1}{7}$ and $\pi = \frac{22}{7}$

(b) Amaechi bought a car for ₦350,000 and after selling he made a profit of 15%. How much did Amaechi sell the car.

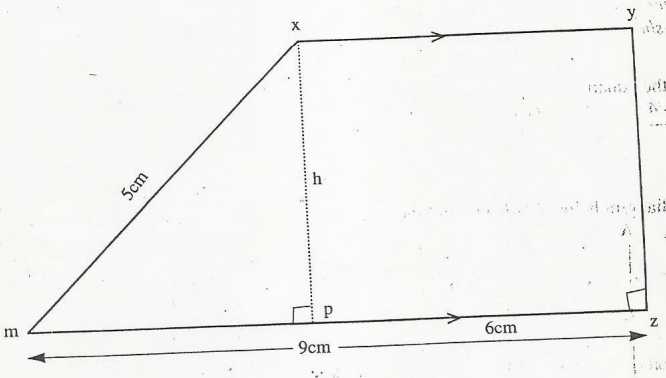
3. *(a)* A student found the figure below in his Mathematical Set and decided to find the area of the shaded portion. What is this area?



(a) Solve the inequality $2x - 3 \leqslant x - 1$

4. (a) Given that $x = -\frac{1}{2}$ and $y = 4$, evaluate $3x^2y + xy^2$

(b) In the trapezium XYZM, XY//MZ, $\angle XYZ = 90°$, /PZ/ = 6cm, /MZ/ = 9cm and /MX/ = 5cm, find the *(i)* Perimeter *(ii)* Area of trapezium.



5. (a) If Sin $Q = \frac{3}{5}$, $0 < Q < 90°$, find the value of $1 - \tan Q$.

(b) Four interior angles of a quadrilateral are $(x + 20)°$, $(x + 10)°$, $(2x - 45)°$ and $(x - 25)°$, find th value of x.

AB/BECE/2013/01 MAY.09/AB.2013/01/F.25

ABIA STATE OF NIGERIA

MINISTRY OF EDUCATION

BASIC EDUCATION CERTIFICATE EXAMINATION, 2013

MATHEMATICS

Time Allowed: 2½ Hours

This Paper consists of 2 Sections, I and II. Section I consists of Objective Questions (Multiple Choice) while Section II consists of Theory Questions .

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Turn Over

JUNE.09/AB.2014/01/E.25

ABIA STATE OF NIGERIA

MINISTRY OF EDUCATION

BASIC EDUCATION CERTIFICATE EXAMINATION, 2014

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SECTION I

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An example is given below:

EXAMPLE : 180 - 125 = ...
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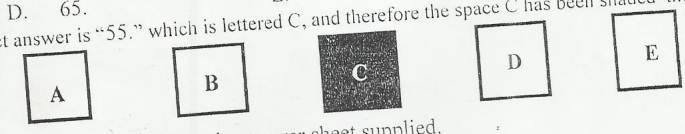
The correct answer is "55." which is lettered C, and therefore the space C has been shaded thus:



Now answer questions 1 - 60 on the answer sheet supplied.

1. Write 482.000 in standard form.
A. 4.82×10^{-6} B. 4.82×10^{-3}
C. 4.82×10^{3} D. 4.82×10^{5}
E. 4.82×10^{6}

2. Divide 138.2 by 10^{-2}
A. 13.82 B. 1.382
C. 13820 D: 0.1382
D. 1382

3. Express 0.006457 to two significant figure
A. 0.00646 B. 0.0065
C. 0.006 D. 0.007
E. 0.006450

4. A rope of lenght 15cm was measured by a boy to be 14cm. Find the percentage error.
A. 6.7 % B. 6.0 %
C. 4 % D. 5 %
E. 6.3 %

5. Factorize the expression $4 - 4x^2$
A. $4(1-x)^2$
B. $4(1-x)(1+x)$
C. $4(x+1)(x-1)$
D. $2(1-2x^2)$
E. $4x(1-x)$

6. What is the perimeter of a semicircle with diameter 14cm. (Take $\pi = \frac{22}{7}$)
A. 88cm
B. 36cm
C. 58cm
D. 44 E. 22

7. Which of the following fractions is equivalent to $\frac{12xy}{8x^2a}$?
A. $\frac{3y}{2x^2a}$ B. $\frac{3y}{2a}$
C. $\frac{3y}{2xa}$ D. $\frac{4y}{3xa}$
E. $\frac{3y}{2a^2}$

8. Arrange the following fractions in descending order of magnitude
$\frac{5}{9}, \frac{7}{15}, \frac{11}{20}, \frac{3}{8}$
A. $\frac{3}{8}, \frac{7}{15}, \frac{11}{20}, \frac{5}{9}$ B. $\frac{11}{20}, \frac{7}{15}, \frac{5}{9}, \frac{3}{8}$
C. $\frac{5}{9}, \frac{11}{20}, \frac{7}{15}, \frac{3}{8}$ D. $\frac{11}{20}, \frac{3}{8}, \frac{5}{9}, \frac{7}{15}$
E. $\frac{7}{15}, \frac{11}{20}, \frac{5}{9}, \frac{3}{9}$

9. Find the simple interest on ₦3,900.00 in $4\frac{1}{2}$ years at $2\frac{1}{4}$ % per annum.
A. ₦394.88 B. ₦349.87
C. ₦388.94 D. ₦294.88
D. ₦367.20

10. Find the value of xy in x+y=17 and x - y=5
A. 11 B. 6
C. 116 D. 66
E. 17

11. What is the sum of the exterior angle of an octagon?
A. 8^0 B. 80^0
C. 180^0 D. 240^0
E. 360^0

12. Convert 1111_2 to base ten.
A. 15 B. 11.11
C. 12 D. 13
E. 121

13. A segment of a circle is bound by.....
A. a chord and an arc
B. a radius and a chord
C. a targent and a chord
D. a targent and an arc
E. a diameter and a chord

14. If the volume of a cone is given by the formular $V=\frac{1}{3}\pi r^2 h$, express h in terms of V, r and π^{-2}
A. $h=\frac{3V}{\pi r^2}$ B. $h=\frac{3V}{r^2}$
C. $h=\frac{\pi r}{3V}$ D. $h=\pi r^2 V$
E. $h=\frac{3V^2}{\pi r}$

15. Which of the following is not a solid shape?
A. Kite B. Cube
C. Cone D. Prism
E. Sphere

16. What is the median of the following numbers? 51,47,43,72,75,52,73,60,39,54,69?
A. 75 B. 54
C. 52 D. 69
E. 51

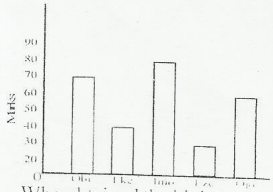
17. What is the commision on ₦ 15,321.00 at 3 kobo per naira?
A. ₦959.63 B. ₦153.21
C. ₦459.63 D. ₦543.63
E. ₦183.21

18. If an egg costs ₦30.00 and a discount of ₦2.00 per egg is given to a buyer who purchases in crates of 30 eggs. How much will a buyer pay for 3 creates?
A. ₦ 2,520.00 B. ₦2,700.00
C. ₦ 900.00 D. ₦1,252.00
E. ₦ 3,000.00

19. Find the value of $[(-3)^3]^2$
A. -12 B. 18
C. $\frac{1}{81}$ D. 81
E. -81

20. The sum of twice a number and 6 is 20. what is the number?
A. 14
B. 13
C. 7
D. 26
E. 25

The bar chart below shows the scores of five Jss3 students of Government college in Abia State in a mathematics examination. Use it to answer questions 21-24



21. Who obtained the highest mark?
A. Imo B. Ojo
C. Eze D. Eke
E. Obi

22. Who obtained the lowest mark?
A. Eke B. Obi
C. Imo D. Ojo
E. Eze

23. What was the total mark obtained by the students?
A. 270 B. 280
C. 290 D. 440
E. 540

24. What was the average mark obtained by the students?
A. 56 B. 58
C. 85 D. 108
E. 54

25. Make m the subject of the formular $X\sqrt{M}=l$
A. $M=\sqrt{\frac{l}{x}}$ B. $M=\left(\frac{l}{x}\right)^2$
C. $M=\frac{\sqrt{l}}{x}$ D. $M=\frac{l}{\sqrt{x}}$
E. $M=\frac{l}{x}$

26. The equal sides of an isosceles triangle are 18cm each. If the base angles are 30^0 each, calculate the height of the triangle.
A. 36cm B. 18cm
C. 48cm D. 9cm
E. 12cm

27. Find the volume of a cone with base radius $3\frac{1}{2}$ cm and height 12cm (Take $\pi=\frac{22}{7}$)
A. $22cm^3$ B. $154cm^3$
C. $42cm^3$ D. $462cm^3$
E. $44cm^3$

28. The factors of a quadratic equation are x-3 and x-5. What is the equation?
A. $x^2 - 15x + 8 = 0$
B. $x^2 - 8x - 15 = 0$
C. $x^2 + 15x - 8 = 0$
D. $x^2 - 8x + 15 = 0$
E. $x^2 + 8x + 15 = 0$

29. From the diagram below, which of the following triangles are similar?

A. △ABE and △ACE
B. △BCE and △CDE
C. △ABE and △ACD
D. △AEC and △BCE
E. △CDE and △CDA

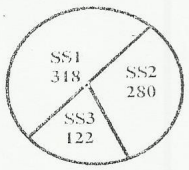
30. Divide $x^2 + 5x + 6$ by $x + 3$

A. $(x - 5)$ B. $(x+2)$
C. (x^2+5) D. $(x- 2)$
E. $(x - 3)$

31. A right trianglar prism has each end of area 6cm². If it is 8cm long, find its volume in cm³

A. 96 B. 48
C. 24 D. 72
E. 64

32. The pie chart shows the population of students in a senior secondary school. What is the size of ss1 students in degrees?



A. 280^0 B. 109^0
C. 318^0 D. 159^0
E. 160

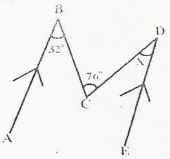
33. In the expression $\sqrt[3]{a+b}$, a+b is called.....

A. Radical
B. Square root
C. Radicand
D. Divisor
E. Ray

34. The reciprocal of 4½ is.....

A. 0.212
B. 0.122
C. 0.222
D. 0.202
E. 0.221

35. In the diagram below AB//ED. Find the value of x



A. 32^0 B. 76^0
C. 108^0 D. 72^0
E. 44^0

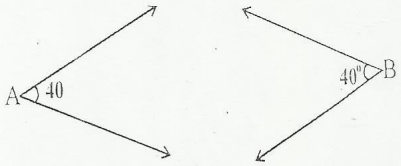
36. The sum of the angles of a triangle are (3x-4), (2x + 7) and (5x - 3). Find the value of x.

A. 18^0 B. 15^0
C. 14^0 D. 10^0
E. 180^0

37. Kalu, Mba and Chijioke shared the sum of ₦8,370.00 in the ratio 4:5:6 respectively. How much is chijioke's share greater than kalu's share?

A. ₦3348.00 B. ₦2232.00
C. ₦1116.00 D. ₦2790.00
E. ₦558.00

38.



In the diagram shown above, ∠A and ∠B are both 40^0, therefore ∠A is _____ to ∠B

A. Equal
B. Alternate
C. Congruent
D. Similar
E. Corresponding

39. If the graph of 2y - 3x = k passes through the point (1,2), what is the value of K?

A. 4 B. 0
C. 1 D. -4
E. -1

40. The radii of two spheres are in the ratio 2:3. Find the ratio of their volumes

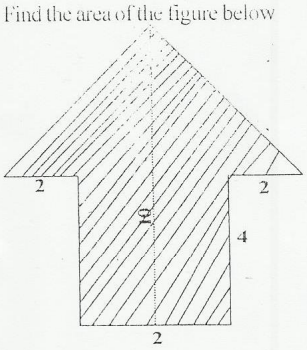
A. 8 : 7 B. 6 : 9
C. 1 : 3 D. 4 : 9
E. 8 : 9

41. The bearing of A from B is 320^0, What is the bearing of B from A ?
A. 140^0 B. 40^0
C. 320^0 D. 160^0
E. 80^0

42. If $P \propto \frac{1}{Q}$ and P =8 when Q=10, find P when Q=5
A. 50 B. 16
C. 8 D. 40
E. 80

43. What is the coefficient of x in the expression $3x^2 - \frac{x}{2} + 11$?
A. 3 B. 1
C. -1 D. $-\frac{1}{2}$
E. 11

44. Find the area of the figure below



A. 26 B. 20
C. 240 D. 46
E. 16

45. The L.C.M of $2x^4bc$, $4b^3c$ and $6xb^2c^2$ is.....
A. 2bcx B. 12bcx
C. $2x^4b^2c^2$ D. $12x^4b^3c^2$
E. $b^4c^2x^2$

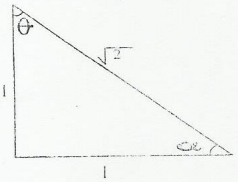
46. What type of angle is 155^0 ?
A. Reflex angle
B. Right angle
C. Obtuse angle
D. Acute angle
E. Straight line angle

47. If two angles $4x^0$ and $5x^0$ are complementary, what is the value of x?
A. 9^0
B. 90^0
C. 10^0
D. $9x^0$
E. 20^0

48. Given that $8m - 3 \leqslant 5m + 6$, then
A. $m \leqslant 9$
B. $m \leqslant 12$
C. $m \leqslant 1$
D. $m \leqslant 3$
E. $m \leqslant -3$

49. What fraction of a circle is a sector that subtends an angle of 30^0 at the centre of the circle?
A. $\frac{1}{12}$ B. $\frac{1}{36}$
C. $\frac{1}{6}$ D. $\frac{1}{30}$
E. $\frac{1}{8}$

50. Which of the following is NOT TRUE of the isosceles right angled triangle below?



A. $\sin\theta = \cos\alpha$
B. $\tan\theta = \tan\alpha$
C. $\tan\theta = \cos\alpha$
D. $\cos\theta = \frac{1}{\sqrt{2}}$
E. $\tan\alpha = 1$

51. In a trapezium XYZW, XY is parallel to WZ. Find the distance apart between XY and WZ, if XY = 24m, WZ = 16m, and the area of the trapezium is $144m^2$
A. 3.6m B. 14.4m
C. $\frac{3}{8}$ m
D. 7.2m
E. $\frac{5}{8}$ m

52. Evaluate (-21.32 + 4.1) + (30.45-13.23)
A. 17.22
B. 34.44
C. 0
D. 69.10
E. -17.22

53. What must be added to $x^2 + 4x$ to make it a perfect square?
A. 4
B. 8
C. 10
D. 12

54. Five divided by three plus a certain number y is equal to three divided by the number y minus seven. What is the number?

A. 52. B. 22
C. 32 D. 42
E. 12

Use the following information to answer questions 55-57
A bag contains 2 black balls, 3red balls and 6 white balls. A ball is picked from the bag at random. What is the probability that it is

55. Black

A. $\frac{2}{11}$ B. $\frac{3}{11}$
C. $\frac{6}{11}$ D. $\frac{8}{11}$
E. $\frac{9}{11}$

56. Red

A. $\frac{6}{11}$ B. $\frac{8}{11}$
C. $\frac{3}{11}$ D. $\frac{9}{11}$
E. $\frac{2}{11}$

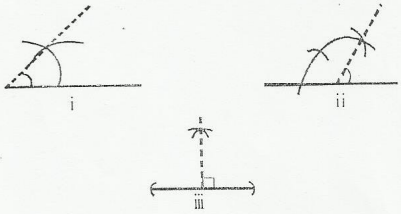
57. Not black

A. $\frac{9}{11}$ B. $\frac{3}{11}$
C. $\frac{2}{11}$ D. $\frac{6}{11}$
E. $\frac{8}{11}$

58. A one-room apartment is in the form of a cube. The walls are 12m long, 4m high and 25m thick. Calculate the area of the apartment

A. $1200m^2$ B. $48m^2$
C. $1000m^2$ D. $12000m^2$
E. $1020m^2$

59. Which of the following diagrams demonstrate(s) the correct way of constructing angle 60^0



A. i only B. ii only
C. iii only D. i & ii only
E. ii & iii only

60. Which of these expressions below describes an obtuse angle?

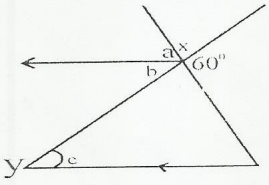
A. $90^0 < x < 180^0$
B. $90^0 > x > 180^0$
C. $90^0 > x < 180^0$
D. $90^0 < x > 180^0$
E. $90^0 \geqslant x \geqslant 180^0$

SECTION II

INSTRUCTION: Answer ALL the questions in this Section. Remember to write your NAME and EXAMINATION NUMBER on the answer sheets provided.

1. (a) Evaluate $\dfrac{\log 5 + \log 5}{\log \sqrt{5}}$

(b) Find the sizes of the angles a, b, c in the figure below, giving reasons



2. (a) Simplify without the use of a calculator or four figure table

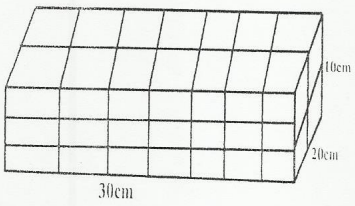
$$\sqrt{\frac{0.08 \times 0.006}{0.0003 \times 0.1}}$$

b. Using a ruler and a pair of compasses only, construct $\triangle$ PQR with /PQ/ =6cm, /PR/=8cm and /QR/= 10cm. Measure $\angle$ PQR

3 (a) A realm of dulplicating papers contains 500 sheets. If the thickness of the realm is 2.5cm, what is the thickness of one sheet. Give your answer in metres in standard form

(b) If the roots of a quadratic equation are 2 and 3, write the equation in the form of $ax^2 + bx + c = 0$

4.



The figure above is a closed cuboid with lenght 30cm, width 20cm and height 10cm. Calculate:

(a) Its volume

(b) Its surface area

(c) How many 2cm square tiles can be used to cover the entire surface of the Cuboid?

5. (a) Solve the equation $\frac{6}{x+3} = \frac{11}{x-2}$

(b) If y varies directly as x and x = 3 when y =4, find the constant term.

(c) Obioma tossed a fair die 30 times and the numbers showed up were as follows

4,	2,	6,	4,	5,	3
5,	4,	4,	3,	5,	4
2,	4,	3,	1,	3,	5
3,	5,	6,	4,	6,	4
1,	5,	2,	3,	5,	3

(i) Prepare a frequency table for the data.

(ii) Find the mode of the data.

(iii) Determine the median of the data.

(iv) Calculate the mean of the data.

AB/BECE/2013/01 MAY.09/AB.2013/01/F.25

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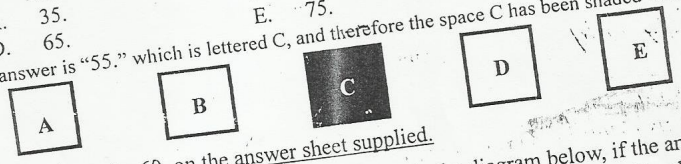


Now answer questions 1 - 60 on the answer sheet supplied.

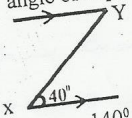
1. Write 789800092 in words.....
A. Seven hundred and eighty-nine thousand, eight hundred and ninety-two
B. Seven hundred and eighty-nine million, eight thousand and ninety-two
C. Seven hundred and eighty-nine million, eight hundred thousand and ninety-two
D. Seven billion, eight hundred and ninety-eighty million and ninety two
E. Seven million, eight hundred and ninety eight thousand and ninety -two

2. Factorise $2d^3 + d^2 (3d-1)$
A. $d^2 (5d-1)$ B. $d^3 (5d-1)$
C. $d (5d-1)$ D. $d^4 (5d-1)$
E. $d (5d^2-1)$

3. If ₦210 is shared among Obi, Peter, John in the ratio 1:2:4 respectively. How much will Peter receive?
A. ₦30 B. ₦60
C. ₦90 D. ₦26
E. ₦150

4. Given that $2^x=64$, what is the value of x?
A. 128 B. 32
C. 6 D. 8
E. 18

5. In the diagram below, if the angle elevation of y from x is 40. what i angle of depression of x from y?



A. 140^0 B. 5
C. 60^0 D. 4
E. 100^0

6. What is the distance that 24cm represent on a map if 1cm=22
A. 540,000km B. 54,
C. 46, 500km D. 54
E. 5,400km

7. Find the value of $(101_{two})^3$
A. 111101_{two} B.
C. 11101_{two} D.
E. 111011_{two}

8. Find the coefficient of t in
A. 24 B.
C. 16 D.
E. 23

9. Solve the equation $-\frac{2}{3}x$
A. $X \leqslant \frac{9}{2}$ F
C. $X = \frac{9}{2}$
E. $X = \frac{9}{4}$

If a varies directly as b, and varies inversely as c then.....

A. a varies directly as c
B. a varies inversely as c
C. a varies partially as c
D. a varies jointly as c
E. a does not vary as c

11. If a set of data has two modes, we say it is .....

A. Modalage B. Bi-modal
C. Centri-modal
D. Pietro-modal E. Barmodious

12. An article bought for ₦17.50 was sold for ₦14.00. What is the percentage loss?

A. 20% B. 3.5%
C. 80% D. 31.5%
E. 40.5%

13. The numbers 1,3,6,10..... are known as triangle numbers. what is the next number?

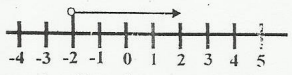
A. 17 B. 15
C. 14 D. 13
E. 12

14. In one year, a hospital admitted 1525 patients, 671 of these were treated for malaria. what percentage is this?

A. 40% B. 44%
C. 45% D. 46%
E. 47%

15. If 8x-4= 6x - 10, find the value of 5x

A. 35 B. 15
C. -3 D. 3
E. 7

16. 

the number line above represents.....

A. $X > -4$ B. $X \leq -2$
C. $X > -2$ D. $X < -2$
E. $X \geq -2$

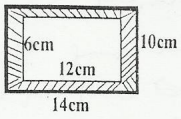
17. Which of the following is NOT a 3-dimensional figure?

A. Kite B. Cone
C. Cuboid D. Sphere
E. Prism

18. Find the radius of a circle if its area is 2464 cm^2

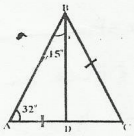
A. 14cm B. 78cm
C. 48cm
D. 28cm
E. 38cm

19. Calculate the area of the shaded portion in the figure below



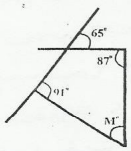
A. $60cm^2$ B. $61cm^2$
C. $64cm^2$ D. $65cm^2$
E. $68cm^2$

20. In the figure below $< DAB = 32^0$, $< ABD = 15^0$, AD= BC. Find the value of $< BDC$



A. 15^0 B. 17^0
C. 47^0 D. 32^0
E. 35^0

21. Find the value of M^0 in the diagram below



A. 65^0 B. 67^0
C. 115^0 D. 178^0
E. 25^0

22. Convert 11101_{two} to base ten

A. 27_{ten} B. 28_{ten}
C. 30_{ten} D. 29_{ten}
E. 26_{ten}

23. An equilateral triangle has equal sides with a square. If one side of the triangle is placed side by side with the square the shape formed is a.....

A. Hexagon B. Trapezium
C. Regular pentagon
D. Pyramid E. Heptegon

24. A student walks 5km due North from x and then 8km due east. What is his bearing from x?

A. 066^0 B. 058^0
C. 040^0 D. 090^0
E. 089^0

25. The mean of 5 integers is 48. If a 6th integer 12 is added to them, what will be the new mean?

A. 60 B. 45
C. 44 D. 42
E. 6

26. Solve the simultaneous equations, $3x + 2y = 12$, $5x - 3y = 1$
A. X= -2, Y = 3
B. X= 2, Y = -2
C. X =2, Y = 3
D. X = 3, Y= 2
E. X= -1, Y = 2

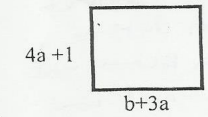
27. If X varies inversly as y, when y is 8, X is 24. Find Y when X = -15
A. -5.0 B. 5.8
C. 12.8 D. -12.8
E. 5.7

28. Given $y = x^2 + 5x - 7$, find the missing values in the table below:

X	-2	-1	0	1	2	3
Y	E	-11	-7	-1	7	G

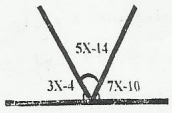
A. E=-13, G=17
B. E=17, G=-13
C. E=-17, G=20
D. E=-13, G=10
E. E=-16, G=20

29. Find the values of **a** and **b** in the square block below, if the area of the block is $81cm^2$



A. a=3, b=2 B. a=2, b=3
C. a=3, b=4 D. a=2, b=4
E. a=1, b=6

30. Find the value of x in the diagram below.



A. 15^0 B. 12^0
C. 28^0 D. 32^0
E. 40^0

31. Approximate 56219 to the nearest thousand.
A. 66,000
B. 56,000
C. 56219000
D. 56,200
E. 57,000

32. A basket contains 3 white balls and [illegible] balls. If a ball is picked at random from basket, what is the probability that it is no[t] black?
A. $\frac{3}{4}$ B. $\frac{1}{4}$
C. $\frac{1}{2}$ D. $\frac{1}{6}$
E. $\frac{1}{5}$

33. The longest bar in a bar chart represents the .....
A. Median B. Mean
C. Mode D. Quantile
D. Rank

34. All these are properties of a square -based pyramid except.....
A. 5 vertices
B. 4 triangular sides
C. 8 edges
D. 5 faces
E. 4 centres

35. The sum of the angles of a polygon is 1980^0. How many sides has the polygon?
A. 9 B. 10
C. 11 D. 12
E. 13

36. Expand the expression $(x-3)^2$
A. $x - 6x + 9$ B. $x^2 - 6x + 9$
C. $x^2 + 6x - 9$ D. $x^2 + 6x + 9$
E. $x - 6x^2 - 9$

37. In a right - angled triangle ABC, /AB/ = 6cm, /AC/ = 10cm and $\angle ABC = 90^0$. find the value of tan ($\hat{BCA}$)
A. $\frac{3}{4}$ B. $\frac{3}{5}$
C. $\frac{4}{5}$ D. 0
E. $\frac{1}{6}$

38. Make **d** the subject of the formular given below $\frac{7n}{3} = \sqrt{d-5}$
A. $\left(\frac{7n}{3} + 5\right)d$ B. $\frac{49n^2}{3} + 5$
C. $\left(\frac{7n+5}{3}\right)$ D. $\frac{49}{9}n^2 + 5 = d$
E. $\left(\frac{42n}{3} + 5\right) = d$

What is the Curved surface area of a cylinder with base radius 7cm and height 10cm?

A. $440cm^2$ B. $154cm^2$
C. $194cm^2$ D. $208cm^2$
E. $422cm^2$

40. Given the sequence 9,12,15,18..... find the sum of the next three terms

A. 27 B. 72
C. 36 D. 63
D. 32

41. If $\frac{1}{2}x-3= 1-\frac{1}{2}x$, find the value of x^2

A. 8 B. 16
C. 1 D. $\frac{1}{4}$
E. $\frac{1}{16}$

42. Find the angle made by a sector of a circle whose lenght is 13.2cm and radius 28cm

A. 41.2^0 B. 14.8^0
C. 27^0 D. 36.9^0
E. 40.0^0

43. The Square root of $81 \div 289$ is.....

A. $\frac{9}{289}$ B. $\frac{1}{29}$
C. $\frac{9}{17}$ D. $\sqrt{\frac{1}{29}}$
E. $\frac{9}{18}$

44. What is the positive difference between the sum of 3.8 and 2 and the product of 3 and 1.3 ?

A. 8.3 B. 9.7
C. 7.1 D. 5.0
E. 1.9

45. Given that $\tan \theta = \frac{5}{12}$, evaluate $1- \cos \theta$

A. $\frac{1}{13}$ B. $\frac{12}{13}$
C. $\frac{5}{13}$ D. $\frac{7}{13}$
E. $\frac{6}{13}$

46. A man is ten times the age of his daughter. His daughter is five years older than their third son who is five years old. What was the man's age four years ago?

A. 50 years B. 15 years
C. 96 years D. 20years
E. 30 years

47. $88.000cm^3$ of water is poured into a cylinder of radius 20cm, find the depth of the water in the Cylinder.

A. 4400cm B. 70cm
C. 60 cm D. 50cm
E. 40cm

48. A man invested ₦250.60 at the rate of 15% for twenty years. Find its simple interest .

A. ₦28.50 B. ₦285.00
C. ₦75.18 D. ₦751.80
E. ₦721.80

49. X varies directly as the square root of y. when x = 3, y = 25. Find x when y = 100

A. 14 B. 12
C. 10 D. 8
E. 6

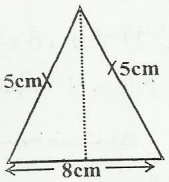
50. A cylinderical tank of diameter 20cm and height 14cm will have a capacity of..... cl^3

A. 34 B. 4400
C. 24 D. 280
E. 32

51. What is the range of the following numbers? 4,1,5,3,7,2,9

A. 8 B. 3
C. 7 D. 10
E. 19

52. The area of the triangle below is.....

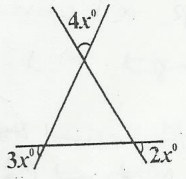


A. $12cm^2$ B. $18cm^2$
C. $18\pi cm^2$ D. $9cm^2$
E. $8cm^2$

53. Which of the following plane shapes has no line of symmetry?

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

54. Find the value of $2x^0$ in the diagram below



A. 20^0 B. 80^0
C. 60^0 D. 180^0
E. 90^0

55. What number do the tally marks ||| ||| ||| ||| //, represent?
A. $4\frac{1}{2}$ B. 4.2
C. 22.0 D. 20.2
E. 42.0

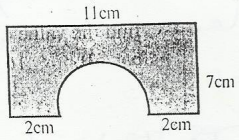
56. In a circle, the region bounded by two radii and an arc is called.....
A. Diameter B. Segement
C. Sector D. Chord
E. Circumference

57. Simplify $(\frac{1}{2})^{-3}$
A. $\frac{1}{6}$ B. $\frac{1}{8}$
C. $-\frac{1}{8}$ D. -8
E. 8

58. 3 nuts and 6 bolts have a mass of 72g, 4 nuts and 5 bolts have a mass of 66g. Find the mass of a nut and a bolt
A. 4g nuts 10g bolts
B. 3g bolts 12g nuts
C. 3g nuts 12g bolts
D. 4g bolts 7g nuts
E. 5g nuts 8g bolts

59. The volume of a cylinder is 396m². if the he... of the cylinder is 14m, what is the radius of t... circular base of the cylinder, if $\pi = \frac{22}{7}$?
A. 4m B. 3m
C. 5m D. 6m
E. 7m

60. The area of the shaded portion of the figure below is .....

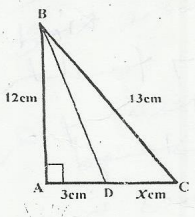


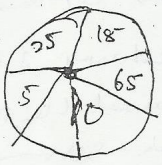
A. 77cm² B. $19\frac{1}{4}$cm²
C. $57\frac{1}{4}$cm² D. 38.5cm²
E. 44cm²

SECTION II

INSTRUCTION: Answer ALL the questions in this Section. Remember to write your NAME and EXAMINATION NUMBER on the anwer sheets provided.

1. (a) Simplify $10111_{two} - 110_{two} + 111_{two}$ leaving the answer in base ten
(b) In the diagram below AB = 12cm, BC = 13cm and AD =3cm.
(i) Find the value of x





(ii) What is the perimeter of the triangle ?

2. The table below shows the expenses of a man in a certain year.

Description	Expenditures(per ₦1000)
House rent	25
Fuel	15
Food	65
Repairs	5
Training and fees	10

(a) Draw a pie chart to illustrate the above information
(b) What percentage of the expenses was spent on food?

3. (a) The area of a trapezium is given by $A = \frac{1}{2}h(x+y)$, where **h** is the height of the trapezium and **x**, **y** are the two parallel sides.
(i) Make h the subject of the formular
(ii) Hence find to the nearest cm the height of a trapezium with sides 10cm and 8cm, and its area $120cm^2$

(b) Simplify completely without using a calculator

$$\frac{2.1 \times 0.64 \times 1.05}{4.9 \times 0.024}$$

4. A child welfare clinic recorded the following for the 30 children treated on a particular day.

C	C	F	R	F	C	M	F	C	C
M	C	R	C	C	R	F	C	F	F
R	F	C	M	F	C	F	R	C	F

C Stands for Cough
F Stands for Fever
M Stands for Measles
R Stands for Rashes

(a) Construct a frequency table for the data
(b) From your table draw a bar chart
(c) What percentage of the children were treated for cough?
(d) What is the probability that a child selected at random from this data was treated against measles?

5. (a) Udoka rented 100 chairs at the rate of ₦300 each, per day; 300 plates at the rate of ₦1.20 each, per day; 150 spoons at the rate of 65k each, per day and 4 canopies at ₦1500 each, per day. If these items were rented for 3 days, what is the total amount paid by Udoka for renting the items?

(b) i Solve simultaneously to obtain **m** and **r**

$5m + 2r = 21$ .....(a)
$-10m - r = -18$.....(b)

ii What is the value of **V** in the equation
$5v^2 - 40v + 75 = 0$