UNIVERSITY OF CAPE COAST

SEX DIFFERENCES AND TEACHERS' AWARENESS OF SCHOOL -BASED ASSESSMENT AMONG SENIOR HIGH SCHOOLS IN HO MUNICIPALITY

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BY

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Thesis submitted to the Department of Mathematics and Information and Communication Technology Education of the College of Education Studies, University of Cape Coast, in partial fulfilment of the requirements for the award of Master of Philosophy Degree in Mathematics Education

JULY 2015

DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this university or elsewhere.

Candidate's Signature: …….. Date: …….

Name: Atachie Fidelis Paul

Supervisor's Declaration

We hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Principal Supervisor's Signature: ……. Date: ……..

Name: Prof. Jonathan A. Fletcher

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Name: Prof. Damian Kofi Mereku

ABSTRACT

This study sought to investigate significant sex differences in students' achievement scores in core mathematics as measured by the School-Based Assessment System. It also investigated the extent to which mathematics teachers were aware and conversant with the provision for the SBA. A survey method was used and simple random sampling and purposive sampling techniques were used to select three Senior High Schools in the Ho Municipality. A total of 194 students had their assessment information used for the study as well as 42 Mathematics teachers participated in the study. A questionnaire consisting of 12 items measured on a 5-point Likert scale was used to collect the data on the teachers while students' academic records on SBA were obtained directly from the schools. The results showed that there was a significant sex difference in achievement scores between male and female students on class assessment task scores. However, given the size of the absolute mean sex difference of class assessment tasks and end of term examination scores, the study concluded that the female students performed equally well as their male counterparts on examinations. It is recommended that assessment should not be used as a means of punishing students but should be used to enhance the teaching and learning process. It is also recommended that an intensive in-service training and workshops be organized for the Mathematics teachers to educate them on the effective use of SBA in schools sampled within the Municipality.

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DEDICATION

To Fidelis Sedem Atachie and Jane Enam Atachie for their immense contribution during the course of my studies.

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CHAPTER ONE

INTRODUCTION

Background to the Study

Mathematics education to a nation is the bedrock that ensures the efficiency of everything that we do. As a vital tool for the understanding and napplication of science and technology, the discipline plays a key role in its applicability in almost all school subjects such as Economics, Accounting, Engineering, and in the Arts. Its role is evident even in the military, health, construction, sports and the like. More so a political party had to contest the 2012 Presidential election in Ghana at the Supreme Court over an alleged poor arithmetic where presiding officers could not count ballot papers and add up figures properly, and in some occasions, blank spaces were filled up with numbers which, perhaps brought about a series of disparities in the final analysis of the result. The consequence of this anomaly is still felt in recent times.

Cockcroft as cited in Ntow (2009) indicated categorically that mathematics is a necessity in life and that without mathematics it would be difficult to live a normal life in very many parts of the world. It is rather interesting to state that people who understand, appreciate and can do mathematics significantly enhance the opportunity of shaping their future.

Perhaps, not many people have bothered to ask themselves why a two or three story-building in Ghana would collapse as in the case of the Melcom building in Accra and many others while a 162 story-building in Asia still stands firm. This is only one of the many questions that can be answered using mathematics. In actual fact, there are principles and methods in mathematics which need to be understood and adhered to stringently. This is because, all who apply these principles and methods of mathematics efficiently do things properly and the blatant neglect of these principles and methods leads to disaster.

Due to the importance Ghanaians attach to mathematics, the mathematics curriculum of the Senior High Schools in Ghana aim to develop in students basic quantitative skills as well as help them to appreciate the qualitative usefulness of mathematics in other school subjects and in the vocations such as commerce (CRDD, 2007). Mathematics according to Clements and Battista as cited in Atsu (2011) enhances creative and logical reasoning skills in dealing with challenges in our geometric world. Actually the planet on which we live is full of geometric features and there has been a growing recognition that students learn mathematics in ways that can help them appreciate the relevance of these features in real life. This is to emphasize the point that mathematics can be learnt easily and made fun.

In spite of this, an important issue around the world today which has generated so much interest is the role of women in national development. A growing area of research has conceptualized that women can play expected roles in society effectively only when they are given enough and quality education (Danquah, 2000). Meanwhile, quality education is crucial to the economic

development and social stability of a nation as it helps develop crucial humanitarian values like equity, tolerance, and peace. These values lead to sustainable national development, environmental protection, and improved family health, along with responsible participation in democratic, social, and political processes (Durodola and Olude, 2005). Despite this, sex differences in academic achievement persists in many economies and has been a long standing issue which now constitutes major research focus across the globe.

In Ghana, as elsewhere, the issue of sex differences in achievement has been an issue of much concern for guidance and counselling coordinators, educational researchers and the general public at large. There is one section that holds the notion that males (boys) are better achievers in school mathematics than (females) girls. This assertion is keenly supported by the study conducted by the Female Education in Mathematics and Science in Africa (FEMSA, 1997) whose findings revealed that the widely held perception that girls cannot cope with mathematics and science subjects or scientific careers still persists. Both literates and illiterates, according to FEMSA, believe that science and mathematics are difficult and therefore girls cannot do them.

Studies on the trend of achievement of secondary school students in Ghana reported a low achievement in mathematics and females' achievement was lower than that of males (Eshun, 1999; Anamuah-Mensah et al, 2008). Moreover, the West African Examinations Council's statistics on performance of students in mathematics (both Core and Elective) for 2011/12 and 2012/13 examinations

showed a downward trend in achievement and females achievement was lower than that of males over the period under consideration.

Elsewhere, O'Connor-Petruso, Schiering, Hayes and Serrano (2004) have shown that gender differences in mathematics achievement become apparent at the secondary level when female students begin to exhibit less confidence in their mathematics ability and perform lower than males on problem solving and higher level mathematics tasks. In a different study, data suggests that as students grow older gender differences in mathematics tend to be more pronounced (Campbell and Beaudry, 1998). The study obtained data to show that, in elementary school, gender-based achievement gaps are small or nonexistent. However, as students approach middle and high school, greater gaps are found in mathematics achievement measures, mathematics participation, and in attitudes towards mathematics in general. Also, Gallagher and Kaufman (2005) recognized that the mathematics achievement and interest of boys are better than the girls. They however could not explain the main cause of these differences. Kotte (1992) also indicated that male students perform better than female students in many areas of science and mathematics while Stage, Kreinbery, Eccles and Becker (1985) observed that high school boys performed a little better than high school girls on test of mathematics reasoning involving word problems.

Perhaps, differential socialization in and outside the classroom could encourage autonomous learning behaviors in males and dependent learning behaviors in females. According to Campbell and Beaudry (1998) male students are disproportionately provided with lower levels of help than their female peers

in the classroom and at home which usually leads to encourage self-imposed pressure and persistence in males. However, female students, according to the study are socialized to be more dependent on others for academic help, which serves to negatively affect their self-confidence in developing their mathematics skills.

Moreover, the relationship between self-concept and mathematics achievement is an area that has been investigated by researchers. Hamachek (1995) observed that low self-concept tend to appear together with students' underachievement. The study added that those who have higher self-concept, having more confidence in doing mathematics, gain higher scores in mathematics. The study concluded that self-concept does not only influence students' mathematics achievement but also forms the basis of all motivated behavior.

This phenomenon of low achievement of female students most especially has become a worry to many who show interest in the girl –child education. This is because some basic knowledge of mathematics is essential for all students, not only those pursuing careers in scientific and technical fields, so that these girls are not deprived many career choices, including skilled technical and computer-oriented occupations as well as access to high-salaried occupations. It is obvious that girls' education is not only a fundamental right, but also an important catalyst for economic growth and human development (Oxfam, 2000). There are a host of reasons why the significant gender differences in mathematics achievement and participation are important.

Lamb (1997) argued that mathematics is a critical filter in career choice. Moreover, mathematics is increasingly being used in our technological world, and it is believed that those who would opt out of mathematics from 16 years on-wards may be denied important opportunities. Moreover, given the changing job market, many women could be disadvantaged in their later lives if they had not pursued the required level of mathematical proficiency. This was perhaps especially significant because a higher proportion of women today need to be wage earners due to changes in family structure as well as social and role expectations. Many therefore need to be secured in their jobs and financially independent especially in Africa.

Another significant reason why gender inequities in mathematics was important, according to Ernest (1994) is that they perpetuate the reproductive cycle of gender inequality in mathematics education such that these inequities will reproduce themselves until halted. This, as well as other social influences, reinforces gender stereotyping and negatively influences many girls' perceptions of mathematics and their own abilities in mathematics.

As part of national effort to resolve the anomaly, Ghana in 1987 launched the Science, Technology and Mathematics Education (STME) project designed to address the gender imbalance, wrong social perception and misconceptions about girls' participation in STME. Specifically, clinics were organized for girls in that regard to enable them develop interest in the subject and invest time and effort in it. Moreover, the Ministry of Education also set up a desk for the co-ordination of STME to sustain the process and the clinics were decentralized into zonal levels

where two or three regions were combined in clusters for each clinic. As a result of the STME intervention, a number of reports that were published indicated that student enrolment in the science and mathematics related courses had shot up tremendously. With this, the study of mathematics was reinforced since the subject was seen as a pivot around which many other subjects revolved.

Campaign for female education (Camfed) is also making conscious efforts to support the education of female students and to bring them at par with their male counterparts in some deprived regions in Ghana. Camfed also aim at promoting participation of girls in mathematics and science education at the basic and second cycle levels and to enhance their performance in these subjects and access to careers in mathematics and science.

On the other hand, there are those who hold the view that females do as equally well in academic subjects as their male counterparts and that there is no significant difference in their academic performance. For instance, a study undertaken on gender-achievement by Abiam and Odok (2006) found no significant relationship between gender and achievement in number and numeration, algebraic processes and statistics. They however found the existence of a weak significant relationship in geometry and trigonometry.

Howes, (2002), Sinnes, (2005) posited that mathematics is a science subject and that some gender-based science researchers have reported that what both the 'feminist empiricists' and the 'liberal feminist critics' seem to agree is that females in principle will produce exactly the same scientific knowledge as males provided that sufficient rigor is undertaken in scientific inquiry . They also

believe that initiatives that build on the assumption that females and males are equal in their approach to science, and that inequality in science and science education is caused by political, educational and social factors external to science, would be expected to focus on removing these external obstacles. There is a need therefore to give boys and girls exactly the same opportunities and challenges.

The knowledge of mathematics is actually an essential tool in our society (Baroody, 1987). It is a tool that is so valuable in our everyday life to overcome the difficulties faced (Bishop, 1996). Due to this mathematics had been considered as one of the most important core subjects in the school curriculum. In spite of this, girls often were discouraged from mathematical work in their primary years. They therefore abhor the subject in the secondary years. Eventually, they drop it at high grade levels in far greater numbers than boys. In view of this, fewer women are employed in industries with post needing mathematical ability.

Poor mathematical skills in women deprive them from a large number of professions because in some countries mathematical background knowledge was the pre-requisite for entrance into some professions. For instance, in Australia mathematics results were used as a critical filter for higher education and future careers. Gender differences in academic achievement were therefore serious concerns for such communities (Cuttance, 1995; Barnes and Horne, 1996).

It is a common observation that at higher levels of education fewer females offer mathematics compared with their male counterparts. As a result, males fill more employment vacancies based on knowledge of mathematics than

females. Females do not prefer mathematics at higher level because they perceived it as a male domain. Therefore professions requiring higher level knowledge of mathematics were dominated by the male community.

Lamb as cited in Nyala (2001) observed that in Australia, the difference in the proportion of students who enrolled in additional mathematics was more substantial, with only half as many girls taking up the subject as boys. However, additional mathematics was a prerequisite for engineering, science and technology based courses in higher education. Thus, if the same large gender gap in elective mathematics exist in Ghana, which would mean that more girls than boys would have counted themselves out of these career category. In support of this, statistics obtained from the West African Examinations Council (WAEC) in the year 2000 publication revealed that 35% of boys enrolled in elective mathematics in 1999 as against 28% of girls in schools where the subject was offered. Consequently, more boys than girls, according to the publication, would be open to the opportunity of choosing courses that required mathematics background knowledge granted that they all passed the examination. Ten years later, the situation had still not improved.

There are a host of social hurdles which deter the female students from pursuing their careers in mathematics. It is believed there are many barriers for females in choosing carriers in mathematics. For instance, they may express the interest and pleasure in taking courses in mathematics but their parents may consider it as a useless effort for them. Sometimes female students show less

confidence in mathematics than their male counterparts (Hanson, 1992; Dickens and Cornell, 1993).

Lamb as cited in Agbemaka (2001) observed that girls' confidence in mathematics ability tend to match that of boys in the primary school years and deteriorate more rapidly during high school. The declining interest and growing difficulties were combined with a lower self-confidence. According to the study, female students, compared to their male classmates attributed success in mathematics less to their high ability and failure more to their low ability. Female students also look down heavily on their own abilities as compared to their male counterparts.

Though globally the issue of gender inequality in Science, Technology and Mathematics Education (STME) has produced inconclusive results, one meta-analysis covering the period 1974 – 1987 on mathematics and gender indicated that the average gender gap is very small (statistically insignificant), and that the differences tend to decline with time (Friedman, 1989). As part of research effort to resolve the deplorably low state of academic performance as well as deal with the incidence of gender gap in achievement at the various levels of school mathematics, a host of researchers have identified inherent unfairness in the traditional mode of assessment employed in the schools (Asim, 2007). Here, Francis, Robson, and Read (2002) argued that traditional methods of assessment was seen to reward a style of academic work that is confident, bold and assertive, characteristics which were associated more with men than women. Some other

researchers have also assigned a variety of biological explanations to describe the situation (Kimura, 2000; Cohen, 2003).

Over the last few decades, diverse theories and frameworks have been developed and many have tried to identify factors that influence mathematics performance in order to reduce gender inequality in mathematics achievement (O'Connor-Petruso et al, 2004). Research evidences show that gender differences in mathematics achievement were due to various factors such as biological factors (Geary, Saults, Liu and Hoard, 2000) mathematics learning strategies (Carr and Jessup,1997) sex hormones on brain organization (Kimura, 2002) and symbolic gender (Nielsen, 2003). Despite afore mentioned factors, this study would explore assessment (school based assessment) influence on gender performance in mathematics.

Teacher judgments had been identified as a primary source of information regarding student academic achievement. Judging and scoring refer to the process of determining the quality of a student's performance, the appropriateness of an attitude or behavior, or the correctness of a response. Results derived from judging and scoring may be expressed as written or oral comments, ratings, categorizations, letters, numbers or some combinations of these forms. Research examining the accuracy of teachers' judgments in assessing students' academic abilities had shown relatively high accuracy (Kenny and Chekaluk, 1993: Eaves, Williams, Winchester and Darch 1994).

Assessment is a powerful educational tool. It is used to monitor the quality of the school system, evaluate educational policies and programs, make important

instructional and placement decisions about students, and certify students' learning achievement. In the mind of the ordinary person, assessment encompasses all the processes involved in order to produce a true picture of a characteristic of interest. Assessment in the words of MacGaw as cited in Atsu (2011) help students to see their own progress, enabled teachers to monitor their students and themselves and (assessment) measure what the educational systems consider to be important.

The Assessment Standards for School mathematics define assessment as "the process of gathering evidence about a student's knowledge of, ability to use, and disposition towards mathematics and of making inferences from that evidence for a variety of purposes (NCTM, 1995). The National Council of Teachers of Mathematics (NCTM) contended that effective mathematics teaching require understanding what students know and need to know. Classroom assessment therefore informs the teacher about what students think and about how they think. Assessment in real terms should determine instruction rather than instruction determining what to assess. Indeed, assessment in education, which is the evaluation of male and female students learning, ought to be accurate and true.

Assessment can focus on the individual learner, the learning community or the educational institution as a whole. It serves as the barometer by which students' instructional achievement outcome can be gauged. Accurate assessment of students' academic abilities has therefore been identified as one of the most crucial variables related to effective instructional planning and positive student outcomes (Shinn and Bamonto, 1998).

Assessment enables the school to achieve an overall objective of having as complete a record of the growth and progress of each pupil as possible in order to make unbiased judgments in the cognitive, affective, and psychomotor evaluation in the classroom. Martens and Witt (2004) argued that without a valid assessment of students' academic skills, instructional decision making was unlikely to promote academic competence. According to Moore (1998), assessment is the process of gathering evidence of what a student can do and provide feedback on the student's learning to encourage further learning.

Assessment could either be formative or summative for the purpose of this study. The former is the process of judging the worth of teaching and learning constantly during the period of instruction. Formative assessment require gathering detailed information on students at regular intervals through such means as teacher observation, classroom questioning, home assignments and short tests or quizzes. The main purpose was to provide feedback to both the teacher and the learner about progress being made. In addition, it can be used for diagnostic purposes to provide immediate and meaningful feedback.

On the other hand, summative assessment is the process of judging the worth of teaching and learning at the end of the period of instruction. It attempts to measure the extent to which the broad objectives of teaching and learning are attained. Assessment produced outcome and the outcome would be obtained through measurement. The assessment method according to Black and William (1998) is the systematic way of measuring male and female students' learning. It is evident that classroom assessment forms an integral component of the teaching

and learning process. In fact the mode of assessment employed in our educational establishments in Ghana, even in recent years focus primarily on the lower level concepts which lend itself to measurement under examination conditions.

Yet, classroom assessment ought to help teachers to establish what students already know and what they need to learn. Meanwhile, in Ghana mathematics is often learnt as a set of routines carried out by students in response to deal with test items. This mean that the assessment of mathematics achievement whether formative or summative tend to use the same method. This seems so absurd in the minds of many.

According to Countryman (1992) the rules and procedures for school mathematics make little or no sense to many students. They memorize examples, follow instructions, do their homework, and take tests, but never know what their answers mean. In support of this, the 2008 TIMSS report indicated that most Ghanaian students were unable to apply the knowledge and understanding they acquired in mathematics in real context (Anamuah-Mensah, Mereku and Asabere -Ameyaw, 2008). For instance, a student can recite multiples of 5 very easily, but when the same student enters into a market and sees foodstuffs put in heaps each at Gh₵5. The student cannot tell how much he will pay if he needed 6 heaps. The report added that Ghana's JHS2 students' performance in mathematics and science remain the lowest in Africa and the world. There is need therefore to make learning more relevant to the needs of the learners in order to halt the tendency of developing gender gaps in students' learning.

Meanwhile, Principles and Standards for School Mathematics (NCTM, 2000) argued that students should be encouraged to seek, formulate and critique explanations so that classes become communities of enquiry. Moreover, the Professional Standards for Teaching Mathematics (NCTM, 1991) opined that teachers' responsibilities for assessment traditionally involved judging students' performance throughout instruction and judging students' knowledge and competence at crucial points during a term and compute their grades. The report added that these responsibilities had not changed, but the manner and means of meeting them have.

Ampiah, Hart, Nkhata and Nyirenda (2003) opined that a teacher need to know what students would be able to do or not if the teacher intend to be effective. It must be noted that the search for effective strategies for assessing students' academic achievement had assumed wider dimensions; and the worldwide search for better strategies become the focus of attention for prominent educationists, mathematicians in many countries in the world and as well as this study. Moreover differences in learner characteristics imply that over-reliance on one form of assessment strategy disadvantages students who would be able to display their knowledge, skills or abilities more effectively through other methods (Leder, Brew and Rowley, 1999).

Therefore, in order to revamp the entire spectrum of mathematics activity and then bridge the gender gap, the instruction should focus primarily on reasoning and problem solving rather than rote memorization and computation, which tend, perhaps to be the preserve of males. This will require the

development and use of alternative assessment techniques that measure students' higher level reasoning or cognitive power. In alternative assessment students had the opportunity to demonstrate what they learn. This type of assessment focuses primarily on the growth and the performance of the student. It also offers instructors the opportunity to have a better understanding of students' learning (Winking, 1997). That is, looking at the student product rather than scores, according to Niguidula cited in Atsu (2011) can allow instructors to get further insights regarding students' knowledge and skills. For the past two decades there had been numerous advocates of alternative assessment as one of the critical pieces necessary to enhance student learning. These clarion calls for alternative assessment methods had increased in response to deal extensively with the high incidence of failures in mathematics.

Authors such as Karge (1998) and Morris (2001) described a variety of alternative assessment tools which had the potential to increase students' engagement and made learning more relevant. These include; role –play and drama, students' portfolios, reflective journals, utilizing multiple information sources and group work in which team members design and build models. It is believed that the way students are assessed in mathematics could be indicative of the way they were ultimately taught (Bolt and Hobbs, 2005) and as long as school assessment was based on timed–written test with a number of questions to be answered, very little will change with regards to the methodology and assessment method employed by mathematics teachers in the schools.

As regards the Educational Reform of 1987, continuous assessment of students and external examinations were used stringently to assess students' academic achievement for final certification (MOE, 1987) at all levels of education. The committees which dealt with the continuous assessment in their reports included the Dzobo Commission of 1974 and the Educational Commission of 1985, culminating in the reintroduction of continuous assessment more strongly in 1987. Host and Bloomfield (1975) recommended the continuous assessment model as a better system of assessment than just a 2- or 3-hour examination. Continuous assessment as an alternative assessment model was expected to improve and deal effectively with gender issues surrounding teachers' assessment of students' work. But in Ghana, the emphasis on traditional forms of assessment such as school and national examinations, quizzes and tests made continuous assessment less effective in performing its core mandate to enhance students' learning and thereby their performance.

The Cockroft Committee, cited in Atsu (2011) suggested that an effective mathematics teaching at all levels should comprise the following six elements - discussion, practice for consolidation, practical work, investigational work, problem solving and application of mathematics in everyday situations. The report suggested engaging students in all the elements will make the students active learners rather than passive recipients for mathematical concepts. This report laid much emphasis on project work where the student is expected to construct his own knowledge to enhance deep conceptual understanding (Mereku, 2004). It also made the student an important component in the teaching learning

process. Meanwhile, in Ghana a number of the elements of instruction suggested by the committee above are conspicuously absent in our classroom practice.

Hypothetically, a routine mathematics classroom practice is such that a teacher poses a mathematical problem, explains the process of solution in minute steps and let students practice several of the similar exercises. This mode of instruction according to Clements and Battista (1992) demonstrated to be ineffective in enhancing deep conceptual understanding of mathematical concept by students. This phenomenon according to Parpert as cited in Fletcher (2010) narrows the curriculum because any time one teaches a student something, the student is deprived the pleasure and benefit of discovery. Consequently, as part of efforts to make assessment more comprehensive and to incorporate the other suggested elements of instruction, the School Based Assessment (S.B.A.) which is a modern alternative assessment model was introduced into the curriculum of second cycle schools during the recent curriculum review in 2007 to enhance the continuous assessment (CRDD, 2007). The S.B.A is a school based task which is designed, administered and marked by the students' own teachers.

School Based Assessment (SBA) is a system for collecting performance data on students in the course of their work in school. Education in the school system consists of a variety of practical work, as well as theoretical work. SBA therefore gives schools the chance to ensure that the performance of students on both practical skills and theoretical knowledge is reflected in the marks students obtain in the School Based Assessment records. It is believed that learning does not take place only in the classroom. Education is a broad concept and students

are expected to learn from a variety of sources; from their teachers, friends and elders, the library and generally from their environment. All these sources contributed to the education of the young person. The seriousness with which students learn in the classroom and outside the classroom should therefore reflect in the assessment system of schools.

The SBA presents a reduced number of assignments that can be easily handled by both teachers and students. It is expected that the SBA will help teachers and students to achieve the objectives of the syllabuses and consequently raise the standard of learning in the respective subject areas. It is also designed to provide schools with an internal assessment system and purposed to;

(i) standardize the practices of internal S.B.A. in all schools in the country, provide teachers with guidelines for constructing assessment items and other assessment tasks.

(ii) introduce standards of achievement in each subject and in each class of the school system,

(iii) provide guidance in marking and grading of test items and other assessment tasks,

(iv) provide teachers with advice on how to conduct remedial instruction on difficult areas of the syllabus to improve students' performance (CRDD, 2007, p. ix)

The switch from continuous assessment to school based assessment brought about some changes in the classroom assessment system. Previously, continuous assessment comprised 30% of a student's total achievement in a term

but in the School Based Assessment it is 50%. Moreover, homework scores obtained by a student composed the assessment scores for continuous assessment but these marks would not form part of School Based Assessment.

Ideally, alternative assessment is a generic term referring to the new forms of assessment other than traditional forms of assessment (Winzer, 1992). The main goal of alternative assessment, according to Garcias and Pearson (1994) is to gather evidence about how students are approaching, processing, and completing real-life tasks in a particular domain. Alternative assessment may include interview with students, journal writing, students' development of portfolios of their work and writing of reflections of their study. Also, students are encouraged to engage in cooperative learning groups and be assessed individually and jointly. Thus in the alternative assessment process, a student has the opportunity to be responsible for selecting products of their work on which to be assessed. They also reflect on their own learning experience, pointing out what they understood and factors which contribute to their lack of understanding (Huerta-Marcias, 1995).

An advantage of alternative assessments is that they result in measuring directly and explicitly higher level thinking or metacognitive skills. Also the students gain confidence as partners and decision makers in their learning situation while the teacher only facilitates the learning process (Smolen, Newman, Wathen and Lee, 1995). It would therefore reduce considerably the workload on the teacher but making the students more responsible for their own learning. It would also offer the teacher a variety of assessment information on the student.

It is believed that bridging the gender gap in achievement is one major way of achieving equality and enhancing human and social development. Arguments favour alternative assessment as an efficient, effective and authentic technique for assessing and gaining insight into students' academic performance. Research evidence by Eshun and Abledu (2000) indicated that the significant improvement in the performance of only the experimental group on the external tests indicated that the alternative assessment activities significantly increased the students' ability to use problem solving approaches in new situations. They affirmed that the significantly higher performance by the low ability students of the experimental group over their counterparts in the controlled group on the internal tests indicated that female students with lower achievement in mathematics benefited greatly when exposed to alternative assessment.

Lee cited in Eshun and Abledu (2000) found that the real value of alternative assessment is an information source for teachers and a learning tool for the students. Viaskamp, cited in Eshun and Abledu (2000) also found that alternative assessment processes engage students to become active in learning through reflection and judgment of their own learning.

Statement of the Problem

Over the last few decades, an accumulated body of research has documented low achievement in mathematics as a major issue of debate and concern among a host of mathematics researchers. These students' poor performance in mathematics is further worsened by gender imbalance leading to the problem which now constitutes major research focus across the globe

(UNESCO, 2003). Some researchers attributed this to the mode of assessment employed in the schools. Francis et al. (2002) argued that the traditional method of assessment rewarded a style of academic work that was confident, bold and assertive, characteristics which are associated more with men than women. Other research reports also advanced biological explanations to support their claim. Meanwhile, a host of researches undertaken obtained their primary data using the traditional mode of assessment. Could the method of assessment have had any influence on the data and thereby the findings? Or would the use of an alternative method of assessment have brought about some insights or improvement in students' performance?

In 2007, the curriculum of senior high schools in Ghana was revised as part of educational reform which made senior high school education four years. This brought about some changes into the school assessment system. One of the major changes was the introduction of the school based assessment (S.B.A) system to enhance the continuous assessment, then in operation. This was deemed prudent since the workload on teachers in carrying out continuous assessment was pronounced to be burdensome. Owing to this many teachers in the recent past years were alleged to have been producing their own marks in completing the continuous assessments for their students which never reflected the true picture of the students' academic achievement.

Unlike the traditional assessment which provided very little information on the student achievement, the School Based Assessment system contained varied information from diverse sources and would be more representative of the

students' actual performance in mathematics. It also offered the students the opportunity to relax when taking the test. As a result, the students would perform well since they would be familiar with their own classroom environment.

If the School Based Assessment would help broaden and deepen students' knowledge base then, all things being equal, both male and female students are more likely to demonstrate better and equal achievement in mathematics.

Although, the School Based Assessment was introduced into the school system, observation and interaction with other colleagues indicated that mathematics teachers who are supposed to be the key players in the implementation process, perhaps, do not seem to have much idea or firm grip on the assessment process. Meanwhile, for any system of assessment to achieve the intended purpose, it is imperative that teachers are educated adequately on the changes which needed to be incorporated into the implementation process. There is no research evidence to the best of my knowledge that this is the case. Nor there is any evidence that male and female mathematics students are benefiting unequally under the SBA system. It is this void that the present research sought to address.

Purpose of the Study

The aim of this study was to investigate sex differences in students' achievement scores in core mathematics as measured by the School-Based Assessment System. It also investigated the extent to which mathematics teachers were aware and conversant with the provision for the S.B.A.

Research Questions

This study addressed the following research questions:

1. What is the significant mean difference in achievement scores between male and female students in CATs scores in core mathematics?
2. What is the significant mean difference in achievement scores between male and female students in their end of term examination?
3. What is the mathematics teachers' level of awareness and understanding of the provisions for the implementation of the school based assessment tasks?

Significance of the Study

A search through a host of academic research reports on gender and academic achievement in mathematics had yielded inconclusive results. It is expected that the findings of this study will be useful to classroom teachers to enable them deal effectively with gender issues in the acquisition of mathematical knowledge in their classrooms. It also purposed to present numbers to show the difference in academic achievement scores between male and female students on class assessment task and end of term examination. It is hoped that if the result of this study is indicative of the fact that gender differences in academic performance is dependent on the choice of assessment technique, it would be useful for the Curriculum Research and Development Division (CRDD) to look keener on the choice of assessment practice to suggest in the mathematics curriculum of Ghanaian schools. The results of this study have also drawn the attention of other entities to encourage the use of pragmatic methods of teaching,

learning and alternative form of assessment. It has also brought to light some of the weaknesses in teachers' classroom assessment.

The Ghana Education Service could also adopt the complete study report in order to organize an In-SET program to train teachers on the effective use of school based assessment practice in the classroom.

Delimitation

The study was delimited to the Ho Municipality in the Volta Region of Ghana. Students' records were drawn from three Public co-educational institutions for the study. The study was also limited to the high school students only since research studies indicated that gender differences in students' mathematics achievement become apparent at the secondary level. The study focused mainly on students' class assessment task and end of term examination scores to draw conclusions.

Limitations

The study was restricted to only three mixed schools in the Ho municipality and in view of this, the findings of the study cannot be used to paint a national picture of the use of SBA in schools. Perhaps, a major limitation of this study was using students' scores without actually verifying from the students how the scores were generated, albeit their teachers described vividly how the scores were generated. Even so, the scores used in the study were actually used by teachers to make decisions about the students so provided they were valid, in the sense that they represented the students' achievement levels, then using them without verifying their authenticity from the students does not invalidate the

findings of the study. The key issue here is the validity of the teachers' scoring of the students and this was ascertained through the work the researcher did with the teachers.

Moreover, since the individual student's score cannot be distinguished from the overall score and for the purposes of comparison, some components of the SBA such as group project and group work were left out of the study. As a result, class test, class exercises and end of term examination scores were the only components of SBA used for the study.

Definition of Terms

Traditional Assessment

Traditional Assessment refers to the forced-choice measures which include multiple-choice tests, fill-in-the-blanks, true-false, matching and the like that have been and remain so common in education. Students typically have to select an answer or recall information to complete the assessment. These tests may be standardized or teacher-created. They may be administered locally or state-wide, or even internationally. Traditional assessment approaches mostly focus on product rather than progress and process (Birenbaum and Feldman, 1998). Therefore, in many educational contexts, assessment is generally conducted at the end of a school term to assign grades or promote students to the next level. In view of this traditional assessment approaches are used more for summative purposes.

Traditional assessment consists of three main components. These include homework, class test and end of term examination. All these are put together to determine the student's total performance in the term.

(i) Homework – a task to be accomplished out of class covering one or few days teaching.

(ii) Class test - a test which is conducted on a unit of work done in class and within class period.

(iii) End of term test – an examination conducted on the whole term's work done at the end of the school term in a formal setting within a stated time limit.

Alternative Assessment

It is a generic term referring to new forms of assessment other than traditional forms of assessment (Winzer, 1992). It can focus on students' performance on tasks that require extended time, complex thinking, and integration of subject matter learning. It may include interview with students, journal writing, students' development of portfolios of their work and writing of reflections of their study.

School Based Assessment

This is a school based task which is designed, administered and marked by the students' own teachers. It was introduced into the school curriculum in 2007 but came into operation in 2008. The new School Based Assessment system consist of 12 assessments in an academic year instead of the 33 assessments in the previous continuous assessment system which leads to a reduction of work load

on teachers as compared to the previous continuous assessment system. This is made up of three assessments and a project work in a term making a total of twelve assessments for the year. The assessments for a term will consist of two tests, one group exercise and a project. The assessments are referred to as Class Assessment Tasks (CATs).

The SBA is purposed to provide schools the chance to ensure that the performance of students on both practical skills and theoretical knowledge is reflected in the marks students obtain in the SBA and on their End-of-Term examinations. It is also to give schools the chance to ensure that all aspects of the education and training of the young person are taken into account in the assessment of the performance of the young person while in school. Finally, it was also aimed at broadening the assessment base to cover more application profile dimensions as well as reduce considerably the workload on teachers.

Organization of the Study

The rest of the chapters were organized as follows:

Chapter 2 – Review of literature; here support is provided for the study from other relevant and related literature.

Chapter 3 - Methodology; research design, instruments development as well as how the reliabilities and validities of the instruments would be ensured and the statistical tools used to analyzed the data obtained.

Chapter 4 - Results of the study;

Chapter 5 -Discussions, Conclusions and Recommendations

- Highlights of major findings from the study, conclusions drawn and their respective implications to educational practice, as well as recommendations and suggestions made for future research.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

Overview

Mathematics is the basis for modern scientific and technological development and an important means of cogent, concise and unambiguous communication (Githua and Mwangi, 2003).

This chapter presents a review related to the problem under study. For the purpose of this study, the review has been organized along the following sub-headings.

(i) Gender Differences in Mathematics Achievement

(ii) Attitude towards Mathematics

(iii) Assessment and Evaluation

(iv) Gender Attitudes towards Assessment

(v) School Based Assessment (S.B.A) Paradigm in the Ghanaian High School Curriculum

(vi) The Use of Portfolio to Assess Students' Performances

(vii) Summary

Gender Differences in Mathematics Achievement

With the realization of the significant role of mathematics to nation building, the government of Ghana made the subject compulsory at the basic and

secondary school levels. This was aimed at ensuring the inculcation in students the basis of logical and abstract thinking skills needed for living, problem solving and educational take off. In order to ensure the full realization of this laudable objective of mathematics education, subject mastery and demonstrated achievement should be evenly distributed across gender. Unfortunately, gender inequality in academic achievement persists in many economies and has remained a perennial problem of global scope (Bordo, 2001; UNESCO, 2003; Reid, 2003).

Gender differences in mathematics performance has been a great controversial issue in the educational domain and research documents show great discrepancies among girls and boys performance in school mathematics (Sprigler and Alsup, 2003; Fenema and Carpenter, 1981). Some researches undertaken have shown that male advantage in mathematics achievement is a universal phenomenon (Janson, 1996, Mullis, et al, 2000).

It is documented that male high school students perform better than female high school students on mathematics achievement tests.(Pisa, 2003; Sprigler and Alsup, 2003). Also, Amrein and Berliner (2002) revealed that females outperform males in both mathematics and reading during the elementary grades and that, by the end of middle school years, females have made additional gains in verbal skills, such as writing and language use. They added that during the high school years, however, females maintain their superior verbal skills but fall behind males on mathematics assessments. Gachukia and Kabira, (1991) opined that female education and training in Africa is generally characterized by lower performance.

Female Education in Mathematics and Science in Africa (FEMSA, 1997) added that the widely held perception that girls cannot cope with mathematics and science related subjects or scientific careers still persist. Both literates and illiterates, according to FEMSA, believe that science and mathematics are difficult and therefore girls cannot cope with them.

A study undertaken on the trend of achievement of secondary school students in Ghana showed low achievement in mathematics and females' achievement was lower than that of males (Eshun, 1999). Moreover, the West African Examinations Council's statistics on performance of students in mathematics (both Core and Elective) for 2011/12 and 2012/13 examinations showed a downward trend in achievement and females achievement was lower than that of males over the period under consideration.

Elsewhere, O'Connor-Petruso, Schiering, Hayes and Serrano (2004) have shown that gender differences in mathematics achievement become apparent at the secondary level when female students begin to exhibit less confidence in their mathematics ability and perform lower than males on problem solving and higher level mathematics tasks. Also, Gallagher and Kaufman (2005) recognized that the mathematics achievement and interest of boys are better than the girls. They however could not explain the main cause of these differences.

Some concerns raised recently also indicated that males outperformed females in mathematics achievement at the junior high and high school levels; there were also significant differences in attitudes toward mathematics between the two groups (Fennema and Sherman,1977).

They argued further that differences in mathematics achievement between males and females may be primarily due to differences in instruction; that males typically receive more and higher levels of mathematical instructions than females do. They suggested that differences in instruction might contribute immensely to differential item performance in mathematics. For instance, differential performance could possibly surface if one group of students has been appropriately instructed with the relevant concepts and the other has not.

Benbow and Stanley (1980) suggested that these differences may be due in part to gender differences in spatial abilities. They added that male students typically have different experiences that may be relevant to the development of mathematical skills than females do. Data from the 2003 Third International Mathematics and Science Study (TIMSS) indicated that boys continued to outperform girls in mathematics. While scores for both increased, the gain from 1995 scores was the same, 12 points, with the boys' average score going from 495 to 507 and girls' average score going from 490 to 502 (National Centre for Education Statistics, 2005). In addition, there is a continued, increasing discrepancy between the scores of high achieving (above the 75th percentile) males and females and a continuing discrepancy in the mathematics course taking patterns of males and females (National Centre for Education Statistics, 2005).

Meanwhile, Agbemaka (2001) observed that, the traditional view of mathematics as a male domain has greatly resulted in the decline in performance and ultimate participation of females in high school mathematics classes. To support this, Judy, as cited in Agbemaka, argued that girls view mathematics and

its related subjects as "masculine" subjects, which are hard disciplines and unrewarding. As a result, most of them tend to rely on their male counterparts to reach higher levels of learning. Hamachek (1995) observed that low self-concept tends to appear together with students' underachievement. Most findings in this area showed that those who have higher self-concept, that is having more confidence in mathematics, gain higher scores in mathematics and vice versa.

This self-derogating ability attribution has been postulated for girls with regards to mathematics on the basis of empirical findings concerning gender differences in attributions for success and failure. The study added that female students, compared to their male classmates attributed success in mathematics less to their high ability and failure more to their low ability. Female students look down heavily on their own abilities as compared to their male counterparts. These self-derogating attributions of female students are assumed and have partly been demonstrated to have serious negative implications for their expectations of future success in mathematics, their feelings accompanying success and failure, their perceptions of self-efficacy and consequently, their career choices related to mathematics and their long-term mathematics achievement.

Research findings show that variations in male and female students' performances in mathematics are due to factors such as attitude towards mathematics (Hammouri, 2004; Kiamanesh, 2004), self-concept (Bryen and Shavelson, 1987), home environment (Weiss and Krappmann, 1993; Fullarton, 2004; Koutsoulis and Campbell, 2001; Howie, 2005), parental education, schools

climate and culture (Fullan, 2001), and school connectedness or engagement (Blum and Libbey, 2004).

Some studies have revealed that the educational level of students' parents, educational resources available in the home, the socioeconomic status of the family (Marjoribanks, 2002), home language versus language of test and provision of quality homework assistance by parents are among factors that can explain variations in academic achievement. In actual fact, the home is the backbone of children's personality development and influences them both directly and indirectly through the kind of relationship the family members have among themselves as well as through helping them to get in contact with the society (Weiss and Krappmann, 1993).

More so, some researchers have also assigned a variety of biological explanations for gender differences in mathematics performance. Biological explanations for gender differences in mathematics achievement can be roughly grouped into three categories: genetic, hormonal, and cerebral, and they tend to focus on measurements of general intelligence and its specific components, especially spatial abilities.

Geary (1998) posited an evolutionary explanation, while Kimura (2000) proposes a hormonal theory. Cohen (2003) argued that there is a cerebral basis, suggesting that males and females have different brain types, and that women are better at empathizing while men are better at systematizing. Actually, considering the role of genes in determining gender, it is not surprising that theories

attributing gender differences in mathematics achievement to genetic differences exist.

Child and Smithers (1971) argued that due to the differences in the physical development of human brains, males have better developed visual spatial ability than females. Gray (1981), added that women suffer from a genetic deficit, and that biological differences between men and women really can account for some of the under-representation of women in some fields of science and mathematics. It would therefore not be surprising to indicate that individuals who subscribe to this philosophical framework would certainly be reluctant to commit resources to serve the needs of women, thereby widening the gender gap. While some researchers of biological gender differences in mathematics achievement argue that it is important to keep cultural factors in mind, others seem to regard biology as an immutable destiny (Blum, 1997).

In spite of research evidences for males' superiority in mathematics achievement, some research findings do not support the idea of gender differences in mathematics achievement. Findings from longitudinal study about gender differences in mathematics show that there is no difference among boys and girls in mathematics achievement (Ding, Song & Richardson, 2007). Their study shows that growth trend in mathematics among two genders was equivalent during the study times.

According to a recent international study conducted by Iranian Educational Authority, on average across all countries, there was essentially no difference in achievement between boys and girls at either the eighth or fourth

grade (Mullis et al, 2004). Accoding to Kiamanesh (2006), findings of two consecutive International studies (TIMSS 1999 and 2003) in Iranian educational system (a system that co-education is prohibited and female teachers teach in the girls' schools and male teachers teach in the boys' schools) also confirms that there is no significant differences between boys and girls in mathematics achievement. Data from these studies show the significant decrease in the boys' mathematics achievement score from the time of TIMSS 1999 and the significant improvement in the girls' achievement over the same period. The study observed that teacher job satisfaction, positive perspective of female teachers regarding teaching of mathematics as well as efficient assessment practices may be the factors behind the better mathematics performance of Iranian girls than boys at Grade 8 in Iran.

Meanwhile, Hyde (1993), Hyde and Mezulis (2001) believed that the cognitive differences between males and females have been exaggerated. Indeed, Hyde (1993) pointed out that there is considerable overlap in the distribution of male and female scores on mathematics and visuospatial tasks. However, Druva-Roush (1994) cited specific domain where gender differences existed in Mathematics, pointing out that girls seem to outperform boys in computational tasks and do less well on problem-solving whereas boys outperform girls on spatial tasks. Also, in a national study undertaken by the United States Department of Education (2004), it was reported that males did slightly better than females at mathematics and science whereas in the overall assessment, females showed superiority and they were significantly better in reading.

Leahey and Guo (2001) also found that among students in Grades Seven through Ten with low initial mathematics scores, females scored higher than males, but their growth rate was slightly slower. The report added that among those who had higher initial mathematics scores, no significant gender differences in initial scores and growth rate were found.

In contrast, Zhang and Manon (2000) reported that males had a larger variance in mathematics scores than females. Moreover, females tended to outperform males among the low-achieving students while males tended to outperform females among the high achieving students. Also, Hedges and Novell (1995) reported that males are more likely than females to be found at the tail ends of a given intelligent-testbell-curve and that as one approaches the ends of the tails, the effect becomes larger and at several standard deviations above and below the mean. They added that the ratio of individuals with identical scores tend to be one female to every five males. Intrigued by Hedges and Novell (1995)'s findings, Ma (1999) concluded that the differences in standard deviations for male and female cognitive traits might account for differences in high powered science job in favor of males.

Attitude towards Mathematics

Attitude is a central part of human identity. Everyday people love, hate, like, dislike, favour, oppose, agree, disagree, argue, persuade and the like. All these are evaluative responses to an object. Hence attitudes can be defined as a summary evaluation of an object of thought (Bohner and Wänke, 2002). Attitude towards mathematics (ATM) is the student's organized predisposition to think,

feel, perceive, and behave towards mathematics. To Nitko (1996), attitudes are characteristics of a person that describe their positive and negative feeling towards particular objects, situations, persons or ideas. A host of research studies have been done in many countries to find the factors that influence the students' performance in mathematics. Among these factors, students' attitude towards mathematics is one important factor that has been consistently studied. Often, the studies on relationship between students' attitude and academic performance show a positive relationship (Mohd, Mahmood, and Ismail, 2011; Bramlett and Herron, 2009; Papanastasiou, 2000). Students' success in mathematics depends largely upon attitude towards mathematics. It also influences the participation rate of learners.

Attitude towards mathematics plays a crucial role in the teaching and learning processes of mathematics. Positive attitude toward mathematics plays an important role in causing students to learn mathematics. It therefore affects students' achievement in mathematics. The teaching method, the support of the structure of the school, the family and students' attitude towards school affect the attitudes towards mathematics. Researches undertaken found that most often, the way mathematics is represented in the classroom and perceived by students, even when teachers believe they are presenting it in authentic and context dependent way stands to alienate many students from mathematics (Barton, 2000).

Baker (1995) observed that teachers did not view assessment in mathematics as an integral component to teaching and learning; rather, they saw it as an additional task which bore little relationship to classroom activity.

Subsequently, this compelled them to dislike and even disdain the classroom assessment. Studies concluded that positive attitude towards mathematics promotes success in mathematics. Fullarton (2004) exemplify that although poor attitude towards mathematics has often been cited as one major factor which has contributed to lower participation and success of girls in mathematics. They added that interest and attitude towards the subject are special predictors for the male and female students' participation and success in the subject. It is proposed also that gender based differences in achievement are due to the individual's perception of own abilities and the sex role (Schiefele and Csikszentmihalyli, 1995).

There are a number of social hurdles which deter females from opting for careers in mathematics. On some occasions they express the strong interest in choosing careers in mathematics but their parents may consider the choice as a useless effort for them. Simpkins, Davis-Kean and Eccles (2005) reported that parents more often encouraged their sons to participate in mathematics and science related activities and to acquire skills in mathematics and science significantly more than their daughters. Perceiving parents' low expectations of their achievement in a male domain and experiencing "academic sexism" (Leaper and Brown, 2008, p. 685) may partly explain girls' lack of confidence in their mathematics ability (Eccles and Wigfield, 2002), even when talented female students have the potential to perform at a high level in mathematics (Reis and Park, 2001)

It has been proposed that the attitude of girls toward mathematics is one factor that influences their lack of participation in science-related careers. This concern has resulted in a variety of studies designed to identify gender differences that could affect the number of girls in the scientific pipeline (Oaks, 2000).

Kahle (2003) and Kurth (2007) observed that, in the United States, boys hold more positive attitudes toward mathematics than girls. Kanai and Norman (2007) added that gender differences seem to predominate as students move from the elementary to the high school level. The study indicated that gender differences in attitudes toward mathematics do not exist in the elementary grades.

In support of that, a study observed that 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; Lockheed, Thorpe, Brooks-Gumn, Casserly, and McAloon, 2005; Oakes, 2000).

Another study observed that by high school, few young women would consider mathematics and science-related careers as desirable options. Some experts, according to the report, attribute this phenomenon to the fact that, perhaps, during the middle school years, adolescents formulate their gender identities and career aspirations (American Association of University Women, 2002; Oakes, 2000).

Costello (1991) reported that almost all literature on this topic points to the wildly held perception that mathematics is male domain has contributed to the decline in female participation and hence performance in mathematics. He added

that males are more inclined towards mathematics than females. The study observed also that at the secondary school level most of the girls rarely actively participate in mathematics classes due to their poor perceptions about mathematics. Girls are negatively influenced by their sex-role stereotypes (Ethington, 1992).

Fennema, as cited in Eshun (1999) stated that as a group, females in secondary schools indicated that they do not feel they would need or use mathematics in the future, but males as a group are much more apt to report that mathematics is essential for whatever career they plan. As a result, fewer women are employed in industry in post needing mathematical ability. Consequently, women hold the majority, 59% of low wage jobs (Kim, 2000). Research report had indicated that attitudes develop and change with time. According to Multicomponent model of Attitude (Eagly and Chaiken, 1993), attitudes are influenced by three components. They are cognitive (beliefs, thoughts, attributes), affective (feelings, emotions) and behavioral information (past events, experiences).

Generally, there are several factors which influence students' attitude towards mathematics. These factors can be categorized into three distinct groups. Firstly, factors associated with the students themselves. Some of these include the students' mathematical achievement score (Köğce et al, 2009), anxiety towards mathematics, students' self-efficacy and self-concept, extrinsic motivation (Tahar et al, 2010) and experiences at high school (Klein, 2004; Bobis and Cusworth, 1994).

Secondly, those factors which are associated with the school, teacher and teaching. Some of these include the teaching and learning materials used by the teacher, teachers' classroom management skills, teachers' content knowledge and personality, teachers' ability to teach topics with real life enriched examples (relia), teaching methods, reinforcement (Papanastasiou, 2000), receiving private tuition (Köğce et al, 2009), teachers' beliefs towards mathematics (Cater and Norwood, 1997) and teachers' attitude toward mathematics (Ford, 1994, Karp, 1991).

Thirdly, factors from the home environment and society also affect students' attitude towards mathematics. Factors such as educational background of parents, occupation of parents (Köğce et al, 2009) and parental expectations (Tobias, 1993) play a crucial role in influencing students' attitude towards mathematics.

Leder and Taylor (1995) opined that gender issues pertaining to participation must be linked with affective variables, particularly interest and confidence. Students' confidence is another ingredient for education of mathematics. According to Robson, cited in Atsu (2011) having a positive attitude towards mathematics means generally enjoying working with mathematics and having confidence in one's own ability to do it but it does not mean that a student will display this positive attitude towards the whole area of mathematics all the time. Liu (2009) also reported that two affective variables, mathematics self-confidence and mathematics anxiety, were significant predictors of the mathematics performance of 15-year-old U.S. students. According to the report,

those who had high levels of mathematics self-confidence performed better, while those who displayed high degrees of mathematics anxiety performed poorly on the PISA 2003 assessment.

The study which analyzed students' responses with respect to guessing behaviour on the Australian Mathematics Competition showed that males were more confident than females about answering questions and that this contributed to differences in performance of male and female students. However, a meta-analysis on existing literature carried out by Ma and Kishor (1997) shows that the correlation between attitude and achievement is statistically not significant, and the results emerging from different studies are often non-comparable and even contradictory.

In a different study Nicolaidou and Philippou (2003) opined that there was no significant difference between attitude towards mathematics among male and female students while Grootenboer and Lowrie (2002) suggested that the attitude of the participants of their study towards mathematics was more positive in the third year than the first year. Hence it can therefore be said that students' attitude towards mathematics are very subjective and varies among the students.

Assessment and Evaluation

Assessment in education is the evaluation of male and female students learning through an assessment method. According to Moore (1998), assessment is the process of gathering evidence of what a student can do and provides feedback on the student's learning to encourage further learning. The Assessment Standards for School Mathematics of the National Council of Teachers of

Mathematics describes assessment as "the process of gathering evidence about a student's knowledge of, ability to use, and disposition toward mathematics, and of making inferences from that evidence for a variety of purposes."

Assessment is a powerful educational tool. It is used to monitor the quality of the school system, evaluate educational policies and programmes, make important instructional and placement decisions about students, and certify students' learning achievement. Assessment in the words of MacGaw cited in Atsu (2011), helps students to see their own progress, enables teachers to monitor their students and themselves and (assessment) measures what the educational systems consider to be important.

Assessment method is a systematic way of measuring male and female students' learning. Learning, on the other hand, is a cognitive process of acquiring skills or knowledge. The positive relationship between assessment, teaching and learning is well researched. Benefits to teaching and learning due to assessment include improvements in student test scores and achievement (Black and Wiliam, 1998), better pedagogical decisions by instructors (Crooks, Kane, and Cohen, 1996), and elevated teaching and learning standards (Black, Harrison, Lee, Marshall and Wiliam, 2003). Some theories which define learning include the Cognitivism, Behaviorism and Constructivism.

Palomba and Banta (1999) suggested that the more institutions value and perceive these benefits to enhance classroom teaching and learning, the more willing they are to engage in assessment.

Evaluation is the process of interpreting the evidence and making a judgment of a performance in order to make informed decisions such as assigning grades or promoting the student to climb up the academic ladder.

Assessment of male and female students' performances is an integral part of learning since it paves the way for further learning. In practice, an assessment task with regard to mathematics education may be defined as those specific, discrete learning activities or exercises designed to obtain evidence of male and female students' achievement of an expected learning outcome. This could range from assignments, tests, examinations, portfolios and the like. Consequently, the assessment task should be designed in order to enrich or enhance the learning of mathematics and also avoid the tendencies of generating gender differences in achievement. Therefore the teacher's role was to activate the learning potential embedded in the assessment task so as to contribute to the development of suitable analytical skills and effective learning strategy for male and female students.

Meanwhile in alternative assessment, the student has the opportunity to demonstrate in varied forms whatever knowledge he has acquired. This type of assessment focuses primarily on the growth in performance of male and female students. Thus if a student fails to perform a given task properly, he has the opportunity and the tendency to demonstrate his ability at a different time and in different situations. Alternative assessment techniques actually help in broadening the student's reasoning base. Unlike standardized testing, which usually produces a score that may not be meaningful by itself, information from alternative

assessment is easy to interpret and understand. This presents a tremendous benefit for all possible clients of assessment. For students, alternative assessment allows them to see their own accomplishments in terms that they can understand and, consequently, it allows them to assume responsibility for their learning (Alexander 1993, Jonker 1993). Alternative assessment enables parents to share in the educational process, and it offers them a clear insight into what their children are doing in school (Davies, Cameron, Politano and Gregory, 1992). For teachers, the primary advantage of alternative assessment is that it provides data on their student and their classroom for educational decision -making.

In addition, it chronicles the success of the curriculum and provides teachers with a framework for organizing students' work. Even administrators, who are typically least convinced of the advantages of alternative assessment, can benefit from the clear information about student and teacher attainment over time.

According to Brualdi, cited in Atsu (2011), alternative assessment tools such as portfolios, independent projects, journals and the like enable students to express their knowledge on the material in varied ways using different intelligences. Some of these intelligences, according to Brualdi (1996) include;

(i) Linguistic intelligence

(ii) Logical mathematics intelligence

(iii) Spatial intelligence

(iv) Naturalistic intelligence

(v) Interpersonal and intrapersonal intelligences

(vi) Bodily- kinesthetic intelligence

(vii) Musical intelligence.

The report added that in order for Senior High School students to develop all these intelligences, there is the need to assess students using alternative forms of assessment.

In a broader sense the assessment of student learning should be done regularly to measure whether learning occurs and whether it has occurred based on the expected learning outcomes of the course syllabus. The assessment tools and tasks employed should be designed in accordance with the learning method employed by the teacher.

It is important that male and female students are tested in a 'dynamic' way by considering different study situations so that they can express their abilities in varied ways. This implies that assessment could take both quantitative and qualitative forms. The assessment of students' knowledge in mathematics especially has often been quantitative. A solution has either been right or wrong or the final result is correct with regard to a specific method. It is not necessarily true that a correct answer shown by a student implies that he is more skilled in the tested subject since the understanding-focused thinking can also be shown qualitatively. However, some teachers find assessment burdensome and redundant, especially when mandated as part of a learning process (Hutchings, 2010).

Baker (1995) found that teachers did not view assessment as integral to teaching and learning; rather, they saw it as an additional task which bore little relationship to classroom activity. Consequently, this compelled them to

dislike and even disdain classroom assessment. For these teachers, there was a feeling of being overloaded with assessment requirements. That is, the time investment associated with assessment practices most often deters people from being fully involved. Moreover, teachers' construct of assessment did not tally with their construct of teaching and learning. Assessment was mainly perceived as a summative activity, rigidly separated from learning, an understanding more in tune with a transmission model of teaching than with constructivist understandings of male and female students' learning. Many teachers remained uncomfortable with the idea of assessment, seeing it as alien both to the process of teaching and the social relationships they wished to foster in their classrooms, a finding confirmed by other studies (Gipps, Brown, McCallum and Mcalister, 1995).

Although, research reports and findings indicated that a paradigm shift in the mode of assessment practice enhanced classroom teaching and learning, they also point to one fact that academic achievement of male and female students in mathematics can only be obtained through assessment and moreover school based assessment is a system that is keenly practiced in the educational institutions in Ghana.

Gender Attitude towards Assessment

Attitude is generally described as a predisposition to respond to a certain object either in a positive or in a negative way.

Gender, according to Scantlebury and Baker (2007) is a social construction, usually based upon the biology of one's body. Both genders

inherited socio-cultural expectations and treatments that should not have had anything to do with their sexual designation. However, most cultures led females and males into different experiences so that males and females started school with different knowledge, expectations, and self-confidence in learning.

A host of researches have confirmed the presence of gender stereotypes in mathematics and science learning. Due to this females develop less confidence in their ability to learn mathematics and as well higher mathematics test anxiety than males. According to Adams, Thomas and King (2000) males have been found to consider that the primary role of assessment is to provide a unit mark representing their capabilities whilst females consider giving students feedback on progress to be most important.

Smith (2004) opined that female students have been found to work harder than their male counterparts. Birenbaum and Feldman (1998) contended that males have more favourable attitudes towards multi-choice assessments than females.

Furnham and Chamorro-Premuzic (2005) put forward the argument that females have been noted to have more negative attitudes towards examinations than males whilst males tend to have more negative attitudes towards continuous assessment. This was supported by Myers and Myers (2007) who indicated that more frequent assessment benefits females more than males. Moreover females are more likely to adopt a surface approach to learning than males whilst males are more likely to adopt a deep approach to learning than females (Severiens and Ten Dam, 1994). Meanwhile, females are perceived to be more conscientious,

articulate and concerned with aesthetics than males whilst males are considered to be more self-confident, bold, logical and focused yet displaying more haste and carelessness (Francis, Read and Melling, 2003) .

However, male and female students according to Byrne, Flood and Willis (1999) do not differ in their approaches to learning and gender was not found to impact on students' performance in either coursework or examination, regardless of whether their attitude towards learning took a deep or surface approach (Tian 2007). In view of the analogy espoused above, it is obvious that if females have more negative attitudes towards examination then females could have less favorable attitudes than males towards one-time assessment model. On the other hand, if males have more negative attitudes towards continuous or frequent assessment then females could have more favorable attitudes than males towards school based assessment practices.

Alternatively, if there is no interaction between gender and mode of assessment in mathematics then male and female students' attitude towards class assessment task and end of term examination may not differ and hence the performance.

School Based Assessment (S.B.A.) Paradigm in the Ghanaian High School Curriculum

School Based Assessment (SBA) is a system for collecting performance data on students in the course of their work in school. It is a school based task that is designed, administered and marked by the students' own teachers.

Education in the school system consists of a variety of practical work, as well as theoretical work. It is a common observation that students tend to do well on tests administered in their schools because they are more relaxed when taking tests in their own classrooms.

The conversance or familiarity with their own classroom and school surroundings helps them to do better on tests administered in their school. External examinations during which students' work is supervised by people, who are not known to the students, tend to create anxiety for some of these students. This anxiety eventually tends to reduce the level of performance on the part of some students. It is therefore generally accepted that the performance of students on tests administered by their teachers in their classrooms better reflects the true performance of the students. It is for this reason that the Ministry of Education decided that a percentage of the marks for the students' certification should come from performance of students on their school based assessment. This mode of assessment was introduced into the curriculum during the last curriculum review in 2007 but came into full gear in September 2008 to enhance the continuous assessment which was in operation then.

The SBA is expected to provide schools the chance to ensure that the performance of students on both practical skills and theoretical knowledge is reflected in the marks students obtain in the class assessment tasks and on their End-of-Term examinations. It is also to give schools the chance to ensure that all aspects of the education and training of the young person are taken into account in the assessment of the performance of the young person while in school. Thirdly, it

was also aimed at broadening the assessment base to cover more application profile dimensions as well as reduce considerably the workload on teachers by 64% (CRDD, 2007). Finally, it was aimed to provide students the chance to show the quality of their learning in and out of school on the marks they obtain on their SBA assignments. The SBA in effect, gives students the chance to receive a broad education. The school based assessment system is characterized as follows;

i. Periodic collection of assessment information- By collecting accurate and reliable test data on students. Here, the test is spread over a considerable period of time, allowing the students to take the tests at different times throughout the year. The school based assessment prescribes the administration of one assignment at the end of each month of the school term. The average of the scores earned by the student will be a more accurate indicator of the student's performance in the subject.

ii. Use of different test modes- The performance of students can be better assessed if the assessment is made on diverse test modes such as class tests, class exercises, home work, projects and other practical activities. SBA consists of class tests, class exercises and projects. Homework, which featured prominently in the then continuous assessment system, has been eliminated in the redesigned SBA programme. Here, more prominence is given to projects. The justification for eliminating homework from the SBA programme is that it became not very certain whether homework would be carried out for the student by an adult. Although, homework is important in the instructional system and teachers

are required to give a substantial number homework as part of the instructional process. Homework would however, not be scored as a component of the SBA. There may be situations, as in the projects, where the SBA will involve students in seeking views and opinions from teachers, parents, elders and school mates. It is believed that this is the usual work practice in the adult world where the opinion of colleagues and views collected from books are vital for effective work performance. Teachers are entreated to encourage students the need to search for information during the project period.

iii. Inclusion of more complex thinking skills in the testing programme- A further characteristic of the SBA is that it designs tasks that require high ability thinking and performance. Such tasks require analytical thinking; the ability to generate different solutions to a problem; the ability to plan a project; and the ability to be innovative, generate new ideas and create new products etc. High level thinking skills generally require extended time for learning and responding. The addition of such skills in the SBA programme will encourage students to form the habit of using high level thinking skills in solving problems rather than the habit of memorizing class notes which defeats the purpose of education and does not help in problem solving.

iv. Teacher assistance and remediation- The new School Based Assessment system also fosters cooperation between the teacher and the student especially in the area of students' class projects. The process

allows the teacher to provide assistance to students in the form of advice on various aspects of students' projects. The teacher is expected to provide constructive feedback to help students reach better understanding of their projects. Students learn to consult and collaborate with the teacher, classmates and other sources on aspects of their project.

v. Reduced number of assessments and mark recordings- The SBA has been designed to reduce the amount of workload in the previous continuous assessment system by 53 percent on the part of the student and by 64 percent on the part of the teacher. The reductions have been made to reduce the tediousness in the SBA process and at the same time make SBA a more useful tool for improving school performance and for improving the thinking abilities of school children.

vi. Emphasis on student-centred learning- One of the major problems that lead to low performance of students on national tests (National Education Assessment (NEA) and BECE as well as WASSCE is the predominantly teacher-centred approach; used in the instructional system in schools. As a method for improving this situation, the syllabuses that the Ministry of Education has issued to schools since 2000 have all stressed the importance of high ability thinking skills on the part of students. However, the SBA system puts a lot of stress on project undertaking. This is the component that allows the student either individually or in groups, the freedom to explore different ideas

and skills to produce something of their own. This is the student-centred learning component which should help in improving the standard of education in the country.

vii. Standardization of SBA Practice Across Schools – Previously, where class teachers had the option of setting their own continuous assessments, a variety of exercises, some good and many of them rather trivial, were used in the school system. The number of items used in the continuous assessment system was not uniform and the marking and grading systems varied from school to school. The current SBA system has been designed to improve the old practice of schools to develop their own assignments by supplying schools with sample items/questions, project topics, marking and grading systems as a procedure for standardizing the SBA process across schools in the country.

The major changes which came with the assessment reform are summarized in Table 1.

Table 1- *Major Changes to Assessment which came with the 2007 Reforms*

No	Nature of changes	CA	SBA
1	Use of class exercises and home work	Largely for CA	For formative evaluation only
2	% contribution of Class Exercises/ Homework/project work to overall school assessment	30%	-
3	% contribution of SBA Tasks to overall school assessment (i.e. class tests & project)	-	50%
4	% contribution of end of term exams to overall school assessment	70%	50%
5	% contribution of (I or II and III) to final WASSCE score	30%	30%
6	Number of assessments per term	11	4
7	Number of assessments per year	33	12
	a) Number of project tasks given per term	4	1
	b) Term distribution of project tasks by individual or group	All individual tasks each term	Individual tasks in terms 1 and 3;

Table 1 cont……

		Group task in term 2
c) When is project task given and completed?	Any time, i.e. teachers discretion	Beginning of the term and submitted at the end of the term
d) Written report required?	Optional, largely oral presentation	Yes, with references
e) Scoring projects	5	20

(Source: Mereku, Nabie Appiah and Awanta, 2011)

Moreover, The School Based Assessment is structured to enable students acquire;

i. Thinking Skills- Better understanding of issues and the ability to generate ideas and develop new processes and strategies.

ii. Problem Solving Skills: The ability to understand a problem, looking at it from different angles ways and adopting solutions based on combination of knowledge and practices of transfer of knowledge from different subjects.

iii. Cooperative Learning: The ability to work with other colleagues and in groups to carry out projects and learn in the process.

iv. Literacy and Numeracy Skills: This involves greater ability to understand and analyze issues critically and use mathematical ability to solve everyday problems.

v. Moral and Spiritual Development: The attitude of fairness in dealing with others and a general positive attitude in life.

vi. Formal Presentations Skills: The ability to make formal presentations before class mates and answer questions.

With the new system of assessment, the use of project work was entrenched and the emphasis is to help improve students' learning by encouraging them to produce essays, poems, and artistic work using appropriate process skills to analyze information and other forms of data accurately, make generalizations and draw conclusions. Although, group exercises and homework scores represented components of continuous assessment, they do not to contribute to the SBA scores.

The new School Based Assessment system consist of 12 assessments in an academic year instead of the 33 assessments in the previous continuous assessment system which leads to a reduction of work load on teachers as compared to the previous continuous assessment system. These assessments are referred to as class assessment tasks (CAT) in the S.B.A and each term has four of these assessment tasks. The assessments for a term consist of two class tests, one group exercise and a project as follows:

i. Class tests

ii. Group exercise (Cooperative learning exercise)

iii. Project (investigative, experimental or materials production).

The 12 assessments are labeled as Task 1, Task 2, Task 3 and Task 4 to be administered in Term 1; Tasks 5-8 administered in Term 2, and Tasks 9-12 administered in Term 3.

Task 1 will be administered as an individual test at the end of the first month of the term. The objectives are therefore objectives taught in the first four weeks of the term. Classroom assessment task (CAT1) or Task 1 would be administered, scored and reported to provide information on each student's performance on the items set in the task. The first CAT for the term is scored out of 30 marks.

CAT1 should essentially cover the following separate profile dimensions of the material taught in class. These include Knowledge, Understanding, Application and Analysis.

The equivalent of Task 1 would be Task 5 and Task 9 to be administered in Term 2 and Term 3 respectively.

Task 2 would be administered at the end of the second month of the term as a group exercise and would consist of two or three instructional objectives that the teacher considers challenging to teach and learn. The selected objectives could also be those objectives considered very important and which would require the students to do a lot of practice. The purpose of the group exercise is to get students well exposed to the principles and ethics of cooperative learning; that is, working together in groups to arrive at a group decision together using the ideas and abilities of each group member. They also learn to develop positive attitude and fairness to the group members and their ideas. In addition, the group exercise

is purposed to ensure that the class is able to master the key topics they have some challenges with. The exercise would be problem-solving oriented requiring students to use knowledge, understanding, application and analysis to solve or provide answers to an assignment that is based on material already learned in class. The teacher's role is to move round the groups as they work and offer assistance as may be required without providing answers.

The intention of the exercise is to get the groups to arrive at solutions themselves and learn in the process. The teacher should give encouragement and possibly supply materials that the groups may need for their work. The equivalent of Task 2 will be Task 6 and Task 10 to be administered in Term 2 and Term 3 respectively.

Task 3 would also be administered as individual test under the supervision of the class teacher at the end of the eleventh or twelfth week of the term.

In setting Task 3, Task 7 and Task11 the teacher should develop the task in such a way that it will consist of 20% of the instructional objectives of the first four weeks, 20% of the objectives of the second month of the term and 60% of the instructional objectives studied from Week 9 – Week 11. The overlapping system developed for setting Task 3, Task 7 and Task 11 would coerce as well as motivate students to learn all the important instructional objectives taught in the first and second months and those taught in the third month of the term. Task 3 would also involve the use of higher-order abilities such as analysis, creative application of principles and ideas to unfamiliar and real life situations. Tasks 3, 7 and 11 are scored out of 40 marks.

Task 4, Task 8 and Task 12 are supposed to be projects to be undertaken throughout the respective terms and the result submitted at the end of the term. The projects would consist of investigations, experiments, material production or idea development. A project could be based on investigations leading to the production of a physical product or a new idea.

A student is expected to select one project topic for each term. Meanwhile, project for the second term will be undertaken by teams of students as group project. The project is intended to give equal opportunity to both male and female students to demonstrate the knowledge and skills acquired on the processes of an investigational study. This includes observation, gathering data, drawing inferences, identifying, measuring, analyzing, determining patterns and or relationships, graphing and communicating. Meanwhile, the administration of SBA is expected to be completed by the end of the eleventh week of the school term to allow schools the time for preparation and administration of the End-of-Term Test in the twelfth or last week of the term.

Projects should involve high-order abilities such as analysis, evaluation, inventive thinking involving synthesis of ideas and skills toward creation of a new product, a new idea or a new process. There will be one group project in each term scored out of 100. Some projects may last for two terms or a year. In such cases, projects should be segmented in such a way that one segment would be completed and assessed at the end of a term and the remaining segment continued for presentation in the next term.

Project topics are scheduled to be centrally developed by CRDD in cooperation with the Teacher Education Division of GES every three years and distributed to all schools through the District Education Offices. The process for developing the project topics would ensure that the quality of the projects students will carry out in their schools would be of high standard.

The Use of Portfolio to assess Student's Performance

Recent educational developments such as constructivism and multiple intelligence theories as well as society requested new trends engendered to radical change in traditional approaches to instruction and assessment. Since the method of teaching and learning keeps changing it must keep pace with assessment procedures and approaches (Fourie and Van Niekerk, 2001).

With regards to issues related to differences in learner characteristics, effective sampling across the content domain, and recent emphases on assessing meaningfully contextualized abilities and higher-order cognitive processes, the 'traditional' mathematics assessment method does not provide a valid and comprehensive measure of male and female students' ability. The main goal of academic education in the recent past was to enable students to know a certain knowledge domain. Since learning of basic knowledge was very important, behaviorist approach which was generally employed focused mainly on traditional instruction. Here, acquiring knowledge is merely by abstraction and "learning" and "teaching" process is viewed as individual process, and "learning" is conceived as the accumulation of stimulus-response association. Drill and practice play key roles in this process.

Also, the assessment practice is mainly based on testing basic knowledge. Tests such as multiple-choice, true false, matching items and the like are mostly used. This traditional assessment approach mostly promotes students to memorize rules or algorithms rather than enhance conceptual understanding, and focus mostly on small, discrete components of the domain (Dochy, 2001). Also, these techniques provide less useful information about the students' understanding and not enough to assess higher order cognitive skills such as problem solving, critical thinking and reasoning skills (Romberg, 1993).

Moreover differences in learner characteristics imply that over-reliance on one form of assessment strategy disadvantages students who are able to display their knowledge, skills or abilities more effectively through other methods (Leder, Brew, and Rowley, 1999). To encompass a range of learning styles and goals, there is the need to employ a wide range of methods for gathering assessment information (Niss, 1999). It has been argued that newer approaches such as performance-based assessment have strong potential to impact mathematics teaching through emphasizing challenging material for male and female students. Meanwhile, the Assessment Standards for School Mathematics (NCTM, 1995), call for the use of multiple and complex assessment tools including written, oral, and demonstrations formats, and recommend that assessment should contribute to students' learning.

This implies that assessment techniques should focus an assessing what students know as well as what they do not know. These recommendations can be achieved through alternative assessments measuring students' performance and

developments in learning process. Consequently, there is the need to incorporate alternative methods of assessment that are able to effectively assess a wide range of students' mathematical abilities. Alternative assessment approaches are needed in assessing both learning process and learning product. Nowadays, one of the alternative assessment techniques used in various disciplines especially mathematics is the portfolio.

Portfolio, according to Arter and Spandel (1992) is a purposeful collection of student work that exhibits to the student and others, her efforts or achievement in one or more areas. Paulson, Paulson and Mayer (1991) define portfolio as a purposeful collection of students' work that exhibits the students' efforts, progress and achievement in one or more areas.

Grace (1992) defined portfolio as a record of the child's process of learning: what the child has learned and how she has gone about learning; how she thinks, questions, analyzes, synthesizes, produces and creates and how she interacts--intellectually, emotionally and socially-with others.

Forgette-Giroux (2000) opined that "portfolio is a cumulative and ongoing collection of entries that are selected and commented on by male and female students, the teacher and peers, to assess the student's progress in the development of a competency".

De Fina (1992) who emphasizes the characteristic of portfolios, states that portfolios are systematic, purposeful, and meaningful collections of students' work in one or more subject areas.

Birgin (2003) defined portfolio as "the assessment of some data about students' skills in one or more areas at a certain time period, regular collection of his studies and performances according to predetermined criteria. There are some essential characteristics to the development of any type of portfolio used for assessment.

Barton and Collins (1993) stated that portfolios should be multi-source, authentic, forms of dynamic assessment, explicit of purpose, establish a correspondence between program activities and life experiences, based on students' ownership, and multi-purposed. He added that portfolios should be on going so that they show the students' efforts, progress, and achievement over a period of time. This is prudent to project a fair picture of students' academic performance over a considerable period of time.

With regards to the descriptions stated above, portfolio is not either the arbitrary collections or observation of student's works to be filled haphazardly. It is important that the portfolio collections should be purposeful, systematic and the purported evaluation criteria should take a considerable period of time.

Summary

An attempt has been made to explore series of literature related to the present study and to determine the depth other researchers have reached on the subject. The review indicated that mathematics education to a nation is the bedrock that ensures the efficiency of everything we do and that an important goal of education is to prepare students for the world of work and at least mathematics is a contributor to this goal.

Due to the relevance nations attached to mathematics, the mathematics curriculum of the Senior High Schools in Ghana aims to develop in students basic quantitative skills as well as help them to appreciate the qualitative usefulness of mathematics in other school subjects and other spheres of life (CRDD, 2003).

However the curriculum of senior high school provides little opportunity for the development of such vibrant and useful intellectual qualities. This is because the mode of assessment employed basically in our educational establishments in Ghana, even in recent years focuses primarily on the development of lower level concepts which lend themselves to measurement under examination conditions. This bars the understanding of mathematical theorems from practice.

As part of national effort to forestall the anomaly, the School Based Assessment was introduced in 2007 into the school curriculum to cause the students to develop conscious, higher thinking and analytical mind. Here project work plays a key role. The review described school based assessment as a school based task that is designed, administered and marked by the students' own teachers.

The review described assessment as the process of gathering evidence of what a student can do and provides feedback on the student's learning to encourage further learning. The review was explicit in distinguishing between traditional and alternative assessment strategies. According to the review the distinguishing factor is based on the complexity of the assessment tasks and the amount of time needed for the assessment. This means that alternative assessment

strategies would require more time to execute its structures when compared with the other method of assessment.

The move from the traditional to the alternative assessment technique has been clearly stated. On the one hand it is deemed prudent since the student plays a significant role in determining his performance in the subject. On the other hand traditional assessment is seen to reward a style of academic work that is confident, bold and assertive, characteristics which are associated more with men than women. In view of this it is deemed appropriate to track the record of performances of male and female students on the class assessment tasks and their corresponding end of term examination scores of the school based assessment in order to compare their achievement on the new system of assessment.

Although findings vary in the literature on gender differences in mathematics achievement at the high school level, some conclusions were indicated:

i. Studies show that male high school students perform better than female high school students on mathematics achievement tests. (Pisa, 2003; Sprigler & Alsup, 2003). The review indicated that, gender differences were not likely to be found until the high school years. Also, in high school, it was reported that gender differences favouring males are common, particularly in the areas of problem solving and applications. Moreover, such differences are not large and that the gender gap may diminish over time (Feingold 1992).

ii. Other researches (e.g. Ding, Song & Richardson, 2007; Mullis et al, 2004) have shown that there is no difference among males and female students in mathematics achievement.

iii. It is found that there is a positive relationship between attitude and achievement in mathematics because students' mathematical achievement can be influenced by students' beliefs and attitudes. The studies added that male students have positive attitudes towards mathematics, more self-confidence in their abilities to learn mathematics, and less mathematics anxiety than female students. Therefore, students' attitudes towards mathematics are governed by their perceptions regarding the usefulness of mathematics, and their confidence in their ability to learn it.

iv. Although some studies have advanced a variety of biological explanations for gender differences in mathematics performance, socio-cultural reasons are more wildly accepted.

A search for the literature revealed that alternative assessment has many benefits and the tendency to measure important educational objectives and processes which could afford male and female students' equal opportunities towards the pursuit of learning.

CHAPTER THREE

RESEARCH METHODS

Overview

This chapter describes the method used to conduct the study. The content covered the research design, population and sample, research instrument as well as the method of data analysis. The aim of this study was to investigate differences in students' achievement scores in core mathematics as measured by the School-Based Assessment System [SBA]. It also investigated the extent to which mathematics teachers were aware and conversant with the provision for the SBA.

Research Design

A research design is the overall plan for answering research questions and hypotheses. The design, according to Polit and Beck, (2007) spelt out strategies the researcher adopted to gather accurate, objective, credible and interpretable information. The main purpose of this study was to investigate sex differences in students' achievement scores in core mathematics measured by the School-Based Assessment System introduced in 2007. It also investigated the extent to which high school mathematics teachers were aware and conversant with the dynamics associated with the implementation of the new assessment system.

Stillman (2001) opined that the usefulness of any assessment strategy could not be achieved unless teachers were made to understand the concept and

equipped with the right knowledge, skills, and attitudes to practice it effectively. It was therefore expedient to find out how well were the teachers conversant with the assessment process in order to describe their level of understanding of the relevant concepts. As a result, the survey design was used. The purpose of the survey design was to observe, describe and document aspects of the situation as it occur naturally. It also helped to determine the relationship among variables. The main variables in this study were sex and students' achievement scores which also lend themselves to the use of the survey design, albeit in this study correlation was also used as part of the design.

Population

The population for the study comprised four hundred and sixty five form two General Arts students drawn from three Public Senior High Schools in Ho Municipality in the Volta Region of Ghana and their mathematics teachers. The Senior High School level was purposively chosen since sex differences in mathematics achievement were reportedly significant at this level.

Sampling Procedure

The sample consisted of form two General Arts students drawn from three co-educational institutions in the Ho Municipality. There were one hundred and ninety four students whose School Based Assessment tasks scores were used for the study. This comprised sixty five males and one hundred and twenty nine females. Here, intact classes were used. The students were purposively drawn from the General Arts classes (languages option) since these were the classes whose teachers were willing to support the study with their students' assessment

information. Moreover, students in this category do not offer elective mathematics.

The classification of the sex of the students in the sample also shows that more girls than boys were used in the study. The high numbers of female students than male students in the study, perhaps suggest that more girls than boys preferred language based courses to mathematics based courses. The classification of educational institutions by the Ghana Education service was based on the number and quality of physical facilities as well as human resources available in the school. This had direct bearing on the quality of students that were admitted into these schools under the current Computerized School Selection and Placement System (CSSPS). This arguably provided the study with homogenous ability and other backgrounds of the participants.

Further, majority of the students that were admitted into this category of schools especially girls were admitted with relatively weak grades in mathematics. Evidently, the schools' previous academic reports had shown that many of these students rarely performed well in their WASSCE core mathematics.

Research Instrument

The instrument used for the data collection was the questionnaire. The questionnaire was developed purposely to gather information from the mathematics teachers. The assessment information on the students was obtained directly from the schools sampled.

The Questionnaire

The questionnaire was in two parts. The first part requested information on the demographic variables of the respondents while the second part measured teacher's knowledge/understanding and use of SBA system of grading students.

Demographic Variables

In this section information was collected on the teachers' sex, professional qualification, rank in GES and number of years served in Ghana Education Service.

Use and understanding of SBA System

This section elicited information on the respondents' knowledge on the use of the School Based Assessment. It was measured using a 12- item scale measured on a 5 – point Likert scale from strongly agree to strongly disagree.

The items were made of closed ended questions. Each item had five options of which only one could be selected according to the respondent's level of approval or disapproval. The weights 1,2,3,4 and 5 were assigned respectively to the various options of "Strongly disagree (SD)", "Disagree (D)", "Undecided (U)", "Agree (A)" and "Strongly Agree (SA)". A neutral response of "undecided (U)"to each item attracted a mean weight of three. Any mean above three was taken to indicate that there was enough evidence of awareness whilst a mean score below three suggested that there was not enough evidence of awareness.

CAT scores and end of term examination records

The class assessment tasks and the corresponding end of term examination records were obtained from the mathematics teachers from the various schools

sampled. The researcher briefed the teachers on the purpose of the study to ensure the right information was obtained on the students. This was also to ensure that the data obtained on the students was reliable and consistent with information from the schools sampled. The assessment information on the students was basically their Class Assessment Task scores and End of Term examination scores in core mathematics.

Although, project work and group work constituted SBA, these scores were not included in the study. This was because it was not feasible to estimate the contribution of gender to group activity. All the assessment information that was obtained from the schools had been put into male and female categories for analysis.

Validity and Reliability

Validity referred to the degree to which a research instrument measured what it purports to measure. This was to ensure that conclusions drawn were authentic and could be relied on. As a result the expertise of the supervisor of the researcher was drawn in setting the items on the questionnaire. The supervisors of the researcher also ensured the content validity of the items on the questionnaire.

Pilot Testing

The questionnaire was further subjected to a pilot test which was considered indispensable for the appropriate administering of the data. It helped the researcher to think well in advance about the analysis of the information (Strydom, 1998). It was also seen as a "dress-rehearsal" for the main investigation.

Three selected Senior High Schools in the Municipality which were not included in the main study were used as sample. The aim was to make sure that the items were distinct and devoid of ambiguities to the respondents. It was also to find out the extent to which the teachers would be comfortable in answering some of the questions. Lastly, it was to determine the reliability coefficient of the items.

The reliability was estimated using Cronbach Alpha. The Conbach Alpha computed for the initial 15 items yielded a reliability coefficient of 0.56. However, item–total statistics computed revealed that when items 7, 10 and 20 were deleted the reliability coefficient was higher. Consequently, using the 12 – items, the reliability coefficient of the pilot study yielded a Conbach Alpha reliability coefficient of 0.74 which is a high reliability. Therefore, items 7, 10 and 20 were deleted from the items used to measure the knowledge/ understanding of the SBA system.

Thus, the twelve items which were used to obtain the main data when measured yielded high Cronbach Alpha coefficient of .95.

Data Collection Procedure

An official letter of introduction was issued from the Department of Science and Mathematics Education, University of Cape Coast to be given to the Headmaster of the schools sampled for the study. The researcher first sought permission from the head of the institution in order to meet with the head of the mathematics department of the school to seek direction. Copies of the questionnaires were distributed to the teachers and understanding was established with the teachers as to when it would be convenient for them to return the

completed copies of the questionnaire. The researcher collected the completed copies of the questionnaire later. All the teachers sampled returned their completed copies so the return rate was 100%.

Data Processing and Analysis

Quantitative methods were employed in analyzing the data collected. The students' achievement scores on the class assessment task and end of term examination were obtained directly from the schools sampled. Each list of achievement scores from the schools sampled was classified into male and female categories and coded. This information was entered into the Statistical Package for Social Sciences (SPSS) software for analysis. The independent sample t–test was used to analyse the scores in order to determine whether there was a significant sex difference in performance between the mean performance on Class Assessment Task scores and the End of Term examination.

CHAPTER FOUR

RESULTS AND DISCUSSION

Overview

This chapter presents the results of the study. The demographic characteristics of the participants are presented, and are followed by interpretation of the results based on the research questions.

Demographic Data of Students and Teachers

The sex distribution of students is presented in Table 2.

Table 2 - *Sex of Students*

	Frequency	Percent (%)
Male	65	33.5
Female	129	66.5
Total	194	100.0

As shown in Table 2, the males were 65(33.5%) and females were 129(66.5%). The distribution showed that more female students than males undertook the study.

The age distribution of the students as shown in Table 3 revealed that majority (57.7%) are aged 17 years, 26.3% are in the age 18 years and 16% 19 years.

Table 3 - *Age Distribution of Students*

	Frequency	Percent (%)
17 years	112	57.7
18 years	51	36.3
19 years	31	16.0
Total	194	100.0

The study also collected information on the demographic characteristics such as sex, age, educational level and number of years with Ghana Education Service and the number of years at the present duty post, on the teachers. Detailed results on each of the demographic characteristics are presented. The analysis of the data as shown in Table 4 revealed that out of the forty-two Core Mathematics teachers who completed the questionnaire 88.1% were males while 11.9% were females. This shows that majority of the teachers used for the study were males.

Table 4 - *Sex of Teachers*

	Frequency	Percent (%)
Male	37	88.1
Female	5	11.9
Total	42	100.0

The next demographic variable examined as shown in Table 5 is the academic qualification of the teachers. The result shows that majority (76.2%)

hold first degree qualifications, 11.9% hold second degree and similar proportion also have Diploma qualification.

Table 5 - *Academic Qualification*

	Frequency	Percent
Diploma	5	11.9
Degree	32	76.2
Masters	5	11.9
Total	42	100.0

The age distributions of the teachers as shown in Figure 1 reveal that majority (54.8%) are aged between 30 – 39 years, 28.6 % are in the age range of 40 – 49 years, 11.9 % in the age bracket of 21 – 29 years while 4.8 % are almost due for retirement.

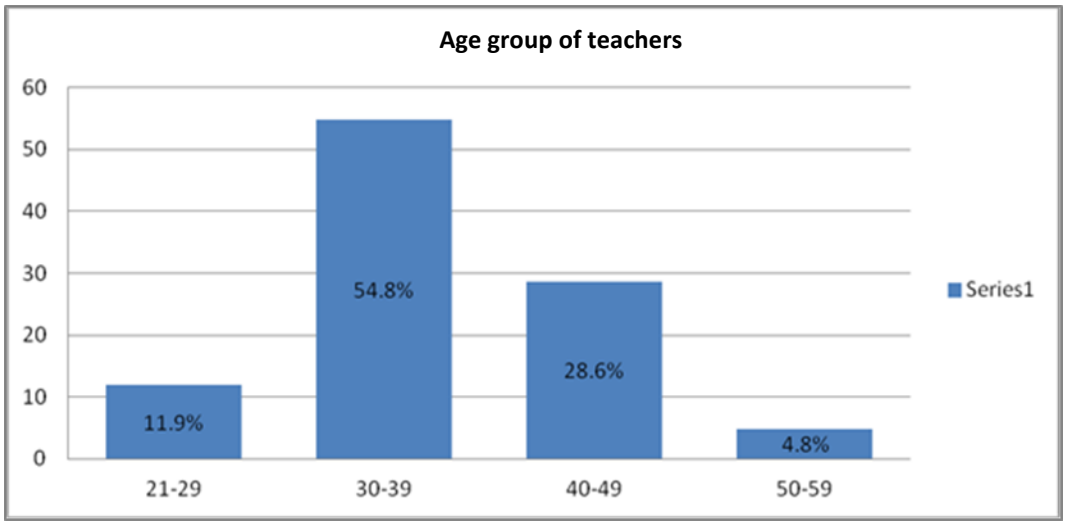

Figure 1: Age group of teachers.

The data further examined the professional ranks of the respondents. As shown in Figure 2, the result shows that more than half of the teachers are on the

rank of Principal Superintendent (69.0%) and 21.4% are on the rank of Assistant Director I while 7.1% are on the rank of Assistant Director II with only one, representing 2.4% on the rank of a Deputy Director. Given the ranks of the teachers, it clearly shows that majority of the teachers are experienced and have been in the service for long and as such understands and have been implementing policies of the Ministry of Education to enhance quality teaching and learning in schools.

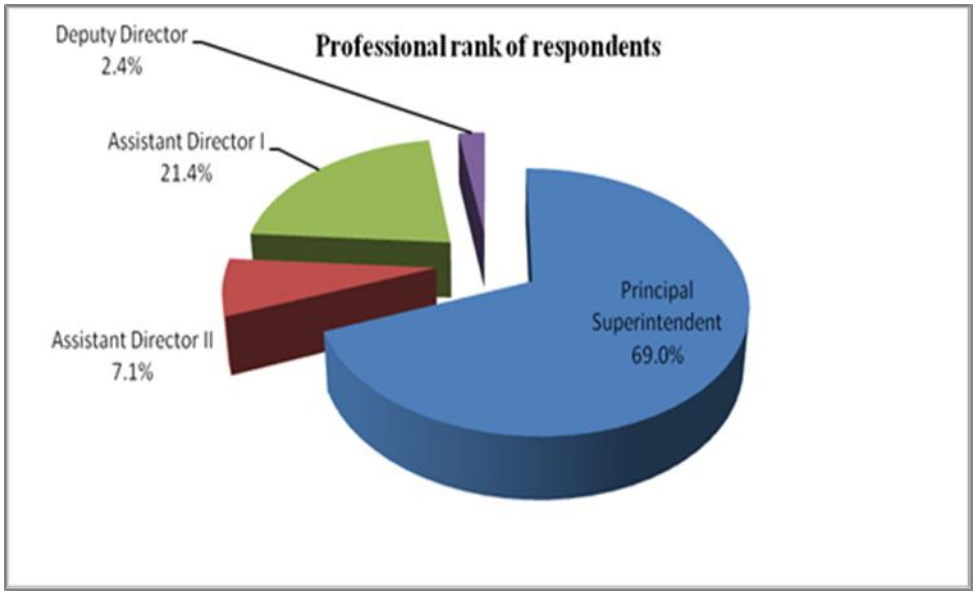

Figure 2: Professional Rank of Teachers.

The last demographic variable examined was the number of years that the teachers have been working with Ghana Education Service and the number of years at the present duty post. The data as shown in Table 6 reveal that majority (45.2%) of the teachers have been with GES for periods ranging from 11 – 15 years and 16.7% have spent 6 – 10 years. Interestingly, a sizable number of them have been with GES for more than 10 years. The result also shows that 7.1% have

been with the service for 21 – 25 years while some have spent over 26 years in the Service.

Table 6 - *Tenure of teacher with G.E.S*

Years	Frequency	Percent
0-5years	8	19.0
6-10years	7	16.7
11-15years	19	45.2
16-20years	3	7.1
21-25years	3	7.1
26-30years	2	4.8
Total	42	100.0

Regarding the number of years spent at the present station, the result as shown in Figure 3 shows that majority (71.4%) have spent less than 5 years while, 19% are in the school for 6 – 10 years with 9.5% in the range of 11 – 15 years at their present school.

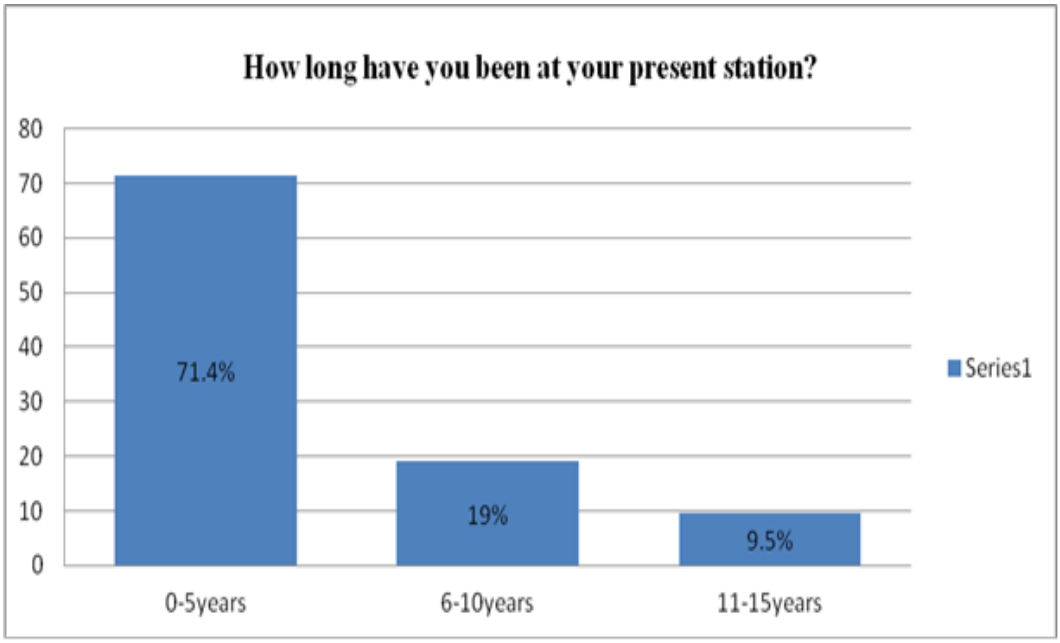

Figure 3: Number of years at present station.

Mean difference in achievement scores between Male and Female Students in Class Assessment Task (CATs)

Research question one sought to examine the mean difference in achievement between male and female students on class assessment task scores in core mathematics. In comparing the mean scores in order to determine whether a significant difference exist between the mean CATs scores, the independent sample t-test was conducted to compare the CATs scores of males and females students. This statistic was deemed appropriate because the independent variable had two levels, the two dependent variables were independent of each other and the measurement scale was at least on the interval scale. Table 7 presents the summary table for means and standard deviations of the CATs scores for male and female students.

Table 7 - *Descriptive Statistics for male and female students in CATs scores*

	N	Mean	Std. Deviation
SBA Males CATs Score	65	15.75	7.55
SBA Females CATs Score	129	12.86	6.34

As shown in Table 7, means and standard deviations of male and female students are M = 15.75, SD = 7.55 and M = 12.86 and SD = 6.34 respectively. The mean score of the male as shown in Table 7 is higher than that of their female counterparts.

To compare the mean scores of male and female students' CATs scores, the independent sample t-test was used. As shown in Table 8, there was a significant difference between mean performance on CATs scores for males [M = 15.75, SD = 7.55] and females [M = 12.86, SD = 6.34; $t(192) = 2.8$, $p<0.05$]. The magnitude of the difference in the means was very small (eta squared – 0.04). This means that, male and female students on the average perform differently on CATs and the effect size represented by eta squared indicated that the magnitude of the difference between the male and female performance on CATs scores was 4%. This further revealed that the proportion of variance in the CATs scores that was explained by the sex of the students was 4%.

Table 8 - *Independent sample t – test summary of male and female students in CATs scores*

	t	df	Sig.(2-tailed)	Eta sq.
CATs Scores Equal variances assumed	2.811	192	.005	.04

This result confirmed a study by Reid (2003), which mentioned that gender inequality in education has remained a perennial problem of global dimension and Mullis et al. (2000) that male advantage in mathematics achievement is a universal phenomenon. Sprigler and Alsup (2003) also documented that male high school students perform better than female high school students on mathematics achievement tests.

However, cultural, economic and social factors, perhaps could also account partially for the seemingly poor performance of females as compared with male counterparts on mathematics skills. The cultural and social orientation of the Ghanaian child is such that the male child is socialized to be adventurous and daring while the female child is to be caring and not audacious (Nkunya, 2003). Perhaps, this creates the erroneous impression that education and especially science and mathematics subjects are a no go area for the female child. In view of this, parents would prefer to provide the learning needs of a boy than a girl.

Mean difference in achievement between male and female students on End of Term Examination scores in Mathematics

Research question two examined the mean difference in achievement between male and female students on End of Term examination scores in Mathematics. In comparing the scores to determine whether a significant difference exist between the mean end-of-term examination scores, the independent sample t-test statistic was used to compare the means.

Table 9 presents the summary table for means, and standard deviations of male and females in examination scores.

Table 9 - *Descriptive Statistics of male and female students in examination scores*

	N	Mean	Std. Deviation
SBA Males End of term Exams score	65	36.11	12.65
SBA Females End of term Exams Score	129	32.60	10.31

As shown in Table 9, means and standard deviations of male and female students are M = 36.11, SD = 12.65 and M = 32.60 and SD = 10.31 respectively. The mean score of the male as shown in Table 9 is higher than that of the female counterparts.

To compare the mean End of Term examination scores of male and female students, the independent sample t-test was used. As shown in Table 10 there was no significant difference between mean performance on End–of–Term

examination for males [M = 36.11, SD = 12.65] and females [M = 32.60, SD = 10.31; t(192) = 1.93, p>0.05]. The magnitude of the difference in the means was very small (eta squared = 0.02). This means that, male and female students on the average perform differently on End of Term examination. The effect size measured by eta squared is very small indicating the difference between the male and female performance on End of Term examination scores was 2% implying that the proportion of the variance in the End-of Term examination scores that was explained by the sex difference of the students was 2%.

Table 10 - *Independent t-test Summary of male and female students in examination scores*

	t	Df	Sig.(2-tailed)	Eta sq.
Exam Scores	1.931	192	.06	.02
Equal variances not assumed				

This result supported the study by Byrne, Flood and Willis (1999), whose findings indicated that male and female students do not differ in their approaches to learning and that gender was not found to impact on students' performance in either coursework or examination, regardless of whether their attitude towards learning took a deep or surface approach. The result of this study also opposed the opinion of Furnham Chamorro-Premuzic (2005) who undertook a study and put forward the argument that, females have been noted to have more negative attitudes towards examinations, and therefore perform lower than males. Perhaps,

this improvement in female performance in end of term examination may have been influenced by the contribution of the alternative assessment contributions embedded in the school based assessment system. This finding would probably support the research evidence by Eshun and Abledu (2000) that female students with lower achievement in mathematics benefited greatly when exposed to alternative assessment.

Knowledge and use of School Based Assessment (SBA)

Knowledge of SBA System

Research question three sought to find out if high school mathematics teachers were aware and conversant with the SBA now being used in the Senior High Schools. This was measured using a 12- item scale measured on a 5 – point Likert scale from strongly agree to strongly disagree. The scale reported a high reliability coefficient of 0.95 with higher scores indicating high level of understanding/knowledge of the SBA system while lower scores indicate low level of knowledge of the system. Items such as 'I have been using the internal assessment system to measure students' performance'; " I always complete the SBA record termly"; and 'the SBA is to standardize the practice of internal assessment in all Senior High Schools' among others were used to measure knowledge / understanding of the SBA system.

The respondents were requested to respond by indicating their level of agreement or disagreement by choosing the options Strongly Agree (5), Agree (4), Undecided (3), Disagree (2) and Strongly Disagree (1). In classifying the scores as low, moderate and high, the scores of the participants were summed and

scores ranging from 12 to 24 were considered as having low level of knowledge, 25 to 47 were rated as having moderate level of knowledge while scores ranging from 48 to 60 as having high level of knowledge of SBA. Table 11 presents the results.

Table 11 - *Level of Knowledge/Understanding of SBA*

	Frequency	Percent (%)
Low level of knowledge	3	7.2
Moderate level of knowledge	19	45.2
High level of knowledge	20	47.6
Total	42	100

The results show that 47.6% of the teachers sampled have high knowledge of the SBA system, 45.2% have moderate level of knowledge while 7.2 % have low level of knowledge of the SBA system. These results clearly showed that majority of the teachers were conversant with the use of the new internal assessment procedure at the Senior High Schools.

Sex, Rank and Highest Qualification against Knowledge Level of SBA

Further examination of the knowledge level of SBA among the Mathematics tutors was conducted based on sex, rank and highest level of education. In the first place, sex was cross tabulated with knowledge level of SBA. The results in Table 12 showed that lesser (45.9%) number of the males measured high on the SBA scale than females (60%). At the moderate level of

knowledge, the results revealed that more men (45.9%) than female (40%) were recorded while no female measured low on the knowledge level of SBA scale.

Table 12 - *Sex Knowledge level of SBA Cross Tabulation*

		Knowledge level of SBA			
		Low level of Knowledge	Moderate Level of Knowledge	High level of knowledge	Total
Sex	Male	3(8.1%)	17(45.9%)	17(45.9%)	37(100%)
	Female	0	2(40.0%)	3(60.0%)	5(100%)
	Total	3(7.1%)	19(45.2%)	20(47.6%)	42(100%)

The next analysis as shown in Table 13 looked at the cross tabulation of highest level of education with the knowledge level of SBA. The results showed that teachers who hold Diploma measured moderate on the knowledge of SBA scale while 53.1% of First Degree and 60% of Master's degree holders scored high on the knowledge of SBA scale. Further, the results showed that 20% of Master's degree holders measured low on the knowledge level of SBA scale while less than 10% of first degree holders measured low on the scale.

Table 13 - *Highest Level of Education/Knowledge Level of SBA*

		Knowledge level of SBA			
		Low level of Knowledge	Moderate Level of Knowledge	High level of knowledge	Total
Highest level of education	Diploma	0	5(100%)	0	5(100%)
	Degree	2(6.3%)	13(40.6%)	17(53.1%)	32(100%)
	Masters	1(20%)	1(20%)	3(60%)	5(100%)
	Total	3(7.1%)	19(45.2%)	20(47.7%)	42(100%)

Lastly, current rank of the teachers and knowledge level of SBA was examined. The ranks of the teachers were Director I, Director, Deputy Director, Assistant Director I and II, and Principal Superintendent. The result in Table 14 revealed that only Principal Superintendents scored low on the knowledge of SBA scale while 44.8% scored moderate and same proportion scored high on the scale. In the Assistant Director II category, 33.3% had moderate level of knowledge while 66.7% scored high on the scale. Lastly, 45.2% of the Deputy Directors measured moderately while 47.6% measured high on the scale.

Table 14 - *Current rank/Knowledge level of SBA Cross Tabulation*

		Knowledge level of SBA			
		Low level of Knowledge	Moderate Level of Knowledge	High level of knowledge	Total
Current rank	Principal Superintendent	3(10.3%)	13(44.8%)	13(44.8%)	29
	Assistant Director II	0	1(33.3%)	2(66.7%)	3
	Assistant Director I	0	5(55.6%)	4(44.4%)	9
	Deputy Director	0	0	1(100%)	1
	Total	3(7.1%)	19(45.2%)	20(47.6%)	42(100%)

Use of SBA in assessing Students in Core Mathematics

The researcher sought to also find out if teachers actually use the assessment procedure to assess their students. Respondents were requested to respond to the item '*I have been using the internal assessment system to measure students' performance'.* The results as presented in Table 15 show that majority (83.3%) of the respondents strongly agree / agree to the statement implying they have been using the SBA system.

Table 15 - *Use of Internal Assessment System to Measure Students' Performance*

Response	Frequency	Percent (%)
Strongly disagree	3	7.1
Disagree	2	4.8
Undecided	2	4.8
Agree	21	50.0
Strongly agree	14	33.3
Total	42	100

Frequency of using SBA

The result further showed that more than half of the teachers sampled reportedly use the SBA every term of the school year. Specifically, 45.2% agreed to the statement that '*I always complete the SBA record termly'* while 35.7% strongly agreed to the statement. Interestingly, 14.3% mentioned they do not use the SBA while 4.8 percent could not tell their position on the use of the assessment procedure. Table 16 presents the result.

Table 16 - *I Always Complete the SBA Record Termly*

Response	Frequency	Percent (%)
Strongly disagree	6	14.3
Undecided	2	4.8
Agree	19	45.2
Strongly agree	15	35.7
Total	42	100

The results indicated that teachers at this level are abreast with the changes currently ongoing in the Ghana Education Service. The Ministry of Education in 2007 reviewed the Curriculum of pre-tertiary institutions and one significant improvement that the policy brought was the introduction of the School Based Assessment to enhance the then continuous assessment system in operation. This took effect in 2008 school year. The results thus confirmed the professional competence of the teachers at the senior high school level. This information of the teachers' awareness and level of conversance with the assessment procedure, in the view of the researcher is very important since the teachers, according to Torrance (1995) tend to perform creditably well on the assessment instrument.

However, teachers with no training background in SBA will have a poor knowledge and understanding of the ideas to implement the system effectively. If this gap is not filled through training workshops, these teachers might make their own effort which may collapse or run the system down.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Overview of the Study

The focus of this study was to investigate whether a significant sex difference exist in students' academic scores in core mathematics as measured by the School Based Assessment (SBA) system in view of the curriculum change in 2007. It also investigated the extent to which mathematics teachers were aware and conversant with the provision for the SBA.

The sample used for the study consisted of 42 mathematics teachers with varying degree of academic qualification, professional rank and experienced in selected Senior High Schools in the Ho Municipality and a total of 194 students whose assessment scores were used for the study. The results of the analysis as presented in Chapter four showed that the data produced enough evidence to answer the research questions. This section discussed the results, strengths and contributions of this study in promoting higher achievement in mathematics and in bridging the gender gap. The section ends with the Conclusion and Recommendation.

Key Findings

1. The first research question sought to investigate if there is a significant sex difference in students' Class Assessment Task scores. The results showed

that there was a significant sex difference in achievement between male and female students in their class assessment tasks.

2. The second research question sought to investigate if there is a significant sex difference in students' academic achievement in their End of Term examination scores in core mathematics. The results show that there was no significant sex difference between the mean performance of students on End of Term examination.

3. The third research question sought to find out whether teachers at the senior high school level were aware and conversant with the SBA system. The study found that 92.9% of the teachers sampled demonstrated considerably level of knowledge/understanding and usage of the SBA in assessing their students in core mathematics. Evidence from the data further revealed that 80.9% used and completed SBA every term of the academic year to assess their students.

Conclusions

There is significant sex difference in mean performance in CATs scores in core mathematics in favor of boys. However, the mean gender gap narrows when compared with the performance in End of Term examination. This means that female students generally, are more likely to achieve higher when they are exposed to a robust and flexible assessment system. This is to establish that the choice of assessment system influences gender achievement in mathematics.

This result is consistent with the research evidence by Eshun and Abledu (2000) which indicated that the alternative assessment activities significantly

increased the female students' ability to use problem solving approaches in new situations. They affirmed that the significantly higher performance by the low ability students of the experimental group over their counterparts in the control group on the internal tests showed that female students with lower achievement in mathematics benefited greatly when exposed to alternative assessment. Since the classroom assessment is a continual activity for teachers to improve the quality of instruction and motivate students to learn (Gronlund, 2006). Consequently, the assessment task should be designed in order to enrich or enhance the learning of mathematics and also avoid the tendencies of generating sex differences in achievement.

Therefore the teacher's role should be to activate the learning potential embedded in the assessment task so as to contribute to the development of suitable analytical skills and effective learning strategy for male and female students. Teachers should desist from using assessment as a means of punishing students but rather use it to enhance teaching and learning. The teacher should also be guided through professional development seminars and workshops in order to update their skills in a bid to help the students to develop cooperative learning strategies so that the high ability students could learn to interact and share knowledge with their weaker colleagues.

In conclusion, the study discovered that there is a significant sex difference in CATs scores of the School Based Assessment in core mathematics at the senior high school level within the Municipality. However, the absolute

mean difference was minimal which indicated that the female students performed equally well as their male counterpart on the End of Term Examination.

Recommendations

It is recommended that classroom teachers should be cautioned to desist from using assessment as a means of punishing students but rather use it to enhance the teaching and learning process. It is also recommended that a comprehensive teachers' guide and necessary logistics be served the schools sampled on the study. It is further recommended that an intensive in-service training and workshops be organized for all the mathematics teachers in schools where the study was undertaken so that the teachers would be offered more opportunity to design and also learn to explore the SBA system of assessment.

It is recommended that this study be replicated in other Regions of Ghana. It could also be conducted in either rural, urban or a blend of the two backgrounds so as to enable inter regional/locality comparisons in order to provide equal backgrounds for more general conclusions about gender differences in mathematics achievement in high schools in Ghana. In replicating this study it is further recommended that researchers take cognizance of the fact that this study did not actively involve students. Future studies should thus engage students actively since the scores would be generated from their performance.

There are other components of the school based assessment records such as project work and group works which were overlooked in this study since it was not feasible to estimate the contribution of gender to each of them. The study however focused primarily on class test, class exercises and end of term

examination to draw conclusion. It is therefore recommended that researches of this sort which would be carried out subsequently should target single sex schools for a more general conclusion to be drawn.

Another area of concern to the researcher is to investigate whether males differ from females in mathematics performance on CATs when the location of their schools is taken into account.

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APPENDICES

APPENDIX A - Questionnaire

SURVEY QUESTIONNAIRE

Dear survey participant,

This study is aimed in part at examining your knowledge on and the usages of the new internal assessment – School Based Assessment (SBA) at the Senior High level. To help achieve this objective, you are please requested to provide relevant and objective responses to the items on this questionnaire. It will take about 20 minutes to be completed.

Please be informed your responses will be treated in confidence and used only for this study. Thank you.

SECTION A

The items in this section request personal information. Please, either tick the appropriate boxes or enter a statement where required.

1. Please, tick your sex.

   Male [ ] Female [ ]

2. To which of the following age groups do you belong?

   a) 21-29 [ ]

   b) 30-39 [ ]

   c) 40-49 [ ]

d) 50-59 [ ]

3. Please, tick the highest academic qualification you hold.

Diploma [ ] Degree [ ] Masters [ ] Doctorate [ ] Other [ ] Please, specify……

4. What is your current rank? …….....

5. How long have you been working with Ghana Education Service? ……

.....

6. How long have you been at your present station?.....

.....

SECTION B

Please complete the following items by circling the responses that best suit your knowledge/understanding of the SBA system. Use the codes provided below.

Strongly agree	*Agree*	*Undecided*	*Disagree*	*Strongly disagree*
5	*4*	*3*	*2*	*1*

7. I am not aware of the new School Based Assessment system

1 2 3 4 5

8. I have been using the internal assessment system to measure students' performance.

1 2 3 4 5

9. I always complete the SBA record termly

1 2 3 4 5

10. I cannot tell all the components of SBA system.

1 2 3 4 5

11. The SBA is to standardize the practice of internal assessment in all Senior High Schools.

1 2 3 4 5

12. The SBA provides a reduced assessment task for subjects studied at the Senior High School.

1 2 3 4 5

13. The SBA provides teachers with guidelines for constructing items and other assessment task.

1 2 3 4 5

14. Measuring standards of achievement in each subject and in each class is one purpose of the SBA system.

1 2 3 4 5

15. The SBA system is to provide guidance in marking and grading of test items and other assessment task.

1 2 3 4 5

16. Accuracy and reliability of teachers' marks can be moderated through the SBA system.1 2 3 4 5

17. SBA could be conducted using the following: mid-term test, Group Exercise and Project.

1 2 3 4 5

18. Assessment and grading of students is improved using the SBA system.

1 2 3 4 5

19. SBA introduces uniformity in the grading of students.

1 2 3 4 5

20. The SBA is not a good system of assessment of students.

1 2 3 4 5

21. I use the SBA system for assessing students' performance in Mathematics.

1 2 3 4 5

APPENDIX B – Results

Descriptive statistics

Test Difference output

T-Test

Group Statistics

	Sex of Participants	N	Mean	Std. Deviation	Std. Error Mean
Test Score for Males_Total	Males	65	15.7538	7.54990	.93645
	Females	129	12.8605	6.34028	.55823

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Test Score for Males_Total	Equal variances assumed	2.817	.095	2.811	192	.005	2.89338	1.02939	.86301	4.92375
	Equal variances not assumed			2.654	110.585	.009	2.89338	1.09021	.73297	5.05380

Exams Score difference

T-Test

Group Statistics

	Sex of Participants	N	Mean	Std. Deviation	Std. Error Mean
Examination Results	Males	65	36.1077	12.65435	1.56958
	Females	129	32.6062	10.30813	.90758

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Examination Results	Equal variances assumed	5.322	.022	2.065	192	.040	3.50149	1.69527	.15775	6.84523

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Examination Results	Equal variances assumed	5.322	.022	2.065	192	.040	3.50149	1.69527	.15775	6.84523
	Equal variances not assumed			1.931	107.919	.056	3.50149	1.81309	-.09239	7.09537