UNIVERSITY OF EDUCATION, WINNEBA

INVESTIGATING SCHOOL-BASED FACTORS THAT CONTRIBUTE TO SENIOR HIGH SCHOOL STUDENTS' ACADEMIC PERFORMANCE IN CORE MATHEMATICS IN TAMALE METROPOLIS, GHANA

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A thesis in the Department of Mathematics Education, Faculty of Science Education, submitted to the School of Graduate Studies in partial fulfilment of the requirements for the award of the degree of Master of Philosophy (Mathematics Education) in the University of Education, Winneba

SEPTEMBER, 2021

DECLARATION

STUDENT'S DECLARATION

I, Yenukwa Amadu , hereby declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and duly acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

Signature: …………………...………….

Date: …………………………...………….

SUPERVISOR'S DECLARATION

I hereby declare that the preparation and presentation of this work was supervised in accordance with the guidelines for supervision of thesis/dissertation/project as laid down by the University of Education, Winneba.

Name of Supervisor: Prof. Christopher A. Okpoti

Signature: …………....................………………

Date: …………………….....................…………

DEDICATION

I dedicate wholeheartedly this thesis to my dear mum, wife and my entire family.

ACKNOWLEDGEMENTS

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ABBREVIATIONS

WAEC - West African Examination Council

TIMSS - Trends in International Mathematics and Science Study

KCSE – Kenya Certificate of Secondary Education

WASSCE – West African Senior School Certificate Examination

MDG - Millennium Development Goals

GPEG - Ghana Partnership for Education Grant

UNICEF- United Nations International Children‟s Emergency Fund

CAMFED- Campaign for Female Education

ESP- Education Strategic Plan

PTA- Parent Teachers Associations

SMC- School Management Committees

ICT- Information and Communication Technologies

SHS- Senior High School

MOESS- Ministry of Education, Science and Sports

SASS- Schools and Staffing Surveys

NAEP- National Assessment of Educational Progress

BECE- Basic Education Certificate Examination

CAG - Controller and Auditor General

UNESCO- United Nations Education, Scientific and Cultural Organisation

GES- Ghana Education Service

SHS- Senior High School

HIQ - Head of Institutions Questionnaires

MAT - Mathematics Achievement Test

ABSTRACT

This study explored the school-based factors that contribute to Senior High School (SHS) students" performance in core mathematics in Tamale metropolis in the northern region, Ghana. It examined teacher"s academic qualification and teaching experiences in mathematics, availability of teaching and learning resources in relation to mathematics and other subjects, students" interest and attitude towards the learning of mathematics and the extent to which school administration influence students" learning through inspection and policies, and how these affect performances in mathematics at examinations. In all, 338 SHS Form 3 students, 30 mathematics teachers and 4 heads of SHSs from four schools were involved in this study. The study used both quantitative and qualitative approach, using interviews, mathematics achievement test and well-structured questionnaire. Descriptive statistics, binary logistics and thematic approach, were used in data analysis. The major findings were related mostly to student"s interest and attitude towards the learning of mathematics, as some of the students were found spending more time on other things than learning mathematics. For the null model, the output revealed a correct overall percentage of prediction as 91%. From the model with all predictors the p – value was less than 0.05, which means the model was statistically significant which helped significantly increased ability to predict the decisions made by the subject. Therefore, the data fit the model well in the Hosmer-Lemeshow tests of the null hypothesis. Apart from these factors, also teaching and learning resources were a problem; mathematics textbooks were not readily available for students use. On top of these, few classrooms were readily available for students use; there were no classrooms for some classes thereby compelling the authority to collapse two classes into one. However, most teachers have the academic qualification to teach at their respective schools, they lacked seminars and in-service training. These added to lack of intrinsic motivation among teachers. The study recommended several remedies for that situation.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter highlights the background to the study, statement of the problem, research questions, and significance of the study, objectives and justification of the study, delimitations and operational definition of terms. Each of these stages will help in strongly grounding the research and give it direction.

1.1 Background to the study

Education has always played an important role in human life and it has been conducted in various ways depending on the culture and location. During the past centuries men travelled from country to country for business, migration, war and education. Therefore, the role of mathematics education in the 21st century cannot be over-emphasized, since it has been, it is and will continue to be the fulcrum on which technological advancement of any country revolves. It has come to be an open secret that technological advancement the world enjoys today is mainly driven by the theories, concepts and laws postulated by past and present mathematicians. For instance, Newton's laws of motion, Archimedes principles, Cauchy Riemann theories, Keplers and Taylor series are still useful.

According to Gegbe & Sheriff (2015), mathematics is seen by society as the foundation of scientific and technological knowledge, which is vital in socio-economic development of the nation. Because of this, empirical statement has affirmed why mathematics is a compulsory subject at all levels of education; primary, secondary and tertiary levels in Ghana. Mathematics is taught at all these learning

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stages because of its usefulness to the development of any well organised and respected community or society.

Mathematics is the science of reasoning and computations. It is the science or study of numbers, quantities or shapes. Kitta (2004), also defined mathematics as the language that helps us to describe ideas and relationships drawn from the environment. Mathematics enables one to make the invisible to be visible, thereby solving problems that would be impossible otherwise.

Despite the fact that mathematics is the foundation of scientific and technological knowledge that is vital in socio-economic development of the nation, students'' performance in mathematics globally remains very low (Churcher, Asiedu-Owuba, & Adjabui, 2015). This situation has caused an outcry from mathematics educators, parents, students and the public at large. Mathematics communities in particular began to voice a serious concern regarding the mathematical competency and arithmetical skills of the high school graduates being produced globally.

In recent years, education system in Ghana has been stressing on students'' performance in West African Senior School Certificate Examinations (WASSCE). The performance of our students in the WASSCE is certainly an indicator of the quality of our educational system. The provision of free, quality and accessible education and subsequently high performance in school is inevitable for the realization of Millennium Development Goals (MDG), Ghana Partnership for Education Grant (GPEG) and other non-governmental organisations. In the 1950s and 60s, there was not much competition in the educational sector, therefore, it was easy for one to find a decent job without necessarily having to excel highly in mathematics. This is the time when the contribution of education to individual development was

increasingly recognized, especially in trained man power. Consequently, it turned out that the few who excelled highly in academics dominated top government positions and other top management positions in various sectors of the economy.

It is worth noting that, over the years, many commissions and committees have been formed to review the educational system. It is in this respect that the Government of Ghana in conjunction with United Nations Children"s Fund (UNICEF), formerly United Nations International Children"s Emergency Fund, Campaign for Female Education (CAMFED) and other international organizations have introduced several peer education programs to scale up the provision of quality education through seminars, workshop and financial empowerment for the purpose of improving students" performance at all levels of educational cycle in the country. The Education Strategic Plan (ESP) 2010-2020 sets out eight strategic objectives, which are simplified into five broad medium term objectives (Ministry of Education, 2007). These objectives are as follows;

1. Improve equitable access to and participation in quality education at all levels

2. Bridge gender gap in access to education

3. Improved access to quality education for people with disability

4. Strengthen links between tertiary education and industry

1. 5.Mainstream issues of population, family life, gender, health, HIV/AIDS/STIs in the curricular at all levels and improve quality of teaching and learning.

The government reviewed the curriculum in terms of content, teaching methods, education strategies and administration structures in order to enhance school performance in West African Senior School Certificate Examinations (WASSCE) in

Ghana. It is in this regard that the mathematics syllabus for JHS 1-3 was revised in 2012. The panel recommended the establishment and installation of an effective democratic and community based infrastructure for the management and monitoring of students" performance in West African Senior School Certificate Examinations in Ghana.

Further, the introduction of Community Day Senior High School Education initiated and funded by the government in 2014 and the introduction of Free Senior High School Education program in September, 2017 are policies and interventions introduced to give more students better access to secondary education and to reduce psychological and financial burden on parents and hence enhance students" performance. The government funding in Senior High Schools is also intended to improve infrastructure, teaching and learning resources and subsequently enhance performance in national examinations. In 1999, the government of Ghana through the Ministry of Education reduced the number of subjects offered at the basic level from ten to eight and at the same time students were given a variety of optional subjects for the purpose of excellent performance in all subjects at WASSCE. However, despite interventions by the government, international organizations and communities, students" performance particularly in mathematics at West African Senior School Certificate Examinations (WASSCE) still remains a national problem. This situation has become a great concern to all stakeholders, including teachers, parents, policy-makers, educationists and politicians and has led to the critical question "What are the school based factors influencing students" academic achievement in mathematics at WASSCE?". It is against this background that the researcher has decided to conduct this study at senior high school level in the northern region of Ghana, in some selected districts.

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Various studies have been conducted both internationally and locally with regards to academic performance in mathematics to help understand the issue of students" performance in mathematics at different levels of educational cycles. A study by Lowe (2009), on school improvement strategies in United Kingdom found that, the underperforming schools should strategize to empower students" performance in the failing schools. It is hoped that good academic strategies yields better students performance in a school. According to the study of Nannyonjo (2007) on factors influencing learning achievement in Uganda, the study found that, head teachers" characteristics such as; qualifications, in-service training, age, experience and duration in a station do influence students" achievement together with supervision strategies and administration style employed by the head of institutions. In the same vein, the study of Twoli (2006) on factors that influence poor performance in KCSE in Mwingi District found that poor performance was influenced by the followings; students" attitudes, lack of teaching staff and indiscipline. The study also established that poor support from the local community in provision of teaching and learning facilities influence students" performance at KCSE in mathematics. Further, the study found that lack of physical facilities such as; Land, school buildings, Laboratory, Library, Equipment, Vehicles, Desks, Textbooks and stationeries are other significant factors influenced students" performance in mathematics. Hence, the study of school-based factors influencing students" poor performance in West African Senior School Certificate Examinations is imperative since good performance in mathematics in WASSCE is vital for admission in to competitive courses at the tertiary (Colleges of Education, Technical Universities and Conventional Universities). On the other hand, students" poor performance in mathematics in WASSCE leads to high dropout rate at the senior high school level since due to the mass failure of students" in mathematics

they are unable to further their studies to the tertiary level, which usually tends to limit their contribution to national development.

Academic achievement in mathematics in this research has been classify under two main categories, good academic achievement and poor academic achievement. Good academic achievement in mathematics implies students obtaining the high grades (A1-C6) by the majority of students in an internal or external examinations. Poor academic achievement in mathematics implies obtaining the low or weaker grades (D7-F9) by majority of students in an internal or external examinations in mathematics. Poor academic performance in mathematics according to Aremu (2003) is a performance that is adjudged by the examinee and some other significant as falling below an expected standard. Poor academic performance in mathematics has been observed in school subjects especially mathematics and English language among secondary school students (Adesemowo, 2005). Aremu (2000) stresses that academic failure is not only frustrating to the students and the parents, its effects are equally grave on the society in terms of deficiency of manpower in all spheres of the economy and politics.

According to Lambdin (2009), mathematical demands on students increases as they progress through school; take up their adult lives at home and in the workplace. In order to function in a mathematically literate way in the future, students must have a strong foundation in mathematics. A strong foundation involves much more than the rote application of procedural knowledge.

In Ghana, the problem of Senior High School students" under-achievement in mathematics has persisted for a long time. Available records from some senior high schools over a period of 2011 to 2015 in the Northern region show that performance

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in mathematics among senior high school students in Ghana was abysmal. Table 1 shows the four sampled senior high school students" performance in mathematics in West African Senior School Certificate Examination from 2011-2015.

Table 1: WASSCE Past Results for sample school from 2011-2015

year	Number of candidate		Passed (A1-C6)		Percentage	
	National	Sampled Sch.	National	Sampled Sch.	National	Sampled Sch.
2011	147227	782	64665	106	43.9%	13.6%
2012	174296	962	86677	682	49.9%	70.9%
2013	405356	2920	141567	34	36.8%	1.2%
2014	242162	1519	78460	154	32.4%	10.1%
2015	268812	2031	67983	12	25.3%	0.6%

Source: Regional Education Office (Northern Region)

The statistics in Table 1 above revealed that the schools over the five-year period registered 8214 candidates for West African Senior School Certificate Examination, only 988 passed that is grade (A1-C6) representing a pass rate of 12 percent. This means in numerically that out of every 100 candidates only 12 students could further their education to tertiary as far as mathematics is concern as a requirement.

Further, the sampled schools average percentage passed is 19.28 percent which is far below the national average of 37.66 percent. This gives a clear indication that students performance in mathematics in the Northern Region is far below the national average hence the need to investigate.

According to (Anamuah-Mensah & Mereku, Ghanaian JSS2 Students" Abysmal Mathematics Achievement in Timss- 2003: A Consequence of the Basic School Mathematics Curriculum, 2005), out of the 46 countries that participated in Trends in

International Mathematics and Science Study (TIMSS), Ghana was second from the bottom of the results table with a mean score far below the international average. This means that students" poor performance in mathematics is a global issue with Ghana being almost last out of the total number of the participated countries which needs to be addressed. As a mathematics teacher in a senior high school, I recall that in 2010/2011 academic year, out of 270 students registered, only 19 of them obtained (A1-C6) in mathematics. This indicates almost 93% did not quality for tertiary. Obviously, the mean score was also very low.

Tata (2013) in his study conducted in Nigeria came out with findings that, students" negative attitude toward mathematics, fear of mathematics, inadequate qualified teachers and inadequate teaching materials were some of the causes of students" poor performance in mathematics. Developing positive attitude, motivation and proper guidance toward mathematics and provision of relevant teaching materials could make students perform better in mathematics.

A report by HakiElimu (2013), identified general performance of the year 2009 that about 27.5% of the students scored division zero, meaning they score absolute zeros; in the year 2010 failure increased to 49.6%; in the year 2011 failure was 46.4% and 60.5% in the year 2012. It was not indicated in the report that students performed better in mathematics. Factors for students" failure according to (HakiElimu, 2013) as cited in (Cosmas, 2019) was inadequate in-service training, few qualified teachers to teach mathematics and poor working conditions. This was also associated with a lot of confusion caused by limited understanding of the requirements of the 2005 competence based curriculum and syllabi currently in use (HakiElimu, 2013; Mtitu, 2014).

According to Mabula (2012), students" performance in mathematics subjects was affected by poor quality of mathematics classroom teaching and a decline in interest of students toward science subjects. He also reported that 83.9% of students who sat for CSEE failed in mathematics in the 2010 national examination, meaning that only 16.1% passed. Further research conducted by Mabula (2012), indicated that teacher-students" relationship in classroom teaching and learning of mathematics needs to be improved. Also, according to (Michael, 2015) researchers such as Biotenbeck (2011) and Clement (2013), had associated students" failure in mathematics with teachers" teaching practices. Biotenbeck (2011), defined teaching practices as what teachers do in the classroom, how teachers apply instructional methods and traditional ways of teaching. These were such as lecture style teaching, teacher-centred methods and rote memorization in teaching mathematics.

However according to (Mlozi, Kaguo, & Nyamba, 2013), students" performance in mathematics was not good at all in Tanzania as there were not enough teaching and learning materials as well as mixing of two languages, English and Kiswahili, which confuses students. This means that for effective teaching and learning of mathematics, the instructional medium (language) must be considered a key factor that influence students" performance. This is to say, teachers can use students" language in classroom to explain a concept for better understanding.

The government had laid down a strategy to improve performance in mathematics by promoting the use of students" first language by the teachers to explain concepts for better understanding of the students. The flexibility of thinking will allow them to tackle new areas of mathematics and be willing to continue doing mathematics. This

will improve their understanding of the questions in mathematics and subsequently the ability to answer the question very well.

In another research conducted by Avong (2013), the findings indicated that shortage of qualified teachers is considered to be the greatest factor causing poor performance in mathematics among Senior High School students in Atyap Chiefdom, which is one of the researcher"s tentative answers and is supported by a research conducted by Iheanachor (2007), whose findings indicate that, there is a significant positive relationship between students" academic achievement in mathematics and teachers" background. Teachers who have good qualifications in mathematics have their students performing better in mathematics. Inadequate resource materials for teaching ranked 2nd by both teachers and students. The negative attitudes of teachers and students towards teaching and learning of mathematics was also identified as a factor. In addition, poor teaching methods were considered to also contribute to the poor performance of students in mathematics.

1.2 Statement of the Problem

Mathematics is one of the core and important subject in Ghanaian senior high school curriculum. As a result, it is a mandatory subject that must be offered by all students regardless of the group they belong to. Obtaining minimum grade of last credit (C6) in mathematics is highly mandatory if such student should go to tertiary institution. Literature is replete but not contradiction that there is evidence of academic under-achievement among our Senior High School Students in mathematics across the country (Awanta, 2009) especially in the northern region. Many efforts have been made by the government and individual stakeholders to address this endemic academic problem through several interventions like organisation of workshops and

seminars for mathematics teachers, organisation of mathematics competition across the region and award of scholarship to brilliant mathematics student but to no avail. The problem should not be allowed to continue if Ghana will compete favourably with other advanced countries of the world in Science and Technological development. Therefore, this study sought to investigate and proffer solution to the school-based factors that contribute to students" academic performance in mathematics in northern Ghana.

1.3 Purpose of the study

The purpose of the study is focusing to investigate school based factors that contribute to Senior High School students" academic performance in core mathematics in Tamale Metropolis, Ghana.

1.4 Objectives of the study

1. To assess the relationship between availability of physical facilities in school and students" performance in Mathematics.
2. To assess the effects of teachers" professional qualification/teaching experience and students" academic performance in Mathematics.
3. To investigate the influence of school administration on students" academic performance in Mathematics.
4. To investigate the influence of students" attitudes and academic performance towards Mathematics.

1.5 Research Questions

To achieve the stated objectives above, the study attempted to answer the following research Questions:

1. What influence does students" attitudes have on their academic performance in Mathematics?

2. What is the effect the of availability of facilities in schools and students" performance in mathematics?

3. What is the relationship between the teacher professional qualification/ teaching experience and students" academic performance in mathematics?

4. What influence does school administration have on students on their academic performance in mathematics?

1.6 Significance of the Study

This is an empirical study; therefore, its outcome will influence many stakeholders" decisions on senior high school education in Ghana.

First the study is expected to contribute to the advancement of SHS students" knowledge and students" performance in mathematics in Ghana.

Secondly, the findings of the study is expected to be of great significant to the mathematics teachers/educators and school administrators who may need to understand the current trend of students" academic achievement in mathematics in West African Senior School Certificate Examination. The outcome of this study will also elicit positive attitude towards the teaching and learning of Mathematics among the Senior High School mathematics teachers.

Thirdly, the study will further assist the key stakeholders in education especially the Parent Teachers Associations (PTAs) and School Management Committees (SMCs) in finding prudent ways of mitigating school-based factors that affect students" poor academic achievement. This would help improve the academic performance of students in various schools in the northern region.

Furthermore, recommendations from this study would be useful to mathematics tutors in the Senior High Schools as well as policy makers especially the Ministry of Education and the curriculum planners of Ghana Education Service.

1.7 Justification of the study

All over the country, there is a consensus of opinion on the fallen standards of education in Ghana. Parents and government are in total agreement in the opinion that, their huge investment on education is not yielding the desired results (Ministry of Education, Education Sector Performance Report, 2016). Teachers also complain of students" low performance especially in mathematics at both internal and external examinations. The West Africa senior School Certificate Examination (WASSCE) results conducted by West Africa Examination Council (WAEC) from 2011 to 2015 justified the problematic nature and generalization of poor students" performance in mathematics in different schools especially some schools in the Northern region being the worst.
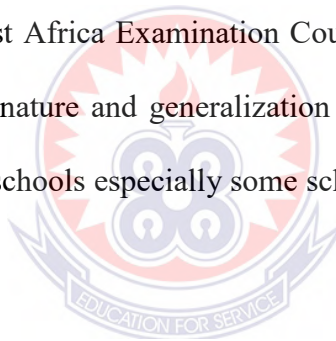
1.8 Delimitation of the Study

The following were the delimitations of the study: First, the study was limited to the public senior high schools in Northern region of Ghana. Three districts were further selected for the research due to limited budget and finance constraints and time allocated for carrying out the study. Other regions and districts were not included in the propose selection of this study. The study used only Form thee students from the Senior High Schools Selected.

1.9 Limitation

The research work was characterised by some constraints. Some of these setbacks include time, resources and willingness of the respondents to respond to the questionnaires. Apart from school based factors that were studied by the researcher, in reality many other factors influence students" academic performance, as emerges from the open ended questionnaires. As a result, the findings of this study may not exactly bring out the influence of such other factors.

1.10 Operational definition of terms

Academic Achievement:

Academic Achievement is the level of schooling you have successfully completed and the ability to attain success in your studies.

Poor: Worse than is usual, expected, or desirable; of a low or inferior standard or quality.

Cause: A person or thing that gives rise to an action, phenomenon, or condition.

Poor Academic Achievement

Poor academic achievement implies obtaining low or weaker grades (D7-F9) by majority of students in an external examination.

Good Academic Achievement

Good academic achievement implies obtaining high grades (A1-C6) by the majority of students in an external examination.

School-Based Factors

School-Based Factors refers to physical, human and financial resources used by schools in promotion of academic performance.

Physical facilities

Physical facilities in school refers to the school plant, that is, the school buildings, classrooms, library, laboratories, toilet facilities, offices and other materials and infrastructures that would likely motivate students toward learning and ultimately improve performance.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter reviews relevant related literature on the topic. It examines key concepts, methods and problems of the topic. It establishes conceptual and theoretical frameworks on variables influencing teaching and learning of mathematics as well as empirical studies on school-based factors influencing students" performance in mathematics and finally the summary of the chapter.

2.1 Theoretical Framework

The study will be based on Skinner"s (2007) motivation theory of learning. According to this theory, humans are motivated to learn through selective reinforcement of progressively more adequate approximation of the desired behaviour (achievement) and extinction of inadequate behaviour. Performance of the learners is inspired by the teacher among others who provides moral support and controls the learners" emotions, environmental destructor and peer pressures in schools. It is a widely accepted management maxim that employees who are satisfied in their work attract better performance and contribute to the achievement of organizational objectives, because they are more productive at the work place (Grudd, 2007). The attitudes and motivations of employees play a crucial role in influencing motivation, productivity, and overall success of an organization. Properly motivated employees do their job better and achieve a higher level of performance. The right employee strategies can encourage loyalty, dedication and self-awareness in the pursuit of excellence. The teachers are the key motivator in the classroom. The teacher must not only understand the learners but must also know ways in which they can be motivated and inspired for high performance. However, some of the factors that deter students" effective

performance are mental limitations, poor teaching and inadequate teaching learning materials, lack of physical facilities, inadequate teaching staff, school environment, unsuitable co-curricular activities and peer pressures. Students" performance depends on immediate reward or feedback. If the teacher wants the learners to compete, then learners must be rewarded for any good performance and that can enhance higher students" performance in schools. Although there is positive and negative reinforcement, Skinner (2007) believes that, learning must be based on positive reinforcement. Hence, for the learners to attain higher academic achievement, schools need to coordinate all efforts of teachers, students and school based–factors for learning to attain the desired performance.

According to Skinner (2007) as cited in Passos (2007), key element for an effective school is an effective head teacher, although school success is influenced by other external and internal factors, head teacher plays a pertinent role. The key driving force for effective head teacher is their motivation level and commitment level in supervision. This is because a head teacher as a leader plays a role in harnessing school resources while giving school direction in terms of visions and mission. A well-motivated head teacher will also motivate other teachers. Accordingly, head teacher"s motivation level is the significant factor in shaping the learning environment and the climate of a school; this is because it is the head teacher who articulates clear goals, expectations, vision and the mission of the school. Skinners" motivation theory is found to be appropriate for this study because it is envisaged that students" high or poor performance will depend on teachers" characteristics (teachers" qualifications, teaching strategies, teaching experience and teachers" attitudes); availability of teaching and learning resources, textbooks, reference books, syllabus, human resource, school practices, curriculum supervision records, school administration and

management strategies, professional records and documents, Environmental factors; (community influence, availability of infrastructure and parents influence); Socio-cultural factors (religious influence, cultural influence) and students" characteristics (students attitude, interest and commitment) .

2.2 Conceptual Framework

The conceptual framework hereunder presents variables that influence teaching and learning in mathematics subject. Sitko (2013), defined conceptual framework as the system of concepts, assumptions, expectations, beliefs, and theories that support and inform about the study. According to McGaghie *et al*. (2001), conceptual framework "sets the stage" for the presentation of the particular research question that drives the investigation being reported based on the problem statement. Students" performance in mathematics is influenced by the teaching and learning resources, teacher academic and professional qualification, and availability of physical facilities and students" cultural backgrounds.
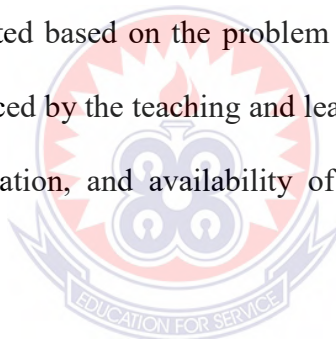
Therefore, the conceptual framework in this study will be an attempt to investigate the possible relationships between students" characteristics, teachers" characteristics, teaching, learning resources factors and Environmental factors influence students" poor performance in mathematics in internal and external examinations.
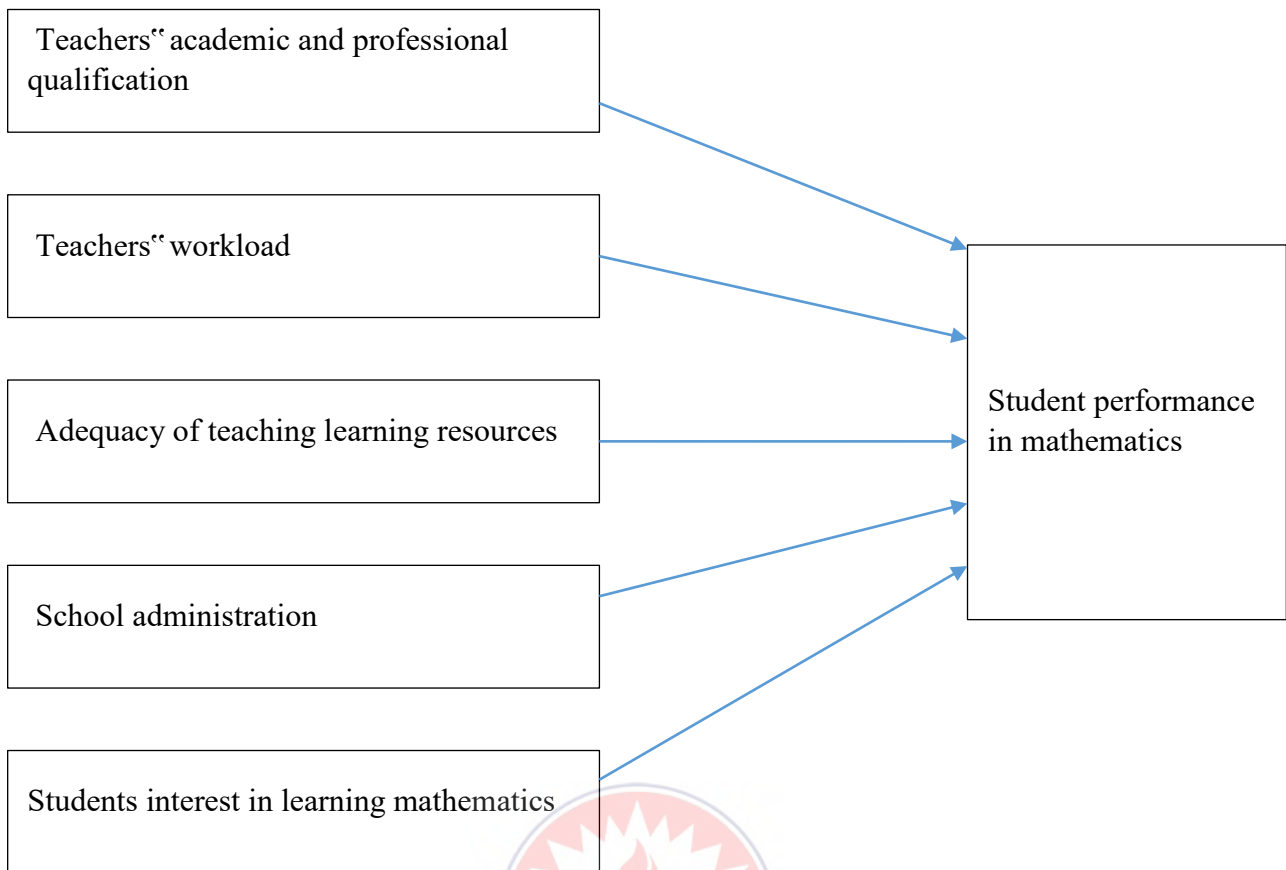
Figure 1: Conceptual Frame Work

Figure 1 exhibits the conceptual framework, which consists of major variables and their possible patterns of influence on each other and assignment impact on students" performance in WASSCE. The effect between independent variables namely; teachers" characteristics and teaching, learning resources factors which motivate students" towards high performance in mathematics in West African Senior School Certificate Examinations is mediated by students" characteristics and environmental factors to produce either higher or lower academic students" achievement.

The conceptual framework implies that two independent composite variables namely teachers characteristics (teachers" qualification, teaching strategies, teaching experience and teachers attitudes) and teaching/learning resources factors (textbooks, reference books, syllabus human resources, school practices, curriculum supervision

record, school administration and management strategies, professional records, enough classrooms and document) have influence on proximate variety which consist of environmental factors (community influence and parents" influence) and students" characteristics (students" attitudes, students interest and commitment in learning mathematics) that directly influence dependent variables "students" performance in mathematics in WASSCE". The independent values on the other hand are: teachers" workload, teacher"s qualification and experience, students" attitude and interest in learning mathematics, availability of physical resources and learning atmosphere.

2.3 Academic Performance

In educational institutions in Ghana, success is measured by academic performance, or how well a student meets standards set out by government and the institution itself. Academic performance according to the Cambridge Dictionary of English (1995) refers to how well a school, college, university, an individual or a group is able to perform when given a learning task, activity or one"s achievement in standardized tests in academic pursuit. Academic performance is related to content and intellect, meaning that academic performance depends on the learner"s competence in all aspect of life. Academic performance is affected positively by academic integration. (Rienties, Beausaert, Grohnert, Niemantsverdriet, & Kommers, 2012). According to Akayuure et al (as cited in Buabeng-Andoh, 2012), the integration of Information and Communication Technologies (ICTs) in school curriculum improves students" learning outcomes and equips them with competencies and survival skills for the information society.

Academic performance is therefore defined by Adediwura and Tayo (2007) as the display of knowledge attained or skills developed in school subjects designated by test

and examination scores or marks assigned by the subjects" teachers. It could also be said to be any expression used to represent students" scholastic standing. Academic performance is described at the state level as an evaluation of students" performance on standardized tests geared toward specific ages and based on a set of achievements students in each age group are expected to meet (Bell, 2014). In this study academic performance is based on the West African Senior School Certificate Examination results in core mathematics subjects. Performance based on education stimulates the development of other important dimensions of learning, namely the affective, social and metacognitive aspects of learning. Based on the above various views of the meaning of performance, it could be defined as a measure of task that the performer carries from the beginning through it completion and is rewarded. Performance based on this study can therefore be classify into two categories; good academic performance and poor academic performance.

2.3.3 High performance

High performance can be described in academia as succeeding or scoring above and beyond standard norms over a long-term. But for the purpose of my study, high performance has been operationalized to suit the study. High performance is described under this study by the researcher as performance of student that can fetch him/her admission into any tertiary and any course of his/her area of studies in Ghana. In other words, high academic performance is a kind of performance where students" performance is above average standard grade for which a student can further their education to tertiary in Ghana. These grades are considered to place the student a higher leaning ability in the particular field or subject. These grades fall within the grades (A1, to C6).

According to Avong (2013) factors, as ranked by students and teachers, which have the strongest link to students" poor performance in mathematics are; qualified teachers has the strongest link to poor performance in mathematics followed by inadequate resource materials for teaching. The third in strength as ranked by students and teachers are lack of motivation of students by teachers and mathematics anxiety respectively. Attitudes of teachers and students towards teaching and learning mathematics was ranked 4th while all others were ranked as having weaker links to poor performance in mathematics with school location having the weakest link.

2.3.1 Low performance

According to Aremu (2003) defines poor academic performance as a performance that is adjudged by the examiner as falling below an expected standard. Poor performance can also be described in academia as a consistent failure to meet specified standards and level of performance following a period of sustained support, development and investigation to curb the situation. However, for the purpose of this study I want to operationalize the definition of poor / low performance as students" whose performance is below minimum standard grade for which a student cannot be admitted to further their education at tertiary level in Ghana. In Ghanaian tertiary institutions (colleges of education, technical universities, universities), it is required that for a student to gain admission to pursue any higher course, he/she must obtain a grade of C6 (credit) or better even though the grades D7 and E8 are pass by the Ghana WASSCE standard it is considered as weak and unacceptable for admissions in tertiary institutions.

2.4 Mathematics as a discipline in Senior High School in Ghana

Mathematics as a discipline has great input in the scientific and technological development of any nation. Knowledge in mathematics is applied in almost every school subject. It is, therefore, significant that a lot of emphasis is laid on the teaching and learning of mathematics from the basic level to the Senior High School level. The study of mathematics in Ghana starts at the primary level through to the Senior High School level, and it is compulsory for all students because it is recognised as a tool in many other subjects (like chemistry, physics, geography, economics, accounting and so on). In the Senior High School level, we have Core and Elective Mathematics. While the Core Mathematics is studied by all students, the Elective Mathematics is studied by General Science, some Business Accounting, Geography, Agriculture and Technical students only

Mathematics enjoys a lot of recognition and respect from policy makers, educational institutions and the world of work. The study of mathematics is important because it is associated with more of academic and career opportunities and at the same time acts as one of the critical filters for entry into higher educational programmes and even in the world of work (Anamuah-Mensah, 2007). Thus, without sufficient knowledge in mathematics, one may not climb the academic ladder. In addition, people who resort to learning a trade because of their inability to make the required grade for further studies end up using mathematics as an important tool for performing their duties in their work places. According to Anamuah-Mensah (2007), the utilisation of science, mathematics and technology has been interlinked with the improvement in productivity and wealth creation of a nation. One of the general aims of teaching mathematics is to communicate effectively using symbols and explanations through logical reasoning (Ministry of Education, Science and Sports

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[MOESS], 2007). The study of mathematics also develops the power of logical thinking, accuracy and spatial awareness. Despite the importance of mathematics in human development, many investigations have shown that students in secondary schools are not very much interested in mathematics (Eshun, 2000; Awanta, 2000). Yara (2009) showed that majority of students saw mathematics as a subject with many technical terms which are difficult to remember.

Mathematics is described as the queen and servant of all school subjects, since it cuts across the school curricula (Fajemidagba, 2006; Akpan, 2007). Mathematics is therefore a subject that is related to other school subjects in areas like number and numeration, variation graphs, functions, logarithms and indices, algebraic process, solution of equation and also in area and volume. Further Mathematics is a highly respected subject and is recognized for its challenging content. Mathematics is a unique subject and it is a fundamental part of school curriculum. It is an instrument for the development of all other sciences. Knowingly or unknowingly, we are using mathematics in every facets of life. However, majority of students across the world dislike mathematics. In Ghana, the subject choices that you make for your secondary school education can have a significant impact on the course options available to you at university.

2.4.1 Needs of studying Mathematics at the Senior High Schools

The benefits embedded in learning mathematics cannot be over-emphasized. It has come to be an open secret that technological advancement the world enjoys today is mainly driven by the theories, concepts and laws postulated by past and present mathematicians. For instance, according to Anamuah-Mensah (2007), the utilisation of science, mathematics and technology has been interlinked with the improvement in

productivity and wealth creation of a nation. This explains why it is important to have skilled human resources in science, mathematics and technology as a nation. Knowledge in mathematics is applied in almost every school subject. It is, therefore, significant that a lot of emphasis is laid on the teaching and learning of the mathematics from the basic level to the senior high school level. Mathematics makes its learners methodical and systematic. Mathematics makes our lives orderly and power reasoning, creativity, abstract and critical thinking, problem-solving ability even effective communication skills. The study of mathematics is needed because it is associated with more of academic and career opportunities and at the same time acts as one of the critical filters for entry into higher educational programmes and even in the world of work (Anamuah-Mensah, 2007). Thus, without sufficient knowledge in mathematics, one may not climb the academic ladder.

Mathematics is the cradle of all creations, without which the world cannot move an inch. Be it a cook or a farmer, a carpenter or mechanic, a shopkeeper or doctor, an engineer or a scientist, a musician or a magician, trainees and students, everyone needs mathematics in their day to day life.

- **Graduate Prospects**

One of the numerous reasons why studying of mathematics is significant is that mathematics graduate prospects is high. Looking at few number of students who pursue their degree course in mathematics and mathematical related courses at the universities, the job market suffered a significant inadequate mathematics graduate making their prospects relatively high, especially in the field of teaching, banking, architecture etc. This high level of employability is strengthened by the fact that careers involving maths are typically permanent, in that numbers in whichever form

they take are going to be around forever, and so money, computing and many other mathematical fields are reasonably safe career paths.

- **Transfer of knowledge**

A mathematician's skillset is not exhausted once they move out of the realm of the numerical. The facets of a student which are developed during a Mathematics degree are easily extrapolated to other situations and areas. For example, rational and logical thought is something which is required in many areas, whether it is in a moral or career capacity. Furthermore, the high level of cognition required to comprehend complex mathematical theories and rules is an asset which will benefit an individual in many ways.

2.5 Factors influencing students' performance in mathematics

2.5.1 Teacher factors

Teacher factors are vital in achieving quality in the provision of senior high school education in Ghana. The achievement of universal participation in education is fundamentally dependent upon the quality of education available. For example, teacher factors have crucial impact on how well students are taught, how much they learn, how long they stay in school and how regularly they attend lessons. It could be judged unfortunate therefore that the quantitative aspects of education have become the main focus of attention in recent years for policy makers (Education for All, 2005). The achievement of quality education requires the collective effort of various stakeholders. Effort needs to be made by students, teachers, school heads and the government in order to realize desirable quality standards in Senior High School education. The schools also require specific physical facilities and optimum conditions in order to facilitate the efforts of the teachers, students and headmasters. This study examined the role played by teacher factors in providing quality education

in senior high school as signified by student''s academic performance. Some of the teacher factors are commitment to teaching, motivation, qualification and experience, his or her mastery of the subject matter and methods of teaching etc.

- **Who is a teacher?**

Teachers are defined as persons whose professional activity involves the transmitting of knowledge, attitudes and skills that are stipulated in a formal curriculum programme to students enrolled in a formal educational institution (Ministry of Education, 2011). A teacher is a person who helps others to acquire knowledge, competence or values. Hammond (2000) study examined the ways in which teacher qualifications and other school inputs were related to student achievement across the states in the United States of America, by using data from a 50-state survey of policies, state case study analyses, the 1993-94 Schools and Staffing Surveys (SASS), and the National Assessment of Educational Progress (NAEP). Among his evidence-based findings for the effects of teacher quality on student outcomes was that, teacher quality characteristics such as certification status and degree in the field to be taught are very significantly and positively correlated with student outcomes. The most consistent highly significant predictor of student achievement in reading and mathematics in each year tested is the proportion of well-qualified teachers in a state. Also Okonkwo (2000) in his study examined the instruction between two independent variables of teacher quality and instructional strategy on students'' performance in secondary school science found that students taught by professional trained biology teachers performed significantly better than those students who were taught by the non-professional biology teachers on the genetic objective achievement test.

- **Teacher professional qualification on student performance**

Impact of Teachers" Professional Training on Students" Achievement There is a common thought that professional qualification of a teacher is a very essential merit of every effective teacher, though some studies indicate otherwise. Ball and Cohen (1999) were of the view that teachers should have an in-depth understanding of meanings and connections in subject matters and not just procedures and isolated information. Lockhead and Komenan (1980) in a review of teacher quality on the achievement of students noted that 60% of 60 studies that examined the effect of teacher education on student behaviour found positive relationship. There is a perfect positive relationship between teachers qualification and students" academic achievement in chemistry (Unanma, 2013). There are different views on the impact that a teacher training has on students" achievement in mathematics. Asikhia (2010) and Umar-ud-Din et al. (2010) who in their study also revealed that teachers" qualification influences student"s academic performance. Findings of different researchers on the relationship between teacher training and students" achievement in mathematics are contradicting. Some researchers in mathematics education indicate that students" achievement is a function of teacher education programs. Researchers who are of this view assume that when teachers of mathematics are well-trained the students they teach will also achieve more in mathematics. Those with the opposing view see teachers" training to have very little influence on students" achievement in mathematics. Findings of Dahar et al (2011) who observed in a similar study revealed that there is no much difference in teacher quality and student academic achievement in school subjects. Some research findings have indicated that the training of mathematics teachers positively relate to student learning outcomes in the subject. Bressoux (1996), using a quasi-experimental design, found that teacher professional

training in mathematics increases students" performance in mathematics. Darling-Hammond (1992) reviewed over one hundred studies on the topic and concluded that fully prepared (trained) teachers are more effective in the classroom and their students demonstrates the larger achievement gains than those teachers unprepared this assertion is supported by Agyeman (1993) who noted that teachers who do not have any of the academic and the professional teaching qualification would certainly have a negative influence on the teaching and learning of their subject. Angrist and Lavy (2001), for instance, claimed that there is a strong relation between teacher training and student achievement in mathematics. Findings by other researchers have also indicated a stronger and more consistent positive result of professional educational training on teachers" effectiveness. Adeyeye and Arifolo (1999) in their study of impacts of teachers" professional qualification and academic qualification on students in Chemistry in Eketi State found that a statistically significance difference exists between the academic achievement of students taught by professional and non-professional teachers in Chemistry in secondary school level. Those taught by professional teachers showed a better overall academic achievement in Chemistry in Ekiti State. Dildy (1982), investigating the results of a randomised trial, found that teacher training increases student performance. A similar finding by Monk (1994) in studying student"s mathematics and science achievement found that the education coursework of a teacher had a strong positive influence on students learning and was sometimes more influential than extra subject matter preparation. In Ghana, teachers are supposed to be trained in the various teacher training colleges and the universities of education (University of Cape Coast and University of Education, Winneba and recently University for Development Studies). In the three universities mentioned, the training is done in specific subjects of specializations of the teacher trainees.

However, there are some teachers who have been recruited into the teaching field without the prerequisite training in education these untrained teachers may have a negative influence on students" achievement in mathematics. For children to receive quality education, we need qualified, competent and committed teachers. According to Mong (1994), for quality education to thrive, it is necessary to ensure that teachers are appropriately trained to effectively impart relevant knowledge and skills to pupils/students. That is to say, to ensure quality education is to emphasise teacher quality. Darling-Hammond (2000) says that the effects of well-equipped teachers on students" achievement can overshadow student background factors such as language, poverty and minority status. She further argues that other kinds of investment such as reduced class size, overall spending on education and teacher salaries do not relate more strongly to students" achievements than teacher quality. A study that examined the mathematics achievement of elementary school students also found that students taught by new, uncertified teachers did significantly worse on achievement tests than did those taught by new certified teachers (Laczko-Kerr and Berliner, 2002). Some other findings by other researchers however, contradict the earlier findings discussed. Other literatures reveal that the training of mathematics teachers contributes very little to students" achievement in mathematics. Wiley and Yoon (1995) and Cohen and Hill (2000), for example, find teacher development programmes to have at least small impact on student performance.

- **Teacher Academic Qualifications and students' performance**

Hammond (2000) study examined the ways in which teacher qualifications and other school inputs were related to student achievement across the states in the United States of America, by using data from a 50-state survey of policies, state case study analyses, the 1993-94 Schools and Staffing Surveys (SASS), and the National

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Assessment of Educational Progress (NAEP). Among his evidence-based findings for the effects of teacher quality on student outcomes was that, teacher quality characteristics such as certification status and degree in the field to be taught are very significantly and positively correlated with student outcomes. The most consistent highly significant predictor of student achievement in reading and mathematics in each year tested is the proportion of well-qualified teachers in a state.

Also Okonkwo (2000) in his study examined the instruction between two independent variables of teacher quality and instructional strategy on students" performance in secondary school science found that students taught by professional trained biology teachers performed significantly better than those students who were taught by the non-professional biology teachers on the genetic objective achievement test. After looking at the teacher"s academic and professional qualifications in relation to students" performance let us dwell on teachers teaching experience as a factor of students" performance in mathematics in WASSCE.

- **Teachers' Years of Teaching Experience and Students' Academic Performance**

In addition to teacher professional qualification and subject-content specialization, other factors may impact students" performance in mathematics. One of such factors is years of teaching experience of the teacher. West and Chingos (2009) define teaching experience as all years the teacher has spent in the profession. Hanushek"s review (1986) of more than 100 studies of teacher years of experience and student outcomes, only 40 showed a statistically significant relationship. Of these, 33 found that additional years of experience had a 21 significant positive effect, but seven found that more experience actually had a negative impact on student achievement. According to Goe et al. (2008), teaching experience is among the attributes under the

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category of teacher qualifications that was found to influence student academic performance.

Further, available literature has indicated positive correlations between years of teaching experience and higher student achievement. Goe *et al*. (2008) studied teachers" teaching experience and students" learning outcomes in the secondary schools in Ondo state in Nigeria. The study findings revealed that teachers" teaching experience was significant with students" learning outcomes as measured by their performance in the secondary school certificate examinations. Schools having more teachers with five years and above teaching experience achieved better results than schools having more teachers with less than five years teaching experience. Teacher"s inexperience is shown to have a strong negative effect on student performance. Conversely, experienced teachers produce higher student achievement. Teachers with more than five years in the classroom seem to be more effective than new teachers. Rivkin et al. (2005) in analyzing the UTD Texas Schools Project data showed that students of experienced teachers attained considerably higher levels of achievement than did students of teachers with one to three years of experience. Similarly, Fetler (2001) in analysis of mathematics achievement and dropout rates in a sample of California high schools found that schools whose dropout rates were within the highest 10 percent had 50 percent more new teachers than did schools in the lowest 10 percent. Ehrenberg and Brewer (1994) also found that teacher experience was positively related to white and African American student gain scores, but negatively related to Hispanic gain scores. Goldhaber and Brewer (1996) also found that teacher experience is positively related to high school students" achievement. Greenwald et al. (1996) examined data from 60 studies and found a positive correlation between years of teacher experience and student test scores. Another study by Murnane and Phillips

(1981) suggest that teachers with less teaching experience normally produce smaller learning gains in their students compared with teachers with more teaching years of teaching experience. Rosenholtz (1986) also argues that teachers with less than three years of teaching experience are not effective as more experience teachers. Hawkins et al. (1998) specify that teaching experience can be viewed as a resource to which students have access. Teachers with more teaching experience have worked with a feeler multiplicity of students and have developed a greater stock of instructional strategies. Hawkins et al. (1998) found that in 1996 the amount of general teaching experience for teachers of fourth-grade mathematics indicated that students who were taught by teachers with less than five years of teaching experience had performance below as compared to the performance of students whose teachers had 6-10 years or 25 or more years of teaching experience. Ferguson (1991) found in his study of over 900 school districts in Texas that teacher experience was positively associated with student achievement gains at the district level. On the contrary, more knowledgeable teachers in educational settings with no opportunity for staff development may become dormant in their performance. However, teacher"s age also counts in his performance, older teachers may grow tired in their teaching. In the study of high school mathematics and science teachers, Monk (1994) found that teacher experience had no effect on student performance. Conversely, inexperience is shown to have a strong negative effect on students" performance. Their findings were supported by those of a comprehensive analysis by Greenwald *et al*. (1996) who examined data from 60 studies and found a positive relationship between years of teacher experience and student test scores. Similarly, the Texas Schools Project data showed that students of experienced teachers attained significantly higher levels of achievement than did students of new teachers (those with one to three years of experience).

The study above shows that teachers experience has positive and negative impact to student academic performance. Apart from teacher's experience in the teaching job, teacher's motivational level can also enhance students' academic achievement.

- **Teacher's motivation**

According to Ngu (1998) as cited in (Ndaliman, Kamariah, Chikaji, & Mohd, 2015) motivation is described as the enthusiasm and persistence with which a person does a task. Motivation may be defined as the amount of effort a teacher desires to exert in a particular class (Richmond, 1990). Motivation has been described as an internal drive, driving force, feeling and desire directing a person to perform a specific activity (Brown, 2001).

In line with this definitions, Kreps (1990) classifies motivation as intrinsic motivation, that an individual has for the enjoyment of an activity and extrinsic motivation that an individual has for an activity due to a reward received for performing the activity. Intrinsic motivation is an individual's inner personal fulfillment bound up with a sense of the inner life, the self and the quest for fulfillment and purpose (Manuel & Hughes, 2006, p.6) such as interest in teaching activity, interest in using their subject matter, enjoy the subject they will teach, job factor/fit, inspired by role models, and opportunities for my academic development.

Extrinsic motivation on the other hand cover aspects of the job which are not inherent in the work itself (Chuene et al.1999; Kyriacou & Coulthard, 2000). There are many extrinsic reasons which can attract people in becoming a teacher, such as financial reasons/salary, long holidays, time for family, teaching as a stepping stone, a social status, job security and have no other choice. In Ghana it is undoubtedly fact that some teachers are in teaching because they have no choice.

Another school of thought had the third classification of motivation in teaching, according to Moran et al. (2001) and Low et al. (2011), imply teachers going beyond any tangible benefits that the teaching profession have to offer. Those are also associated with the view that teaching is an important profession contributing to the betterment of society (Uwin, 1990; Young, 1995; Lin, Shi, Wang, Zhang, & Hui, 2012). In essence, altruism has to do with selflessness, self-sacrifice, generosity and the like. People who choose altruistic reasons in influencing them in choosing teacher education program absolutely have a deep passion for teaching and see teaching as a socially worthwhile and important job, such as love to work with children, desire to help children succeed, shape future of children, enhance social equity, a desire to contribute to society, a socially worthwhile job, to fulfill a mission, and to answer a calling (Muazza, Mukminin, Aina, Rosmiati, & Aryanti, 2017).

Therefore, teacher"s motivation is not only about the motivation to teach but also about the motivation to be a teacher as a lifelong career. Motivation is thought to be responsible for "why people decide to do something, how long they are willing to sustain the activity and how hard they are going to pursue it" (Dörnyei, 2001).

However, Csikszentmihalyi (1990) has proposed that individuals reach a state of happiness and satisfaction when they are involved in an activity and are functioning at the peak of their abilities. In this situation the individual experiences "high levels of concentration, interest, strength, and control"; students seem to recognize the effectiveness of teachers who are satisfied with their teaching performance. Rothman (1981) suggests that, this association exists because teachers serve as more than just educators; they are role models. Teacher's motivation and interest in the teaching job has a part to play on students" academic achievement. This therefore suggest that government and all that matter in education have a responsibility to make sure that

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teachers" interest and motivational level is improved. On the other hand, Teven (2001) argues that a vital requisite to effective teaching is establishing a climate of warmth, understanding, and caring within the classroom. Due to the nature of classroom instruction, length of time spent with students, issues of cultural and cognitive diversity, it is essential that teachers develop a caring atmosphere in which to work with their students. Students who feel that teachers care for them tend to achieve academically. If a teacher is not interested in his teaching profession, it means that he is not intrinsically motivated, thus he will not be eager to motivate his students to learn. Hence it will lead to poor internal and external examination performance.

- **Teachers' Commitment and Dedication to Student Learning**

Those who feel the call to teach, who sense teaching is a profoundly meaningful part of their life, have a passion for teaching (Garrison, Liston, 2004, p.1). Passion simply is defined as: "a strong inclination or desire towards an activity that one likes and finds important and in which one invests time and energy" (Carbonneau, Vallerand, Fernet, & Guay, 2008, p.977). Fried (2001) defines a passionate teacher as: "someone in love with a field of knowledge, deeply stirred by issues and ideas that change our world, drawn to the dilemmas and potentials of the young people who come into class every day" (p.44). For a high quality student learning and ultimately good performance passion is indispensable. According to (Olson, 2003, p.305) states that "when we discover and explore our passions about teaching and learning, and begin to share them with others, doors are opened, and the possibilities are endless". One of the most important factors in the development of passion for teaching is teachers" ongoing commitment and dedication to students and learning. Passionate teachers are aggressively devoted to their work and greatly inspire their students. "The strength of any profession depends upon the degree of commitment of its members. Teaching is

no exception" (Fox, 1964, p.18). It is widely accepted that a distinguishing feature that teachers have, is their dedication and commitment to the development of student academic achievement. According to (Kushman,1992; Rosenholtz,1989) in their studies put forward the relationship between teacher commitment and student achievement. Fried (2001) supporting this idea states that there is a strong connection between passionate teaching and the quality of student learning and ultimately students" performance. Apart from teachers" motivation in enhancing students" performance in mathematics, teachers" attitude plays a significant role in the students" academic achievement.

- **Teachers' attitude and academic performance**

Davis and Wilmot **(**as cited in Karp, 1991) found that teachers who have positive attitudes usually employ strategies which makes the learners independent whereas teachers who have negative attitudes usually employ strategies which makes learners more dependent. (Relich, Way, & Martin,1994), for instance, argue that teachers" attitudes towards mathematics influence pupils" attitudes towards mathematics and their mathematics learning. Ernest (1988) for instance found in his study involving a group of primary school teacher trainees on practice teaching that those who were being trained as mathematics specialist tend to have more positive attitudes toward mathematics and its teaching than those with low levels of knowledge in mathematics. This suggest that teachers" attitude towards mathematics depend on their content knowledge level and professional training of mathematics.

Interest is defined as a state of curiosity or concern about or attention to something (Farlex, 2014). This definition, when view in a classroom perspective it could be described as involving some kind of preference for a school subject or for activities related to that subject.

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There is a considerable research base to support a strong correlation between the degrees of student interest among others. For instance, Cziksentmihalyi *et al*. (1993) study on student interest and choice found that students who are engaged in work that interested them were overwhelmingly abler to see connections between their present work in school and their future academic or career goals. These connections form the foundation of commitment to future learning and foster self-directedness. These findings are in agreement with Glasser (1988), who advocates that students who are interested in what they are learning are motivated to pursue learning experiences of ever-increasing complexity and difficulty.

According to (Mereku, 2007) students with positive attitudes towards science and mathematics had higher mean science and mathematics achievement scores. However, student learning cannot be detached from how the teacher is facilitating learning since the teacher bridges the student interest and classroom learning. According to Eggen and Kauchak (2001), positive teachers" attitudes are fundamental to effective teaching. A teacher must have interest in his/her learners. He/she must manipulate (how do you manipulate your students) his/her students into such a state of interest in what he/she is going to teach them. Hence, other objects of attention get banished from their minds.

Students may be interested in learning mathematics subjects but all in all there must be school inspection to monitor teaching process. Hence, school inspection is necessary in order to ensure quality assurance of what is taught in schools. All in all, students interest in learning a subject should be composed with school inspection to see whether students are taught the right syllabus of the subject which will lead to good or higher West African Senior School Certificate examination performance.

2.5.2 Student characteristics

- **Students' attitude and academic performance**

Attitude like most abstract terms in English language has more than one meaning. Attitude lacks a precise definition. However, some few writers have simplified the definition and meaning of attitude. According to Zanna and Rempel (1988), attitude is a disposition to respond favourably or unfavourably toward some person, thing, event, place, idea or situation. Attitudes are the thoughts and feelings that motivate someone to act as though he likes or dislikes something or somebody. Eshun (2004) defines attitudes as a mental and neutral state of readiness organised through experiences exerting a directive or dynamic influence upon the individual response to all objects and situations with which it is related. It can be inferred from the above definitions that attitudes are learnt from diverse situations. For instance, one can internalise the attitudes of those among whom he lives and from other public sources and institutions such as the mass media and education. Students" attitude on academic performance is therefore describe as a disposition to respond favourably or unfavourably toward academic discipline. According to (Mereku, 2007) Students with positive attitudes towards science and mathematics had higher mean science and mathematics achievement scores. McNeal Jr. (2014) in some forms of parent involvement, particularly parent-child discussion, have a far greater effect on student attitudes, behaviours, and achievement than do others. All the definitions suggest that attitudes are learnt and can be changed. The fact that attitudes are learnt and are capable of being changed is a major significance for studying them.

Most cognitive theorists and researchers have acknowledged that poor academic self-concept, low self-esteem, negative attitudes toward study, or erroneous perceptions of students may be associated with poor academic performance (van der Veer &

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Valsiner, 1991). In another study by Syed Tahir Hijaz and Raza Naqri (2006), they found that attitude towards study has a significant influence on examination performance and thus confirmed the earlier findings by van der Veer and Valsinere (1991).

Engagement in learning - There is substantial evidence that engagement in medical school or college is important in promoting student success and learning and that a number of factors in the college environment foster high levels of engagement. Student engagement can be defined as the level of participation and intrinsic interest that a student shows in college (Newmann, 1992). Engagement in college involves both behaviours (such as persistence, effort, attention) and attitudes (such as motivation, positive learning values, interest, and pride in success) (Connell & Wellborn, 1991). Connell and Wellborn indicates that engaged students seek out activities, inside and outside the classroom, that lead to success and this has been supported by Dowson and McInerney (2001). It has been showed that the engaged students learn more, retain more, and enjoy learning activities more than students who are not engaged and they are the most successful (Kirsch et al, 2002). Many school-level studies have identified higher levels of student engagement as important predictors of scores on the students' academic performance. Therefore, it can be concluded that the more the student engaged in learning the more successful they will be in their academic.

Student attitude toward class attendance and academic performance - Class attendance is believed to have positive relationship with students' academic performance. It was expected that high absentees from the class would have a negative effect on the student's academic grades and would decrease their examination scores and grades.

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Many researchers recognized that class attendance is an important aspect in improving student's performance. A study conducted by (Collett et al., 2007; Stanca, 2006; Chow, 2003; Rodgers, 2001), found that attendance have small, but statistically significant, effect on student performance. Marburger (2001) concluded that students who missed class were significantly more likely to respond incorrectly to questions relating to material covered that day than students who were present. Moore (2006) indicated that class attendance enhances learning; on average, students who came to the most classes made the highest grades, despite the fact that they received no points for coming to class. Arulampalam et al. (2007) found that there is a causal effect of absence on performance for students: missing class leads to poorer performance. On the other hand, Martins and Walker (2006) mentioned that there are no significant effects from class attendance. This is also supported by Park and Kerr (1990) and Schmidt (1993) who found an inverse relationship between students' attendance and their course grades. According to (Chen & Lin, 2008), in their study "Class attendance and examination performance: A randomized experiment", found that class attendance has produced a positive and significant impact on students' examination performance. Their study result revealed that, on average, attending lecture corresponds to a 7.66% improvement in examination performance. Most universities have taken into serious consideration regard percentage of class attendance and therefore imposed a policy of barring the student from examination when the percentage of the attendance is less than 80%.

- **Students' Interest in learning mathematics.**

One of the common goals of every mathematics teacher at the senior high school is that students should understand and learn mathematics and ultimately pass well on any assessment in mathematics. Various factors are involved in shaping the

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understanding and learning of mathematics. One of the prerequisites for understanding mathematics is students" interest in learning mathematics and the desire of students to pass it. The concepts students hold about Mathematics determine how they approach the subject (Churcher, Asiedu-Owuba, & Adjabui, 2015). Interest is a stimulus that increases the activity power. For active learning, students should be interested in the subject they are learning and students may resort to it in order to understand the materials and apply them. However study by Hogan (1977) reported that teachers should be made aware of the differential interest value of various mathematical topics. He added nearly twice as many students like some topics better than others. Therefore, it is necessary to further examine the factors involved in making students interested in learning mathematics so that no one hear such phrases as "Almighty maths! Wow! The boring math class! Difficult and confuse maths! By the way, why should these students often lose interest and may be forced to put up a maths class? Various researches and investigations have been conduction to probe the factors contributing to increase in interest of elementary students in various cities. Few researches have paid attention to these contributing factors in higher levels. Besides, the weakness in mathematics is more vivid in the end of second grade of high school and the start of third grade of high school. Regarding the present article, the viewpoint of math teachers at various levels are collected in terms of factors affecting the level of interest of students including family, school environment, peers, first grade teacher at all educational levels, size and appearance of math books (adding some subject as math puzzles in a textbook), the previous math teachers" behaviors, doing activity in math class, conducting research in the field of mathematical themes and finding the appellation of mathematical titles, studying the history of mathematics, separation of educational classroom of mathematics from the

main classroom (which is decorated with crafts created by students themselves, prior presentation of some concrete applications of mathematical themes in real life. Then, the level and depth of this impact will be gauged so that some strategies are provided for the designers and writers of textbooks as well as parents and educators. Regarding this, students are encouraged to study math more eagerly and, in this way, achieve progress in the other sciences because mathematics is a prerequisite to other sciences.

2.5.3 School-Related Factors that Influence Students' Academic Performance

Researchers have been interested for a long time in the school environment influence on students" motivation and learning and ultimately students" performance. The general consensus has been that environments characterized by mutual respect, high standards, and a caring attitude are more conducive to student persistence to other environment. Awanta (2000) said that influence in the classroom does not always flow from the teacher. He affirms that students do influence each other and can even influence the behaviour of their teachers. He indicates that according to research carried out by Newcomb (as cited in Awanta, 2000), many students confirm to peer group norms some of which are in contradiction to those held by educators and teachers. Students do influence the behaviour of their teacher. He says, behaviour in classroom is bi-directional, that is, behaviour of participants are influenced not only by what the teacher does, but also what students do. Copeland further states that where there is an enabling environment, where students have a positive perception for themselves and their peers and where they have satisfaction for their individual needs, they persist in academic tasks and work cooperatively with the teachers to meet the demands of classroom life. The way teachers handle their classes are important factors that influence the way classes develop norms which they establish for social and academic work. This, he sees, as important function of teachers. Providing

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leadership is a critical executive function performed by teachers. Educators are very much concerned with the workings and influence of the peer group and associated characteristics of students" culture within the school. They end with an appeal to teachers to take into account the fact that peer relationships have a strong influence on what occurs in the school and the classroom. The performance of students is invariably affected by the attitude put up by teachers and their peers. They admitted that students are affected positively or negatively depending on whether they are favourable or unfavourable perceived by their teachers and peers. They conclude that high rate of success is achieved if classrooms are well-managed and students are given enough engaged time. This depends on the ability of the teacher to manage the classroom as an effective learning environment when transitions are orderly and brief. A conducive academic environment, they say, motivates students to attain high level of achievement. On the other hand, if the environment is not challenging enough, any individual within the community will have a low level of achievement and motivation. They talked about socially harmful environmental influences that run counter to school and societal norms. In such a case, he advices heads of schools and educational officers to work with parents to consider all the environmental factors that affect children in the community and find appropriate solutions to them. Agu and Hamad (2000) are also of the view that parental expectations among others have a great influence on the academic performance of boys and girls. They also state that quite a number of studies have proved that teachers" expectation of students" academic performance has a strong influence of the actual performance of the students.

- **Physical Resources and Academic Performance**

Various studies done on effect of school environment on academic performance attest to the fact that school environment that is not conducive for learning may lead to under performance (Chimombe, 2011). Provision of adequate learning facilities at all levels including equipment and human resources enhances the quality and relevance of imparted skills of learners (Lumuli, 2009). Learning involves interaction of students with the environment. Teaching and learning resources include classrooms, laboratories, libraries, playing fields, textbooks among others. Indeed, physical resources go a long way in creating conducive environment that promote effective teaching and learning. It is with this in mind that the Ministry of Education, Education sector performance report (2015) in Ghana identifies textbook ratio and school facilities as some yard sticks to be used to gauge the quality of senior high school education. Juma (2011) links performance in examinations to state of teaching and learning resources in schools. He notes that students from poor backgrounds perform poorly in the examinations because the poor are often in areas where schools are seriously deprived of vital facilities, an attitude of helplessness may be inculcated early into children making them feel that being in school is a waste of time. His assertion was supported by (Akaboha & Kwofie, 2016), the better the BECE grade in Mathematics the better the performance in the WASSCE.

Physical materials in terms of adequacy and quality have been noted to have a great impact on performance of students in the examination (Husen, Saha, & Noonan, 1978). A school that has adequate instructional materials is likely to post better quality grades than a school which has poor quality physical resources. A school with inadequate classrooms will be forced to accommodate more students than recommended. This will exert a lot of pressure on resources such as teachers who may

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compromise their methodology as part of adaptive mechanism (Nafukho, 1991; Pscharapolous & Woodhall, 1985). The lack of basic facilities like laboratories has compromised the teaching of science subjects. Topics that are meant to be taught practically are taught theoretically as part of adaptive mechanism by teachers due to inadequate resources to enable effective teaching of the same. This ends up affecting negatively students" performance reducing their competitiveness for opportunities whose placement is pegged on performance in such subjects (Mayama 2012; Lumuli, 2009). This study proposes to establish the state of physical facilities in public senior high schools in the northern region in order to evaluate how it is impacting on academic performance of learners.

2.6 School Administration and Academic Performance

The study of Sushila (2004) on the role of head teachers in schools" asserts that, the head teachers plays a significant role in school administration and that the performance of the school depends on administration style of the head teacher. The study further found that, the head teacher is the decision maker and a think tank of the school. Leadership style thus describes the common emphasis a leader places on performance and expected behaviour of the followers at a working environment (Warrick, 1981). Head teachers are the immediate caretakers of both the material (school facilities) and human resources (teachers and students) of the schools. The head teachers who employ teamwork as a working strategy is bound to obtain a high academic achievement. It is therefore realized that, the performance of a school is appraised against the performance of the head teacher. It is in this context that Ndunda (2004) remarked that students" performance depends on the head teacher of the school since they are the focal system of a school through which all important functions rests and are therefore the controller of all resources that may influence

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students" performance in a school. A study by Nannyonjo (2007) on analysis of factor influencing learning achievement in Public Secondary Schools in Uganda found out that school performance is influenced by head teachers" characteristics such as; qualification, in – service training, age, experience and tenure of service in the school. The study further revealed that good supervision strategy and administration styles were other significant factors influencing learning achievements" in Kenya Certificate of Secondary of Education (KCSE) examination. The finding of this study concurs with the findings of another study by Sushila (2004) as cited in (Mpaata & Mpaata, 2019) on the role of head teacher in influencing school performance in Kuria District. According to the study a good school administrator should have adequate professional training and administrative experience. The study found that Academic performance of students" in KCSE is largely affected by the availability of teachers, lack of teachers affect students" performance hence, teaching force is assumed to be a factor that affect students" performances in Kenya Certificate of Secondary Education (KCSE) examinations. In his thesis about attitudes of secondary schools" headmasters. He defines the term attitude as an organized predisposition to think, feel, perceive and behave toward a referent or cognitive object. He further says that it is a learned predisposition to respond in a consistently favourable or unfavourable manner with respect to a given object While individual factors clearly contribute to students" participation in governance, individual attitudes and behaviours may be shaped by various settings or context in which student"s lives. This perspective is important because there are some factors which are beyond head teacher"s attitudes. Example smaller schools may allow a teacher to participate more with students. This is structural characteristics which may accounts for the differences in the approach of leadership of the head teachers. The third type of differences in leadership

characteristics concerns school resources. Resources in particular students-teacher"s ratios and teacher quality appear to influence the level of participative governance even after controlling head teacher"s personal characteristics. These schools" factors contribute significantly to head teacher approach of governance; one way is indirectly by creating conditions that influence student engagement. Another way is directly through explicit policies and conscious decisions by school personnel that cause the students to volunteer to participate in decision making because of the prevailing school climate.

- **Supervision**

According to Fullan (2002), supervision is an attempt through second party intervention to ascertain, maintain and improve the quality of work done in schools. For most endowed schools" supervision is carry out at all levels (student level, teacher level, head teacher level, etc) to ensure effective teaching and learning and efficient use of instructional period for good performance. This means every subject teacher including mathematics teachers must be supervised within a certain period in a day, week, mouth or year, but this is not happening as planned by the policy makers. Again both the heads of institution and the teachers and all that matters in an institution are to be supervised or inspected within a term but the inspectorates both the region and national are facing a lot of challenges including financial constraints and reliable means of transport which hinder implementation of inspection in schools. Etsey, Amedahe and Edjah in their study of academic performance among public and private schools in Central Region of Ghana found that the academic performance in basic schools was better in private schools than public schools because of more effective internal supervision (Etsey, Amedahe and Edjah, 2005).

A trend similar to the findings were revealed in Sengerema"s study (2004) which found that ineffective school inspection contributed to poor student performance. Cotton (2003) identified some responsibilities and leadership styles of head teachers that contribute to the successful academic achievements of students. Among some of the responsibilities are discipline, flexibility, input and above all monitoring and evaluation.

It is generally argued that school inspection lead to school improvement including student learning outcome (Whitby, Mikhalovsky, & Gun"ko, 2010; OFSTED, 2007). According to Faro (1996), school inspectors play a pivotal role in teacher development. Fullan (2002) adds that teachers need regular support from colleagues and managers to ensure progressive and effective performance. Also Nyaki (2006) maintains that, the effectiveness of the school inspection is largely determined by the higher frequency, the nature of advice and recommendations given to those who are inspected. Ehren and Honingh (2011) reveals that teachers" perception on those inspected schools had implemented more changes in terms of quality improvement. Further, Wolf *et al*. (2009) found that student scores increased where schools were inspected and concluded that school inspection lead to slightly better school performance. Most schools had to rely on their internal supervision mechanism only. This system of inspection is similar to Peer inspection/ School Site Supervision where colleagues of the same school and same grade could open classroom doors for contact among themselves. This system enables teachers to report to their colleagues as their first source of professional help/support when school inspectors help is not available (UNESCO, 2001) as cited in Barrington (2004).

- **Student-Teacher Ratio**

Student-teacher ratio is the total number of students per teacher at a specific level of education in a given school-year (Ministry of Education, 2016). The higher the student-teacher ratio, the lower is the relative access of students to teachers. It is generally assumed that a low student-teacher ratio signifies smaller classes, which enables the teacher to pay more attention to individual students, which may in the long run result in a better performance of the student. According to the Ministry of Education Education sector performance report (2012), the regional distribution of student-teacher ratio in the senior high schools shows that the Northern region exhibits the highest student/teacher ratio of 30 students per a teacher while the Central region has the lowest figure of twenty (20) students per a teacher. Similar report on regional distribution of student-teacher ratio in the senior high schools in 2013, shows that the Northern region again exhibits the highest student/teacher ratio of 29 students per a teacher while the Volta region has the lowest figure of nineteen (19) students per a teacher though the Northern region has experience a decline in student-teacher ratio however it is still the highest in the country.

- **Student-Classroom Ratio**

According to (Ministry of Education R. o., 2011) Student-Classroom Ratio is the total number of students per classroom for a specific grade or level of education in a given school-year.

The report on Education sector performance by the Ministry of Education, (2012), revealed that student-classroom ratio in senior high schools, is higher in the Northern region as compare to other region in Ghana with a ratio figure of 58.9 while the Central region is the lowest with its ratio figure of 39. Further report on Education sector performance by the Ministry of Education, (2013), shows that the Northern

region student-classroom ratio increase to 61 students per class whilst the central region continues to be the lowest with student-classroom ratio of 38.6 The reports indicated that while the Central region student-classroom ratio experience a slide reduction from 39.0 to 38.6 accounting for 1% reduction, the Northern region students-classroom ratio experience a significant increase from 58.9 to 61.0 accounting for 3.6% increased. However, according to Ministry of Education (2011) the higher the student-classroom ratio, the lower is the relative access of students to proper facilities needed for quality teaching and learning. This suggest that the high student-classroom ratio in the Northern region may reasonably contribute for students" poor performance especially in mathematics in their West African Senior School Certificate Examination.

Similarly, further reports by the Ministry of Education, Education sector performance report (2015), the regional distribution of student-classroom ratio in senior high schools by the ministry of education, reveal that the northern region still has the highest student-classroom ratio of 53.2 this time round with a significant percentage drop while the Volta region has surprisely overtook the Central region with student-classroom ratio with the lowest figure of 33.7. This indicated that a class which by GES standard supposed to contain 30-35 students at a time now accommodate 53 students with same resources. These facts may be considerably significant for students" abysmal performance especially in mathematics.

- **Textbook**

According to Ministry of Education (2011) Report on Basic Statistics and planning parameters for senior high schools in Ghana, textbooks are defined as learning materials designated by the Ministry as covering the knowledge that is stipulated in a formal curriculum programme for a specific grade or level of education. They are

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widely accepted to facilitate the teaching and learning process, this therefore implies that the higher the student-textbook ratio, the greater is the relative access of students to appropriate learning materials needed for quality teaching and learning and this may adversely affect student performance. Bregman and Bryner (2003) argue that secondary school effectiveness is largely determined by its quality and relevance which include sufficient supplies of teaching and learning resources, up to date students" textbooks and supplementary books. According to Anamuah-Mensah and Mereku (2005), without good textbooks students will have little opportunity to engage in activities that will enable them to use concepts, solve problems and reason mathematically. Available literature on substantial research evidence shows that textbooks are one of the most important inputs that have a demonstrable impact on student learning and that the two most consistent characteristics in improving student performance include the availability of textbooks and supplementary books.

According to the Ministry of Education, Education sector performance report (2015), the regional distribution of number of mathematics textbooks per student in senior high schools by the ministry of education, shows that the central region has the highest number of mathematics textbooks per student available in senior high schools accounting for 0.76% whilst the northern region has the lowers ratio accounting for 0.30%. The report indicates that only 30 students out of every 100 students who have their own mathematics textbooks in the northern region while their colleagues in central region 76 students out of every 100 have their own mathematics textbooks.

2.7 Studies with Direct Bearing on Mathematics performance in Ghana

Students" abysmal performance in mathematics in Ghana at West African Senior School Certificate Examinations has not been widely researched. However, few descriptive case studies are available (Awanta, 2009; Akayuure, Nabie, & Sofo, 2013).

2.8 Summary of Literature Review

Various studies done on effect of school-based factors on academic performance attest to the fact that school environment that is not conducive for learning may lead to under performance (Chimombe, 2011). Financial resource is a key element among educational resources. Financial resources are used for acquisition of other resource such as physical facilities, textbooks and human resources (Lumuli, 2009). These studies did not include all the school-based factors like learning techniques and so this study researched on school plant factors.

The study was guided by Skinner"s (2007) motivation theory of learning. According to this theory, humans are motivated to learn through selective reinforcement of progressively more adequate approximation of the desired behaviour (achievement) and extinction of inadequate behaviour).

Skinners" motivation theory is found to be appropriate for this study because it is envisaged that students" high or poor performance will depend on teacher, student and school characteristics. It relates various inputs affecting a student"s learning like pupil-teacher ratio, instructional materials, physical facilities such as library, laboratory, and computer lab among others that affect the quality of education.

The conceptual framework hereunder presents variables that influence teaching and learning of mathematics subject. The study will be an attempt to investigate the possible relationships between student characteristics, teacher characteristics,

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teaching, learning resources factors and Environmental factors influence students"

poor performance in internal and external [West African Senior School Certificate

Examinations (WASSCE)].

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter addressed research design, population and sample, instrumentation, data collection procedure and statistical analysis procedure.

3.1 Research Design

The research design adopted for this study is descriptive survey. Survey according to Olaewe (2016) is a situation whereby a sample population is studied in detail so as to generalize the outcome on the entire population. This attribute is related to this study and hence, its adoption.

3.2 Population and sample

The target population for this study comprised all Senior High School Students in form three in the Tamale Metropolis, Northern Region of Ghana. However, because of time and cost implications, the sample is limited to four Senior High Schools in the Tamale Metropolis, Northern Region of Ghana to represent the whole. They are as followed;

    i.   Tamale Senior High School (TAMASCO)

    ii.   Ghana Senior High School (GHANACO)

    iii. Business Senior High School (BUSICO)

    iv.   Kalpoheni Senior High School (KALISCO)

The schools are randomly selected. According to Saravannel (1991), a sample consists of "a fraction or part of the total number of elements or units in a defined population." As cited in (Lukhele, 2007) a sample is derived from the population. For this study, the sample size was 372, comprising 338 students from four Senior High

schools, 30 mathematics teachers and 4 heads from the SHS selected. Probability sampling was used for this study and under this method; the cluster sampling technique was used to divide the schools into multiple groups after which the simple random sampling was used to select participants for the survey.

Again, for the binary logistic regression analysis the sample simple size (n) was calculated using the formula (Peduzzi, Concato, Kemper, Holford, & Feinstein, 1996), below.

$$\boldsymbol{n} = \frac{\boldsymbol{10k}}{\boldsymbol{p}} = \frac{\boldsymbol{10 \times 6}}{\boldsymbol{0.5}} = 120$$

Where k is the number of covariate = 6 and p is the smallest proportion of the population negative response = 0.5. sample size of 120 was enough according to Pampel, (2000) and Long (1997) recommended sample size for logistic regression analysis as not to be less than 100 otherwise the results may be misleading. Since in this case the sample size for the study is 338 far greater than 100. It therefore expects non-misleading result.
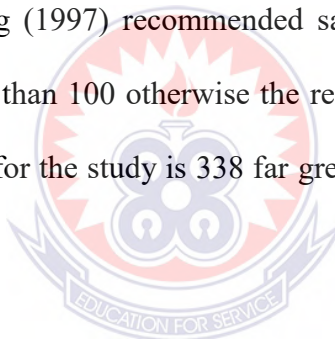
3.3 Research Instrument

Five research instruments which are adopted and modified by the researcher was used to collect the data. They are;

  i.   Mathematics Student Questionnaire

 ii.   Mathematics Teacher Questionnaire

iii.   Head of Institutions Questionnaire

 iv.   Mathematics Achievement Test and

  v.   Interview Schedule

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3.3.1 Mathematics Student Questionnaire (MSQ)

Mathematics Student questionnaire is a 25-item instrument. Various questions aimed at investigating and gathering information from the students about their feelings on mathematics, mathematics teacher, teaching and learning of mathematics are generated.

The instrument is divided into sections A and B. Section A is on biographical information of the respondent while section B contained relevant questions on the subject teaching and evaluation.

3.3.2 Reliability of the Instrument

The instrument after construction was trial-tested on another parallel sample outside the study area using test-retest method of reliability. Reliability coefficient (r) of 0.86 was obtained. An indication that the instrument was strongly reliable to be used for the study.

The study used Cronbach's coefficient alpha to compute for reliability. The coefficient alpha is the average inter-item correlation of all items constituting a scale perhaps representing the best estimate of full scale reliability. The reliability coefficients vary between values of 0.00 and 1.00. The closer the value approaches +1.0 the more consistent a test is and the freer of error of variance. The reliability coefficient was 0.86 for the present study.

3.3.3 Mathematics Teachers Questionnaires (MTQ)

The instrument is a twenty-five (25) item. It is divided into two sections A and B. Section A elicits biographical information while section B elicits information on various factors influencing students' academic achievement in mathematics.

3.3.4   Reliability of the Instruments

The instrument after construction was trial-tested on another parallel population from other district using test-retest method of reliability. After about three weeks the same instrument was trial-tested again on the same population. A reliability coefficient (r) of 0.82 was obtained. Significant that the instrument is reliable and adequate to be used for the data collection.

The study used Cronbach's coefficient alpha to compute for reliability. The coefficient alpha is the average inter-item correlation of all items constituting a scale perhaps representing the best estimate of full scale reliability. The reliability coefficients vary between values of 0.00 and 1.00. The closer the value approaches +1.0 the more consistent a test is and the freer of error of variance. The reliability coefficient was 0.82 for the present study.

3.3.5   Head of Institutions Questionnaires (HIQ)

The instrument is a twenty-two (22) item. It is divided into two sections A and B. Section A elicits biographical information while section B elicits information on various factors influencing teaching and learning of mathematics.

3.3.6   Reliability of the Instruments

The instrument after construction was trial-tested on another parallel population from other district using test-retest method of reliability. After about three weeks the same instrument was trial-tested again on the same population. A reliability coefficient (r) of 0.74 was obtained. Significant that the instrument is reliable and adequate to collect data for the study.

The study used test-retest reliability. After obtain reliability coefficient, split - half method was used to calculate the reliability coefficient of the instrument. The correlation of 0.74 was obtained. Indicating that the instrument was reliable.

3.3.7 Mathematics Achievement Test (MAT)

The instrument is a fifty (50) items objective questions. It aimed at elicits information on the level of students" academic achievement in mathematics.

3.3.8 Reliability of the Instrument

The instrument after construction was trial-tested on another parallel population from other district using test-retest method of reliability. After about three weeks the same instrument was trial-tested again on the same population. A reliability coefficient (r) of 0.88 was obtained. Significant that the instrument is reliable and adequate to collect data for the study.

The study used Cronbach"s coefficient alpha to compute for reliability. The coefficient alpha is the average inter-item correlation of all items constituting a scale perhaps representing the best estimate of full scale reliability. The reliability coefficients vary between values of 0.00 and 1.00. The closer the value approaches +1.0 the more consistent a test is and the freer of error of variance. The reliability coefficient was 0.88 for the present study.

3.3.9 Validity of the Instrument

According to (Herman & Choi, 2012) Validity refers to the degree to which an assessment actually measures what it claims to measure and well serves intended purposes. Based on this perspective, research questionnaire themselves are not valid

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rather evidence of validity must be established in the context of specific interpretations and uses of responses from the sampled size.

3.4 Data Collection Procedure

The researcher was first seek for a permission from the district directors before proceeding to visit the selected schools. Introductory letter was presented to the heads of institutions from the head of department of the researcher convincing them the authenticity of the research. Anonymity and confidentiality of information given by each head of institution was assured. Head of institution in the districts. After the consent of head of institution, the researcher personally with the assistance of some teachers on duties in each school, administer the questionnaires to respondents after normal classes" hours. The instrument was collected back almost immediately to ensure hundred percent return.

3.5 Statistical Analysis Procedures

The data collected from the field was subjected to statistical rigorous such as measure of central tendency and measure of variability example, mean, mode, median, standard deviation, percentage spread.

The main statistical methods used to answer the research questions are descriptive statistics, binary logistics multiple regression and one-way analysis of variance (ANOVA).

3.5.1 Logistic Regression (Logit Regression)

The crucial limitation of linear regression is that it cannot deal with dependent variables that are dichotomous and categorical. A range of regression techniques have been developed for analyzing data with categorical dependent variables, including logistic regression (Logit regression) and discriminant analysis (DA). Logit regression

is regularly used rather than discriminant analysis when there are only two categories of the dependent variable. Since the dependent variable is dichotomous, we cannot predict a numerical value for it using normal regression, so the usual regression least squares deviations criteria for best fit approach of minimizing error around the line of best fit is inappropriate. Instead, logistic regression employs binomial probability theory in which there are only two values to predict: that probability (p) is 1 rather than 0. Logistic regression forms a best fitting equation or function using the maximum likelihood method, which maximizes the probability of classifying the observed data into the appropriate category given the regression coefficients. (Pampel, 2000; Rodrigues, 2007).

3.5.2. Assumptions of Logistic Regression

i.   Logistic regression does not assume a linear relationship between the dependent and independent variables. The dependent variable must be categorical not necessarily dichotomous (2 categories).

ii.   The independent variable need not be interval, nor normally distributed, nor linearly related, nor of equal variance within each group.

iii. The categories (groups) must be mutually exclusive and exhaustive; a case can only be in one group and every case must be a member of one of the groups. (Rodrigues, 2007).

3.5.3 The Logit Model

Taking the logarithm of the odds gives the link function

$$\text{Log}\left(\frac{\gamma}{1-\gamma}\right) = \beta_1 + \beta_2 x \qquad\qquad (3.1)$$

The term $\log[(\gamma/1-\gamma)]$ is sometimes called the logit function and it has a natural interpretation as the logarithms of odds. The simple linear logistic model or logit

model $\log [(\gamma/ 1 - \gamma)] = \beta_1 + \beta_2{}^x$ is a special case of the general logistic regression model.

$$\text{logit } \gamma_i = \log \left(\frac{\gamma}{1-\gamma}\right) = X_i^T \beta \qquad (3.2)$$

Where X_i is a vector of continuous measurements corresponding to covariates and dummy variables corresponding to factor levels and β is the parameter vector. The model is very widely used for analyzing data involving binary or binomial responses and several explanatory variables.

3.5.4 Coefficients and Odds Ratios of Logit Model

The odds of an outcome being present among individuals with $x = 1$ is defined as $\gamma(1)/[1 - \gamma(1)]$. Similarly, the odds of an outcome present among individuals with $x = 0$ is defined as $\gamma(0)/[1 - \gamma(0)]$. The odds ratios denoted OR is defined as the ratio of the odds for $x = 1$ to the odds for $x = 0$ and is given by the equation.

$$\text{OR} = \frac{\gamma(1)/[1-\gamma(1)]}{\gamma(0)/[1-\gamma(0)]} \qquad (3.3)$$

$$\text{OR} = \frac{\exp(\beta_0 + \beta_1)}{\exp(\beta_0)}$$

$$= \exp[(\beta_0 + \beta_1) - \beta_0]$$

$$= \exp(\beta_1) \qquad (3.4)$$

Hence, the odds ratios are the exponential functions of the coefficients in the logit model. Maximum likelihood estimates of the Logit coefficient β, and consequently of the probabilities $\gamma_{i=g\ (X_i^T\beta)}$ are obtained by maximizing the log-likelihood function

$$\text{I}\,(\gamma; y) = \sum_{i=1}^{N}[y_i \log \gamma_i + (n_i - y_i) \log (1 - \gamma_i) + \log \binom{ni}{yi}] \qquad (3.5)$$
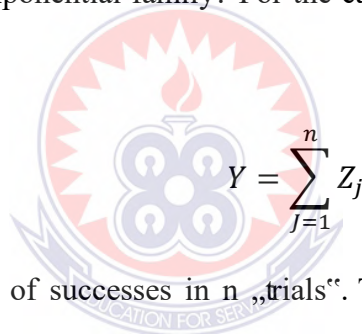
3.5.5 Binary Logistic Regression

Binary Logistic Regression is useful for situations in which one want to be able to predict the presence or absence of a characteristic or an outcome based on values of a

set of predictor variables. It is similar to a linear regression model but is suited to models where the dependent variable is dichotomous. Logistic coefficients can be used to estimate odds ratios for each of the dependent variables in the model. Logistic regression is applicable to a broader range of research situations than discriminant analysis.

In this study, the dependent variable is Performance (Pass or Fail). The independent variables are gender of respondents and age. The variables gender and age which are coded thereby making them dummy variables. The last code of each categorical variable is sacrificed to allow the calculation of the coefficients. However, these last codes are by default taken care of in model. The model is given below:

Which is a member of exponential family? For the case where the γ_j"s are equal, we define

$$Y = \sum_{J=1}^{n} Z_j$$

So that Y is the number of successes in n „trials". The random variable Y has the binomial (n,y) distribution with probability mass function;

$$\Pr(Y=y) = \binom{n}{y} \gamma^y (1 - \gamma)^{n-y} , \quad y = 0,1, \ldots, n \tag{3.6}$$

Writing the logistic regression in terms of odds for success is;

$$\text{Odds} = \frac{Pr(pass)}{1- \Pr(fail)} = \frac{\gamma}{1-\gamma} \tag{3.7}$$

$$= \exp(\beta_1 + \beta_2 x)$$

Therefore $\frac{\gamma}{1-\gamma} = \exp(\beta_1 + \beta_2 x) \tag{3.8}$

3.5.6 The Wald Test

The Wald test provides a test of significance for the coefficients (i.e. the $\beta's$) in the logistic regression. Using the Wald test, we calculate the Wald statistic, which is the square of this ratio,

$$W = \left(\frac{\beta_1}{S.E(\beta_1)}\right)^2$$

The standard errors are estimation by the MLE method.

If the null hypothesis states that $\beta_1 = 0$ is true, then this statistic has a chi-square distribution with „p" degrees of freedom. A p-value less than 0.05 indicate that the coefficient β is significant at 5% level in predicting the outcome variable. In most cases, likelihood ratio test and Wald test lead to the same conclusion. However, in some cases, the Wald test produces a test statistic that is not significant when the likelihood ratio test indicates that the variable should be kept in the model. This is because the estimated standard errors are too large and this happens when the absolute value of the coefficient becomes large so that the ratio (Wald statistic) becomes too small.

3.5.7. Hosmer and Lemeshow Test

The Hosmer and Lemeshow test is a statistical test for goodness of fit for logistic regression model. It is used frequently in risk prediction models. The test assesses whether or not the observed event rates match expected event rates in subgroups of the model population. The Hosmer and Lemeshow goodness of fit statistics $\hat{C}$ is obtained by calculating the Pearson Chi-square from 2 x 2 contingence table of observed and estimated expected frequency

The formula of $\hat{C}$ is given by

$$\hat{C} = \sum_{k=1}^{g} \frac{(O_k - n'_k \pi_k)^2}{n'_k \pi_k (1 - \pi_k)}$$

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Where n'_k is the total number of subjects in the kth group, C_k denote the number of covariate patterns in the kth deciles (Rodrigues, 2007).

CHAPTER FOUR

DATA ANALYSIS AND DISCUSSION

4.0 Overview

This chapter presents data analysis and discussions on the findings. The presentation was done based on arriving on answers for the research questions and achieving the research objectives. The purpose of the study was to investigate school-base factors that contribute to students" academic performance in core mathematics in Tamale Metropolis, in the Northern Region, Ghana. To attain this purpose, the analysis was conducted. A total of three hundred and seventy-two (students, teachers and head of institutions) were used for the study as respondents.

4.1 Questionnaire Return Rate

Respondents were given questionnaires which they filled and returned to the researcher. However, head of institutions and some mathematics teachers returned theirs later due to their busy schedule at the time of administering. The questionnaire return rate is as presented on Table 4.1.

Table 2: Respondents' Distribution base on returned rate

Respondents	Sample	Frequency	Percent (%)
Head of institutions	4	4	100
Mathematics teachers	30	29	96.7
Students	338	338	100

Table 2 Indicates that the response rate achieved for the three sets of questionnaires was 100% for Heads of institutions, 97% for mathematics teachers" questionnaire and 100% for Students questionnaires. From the individual set of questionnaire return rates indicated above shows that the overall returned rate was 99.7% indicating a very

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good return rate for this research. The average 90% return rate was considered adequate in providing valid and reliable presentation of the targeted population. The successful returned of the answered questionnaire was attributed to the fact that the researcher administered the questionnaires personally with the support of some masters on duty in each school.

4.2 Demographic Information of Respondents

The section included the respondent''s gender, age, academic qualification, teaching experience, area of specialization and size of school. This was necessary in order to understand our informants and ascertain whether they would be effective for the study.

4.2.1 Heads and Mathematics Teachers Demographic Information

Senior High School Heads and Mathematics teachers provided demographic information on their gender, academic qualification and teaching experience.

Table 3: Heads and mathematics Teachers Gender

	Headmaster		Teacher	
	Frequency	Percent	Frequency	Percent
Male	2	50	28	93
Female	2	50	2	7

Table 3 above shows that 93% of the sampled schools mathematics teachers were males, and 7% were females. This has indicated a very big gap between the male and female in the field of mathematics in northern region. This indicates gender parity in the distribution for the students. This is because the students were purposively sampled to have unequal gender representation due to simple random sample. However, for those that were not necessarily sampled by gender, the gender distribution shows significant differences such that the male teachers comprised 93%

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while the female teachers comprised of 7%. Regarding students, out of 338 students of 78.1% were male while 21.9% were female.

Table 4: Heads and Mathematics Teachers Qualifications

	PhD		M.Ed.		B.Ed.		B.SC		Diploma	
	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	(%)
Headmasters	0	0	1	25	3	75	0	0	0	0
Maths Teachers	0	0	0	0	17	57	11	36	2	7

Table 4 above shows that in of the sampled schools, 25% of the headmasters are Masters Holders whilst 75% are graduates. There are no other categories of education levels. This is clearly suggest that more of the heads are degree holders. The table also revealed that majority of mathematics teachers had a minimum academic qualification to teach in their respective schools. The findings indicate that students in the selected Districts in the Northern region of Ghana are taught by people with knowledge and skills which are instrumental in the management and teaching in the Senior High schools in Ghana by Ghana Education Service standard. However, we must underscore that there are still 2 teachers representing 7% who fall below the minimum academic qualification to teach in their respective Senior High Schools.

Table 5: Heads and Mathematics Teaching experience

No of years	1 - 5		6 - 10		11 - 15		16 - 20		21 - 25	
	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	(%)	Freq.	(%)
Headmasters	3	75	1	25	0	0	0	0	0	0
Maths Teachers	13	43	10	34	6	20	0	0	1	3

From table 5 above revealed that most (75%) of head of institutions have less experience for effective supervision and management of their schools since they have been head of institution not long enough to be innovative. Only one head of institution that had his headship experience between the age group of (6-10). The teachers on the other hand were some extend better than heads of institution in terms of their experiences, most teachers from the sampled schools (13) representing 43% had their teaching experience within the age group of (1-5) years, follow by those in the age group of (6-10) years, 10 representing 34%. The teaching experience age group of (21-25) years had only one person (1) representing 3% whilst no teacher had teaching experience age group of (16-20).

Figure 2: Headteacher and Teachers Teaching Experience
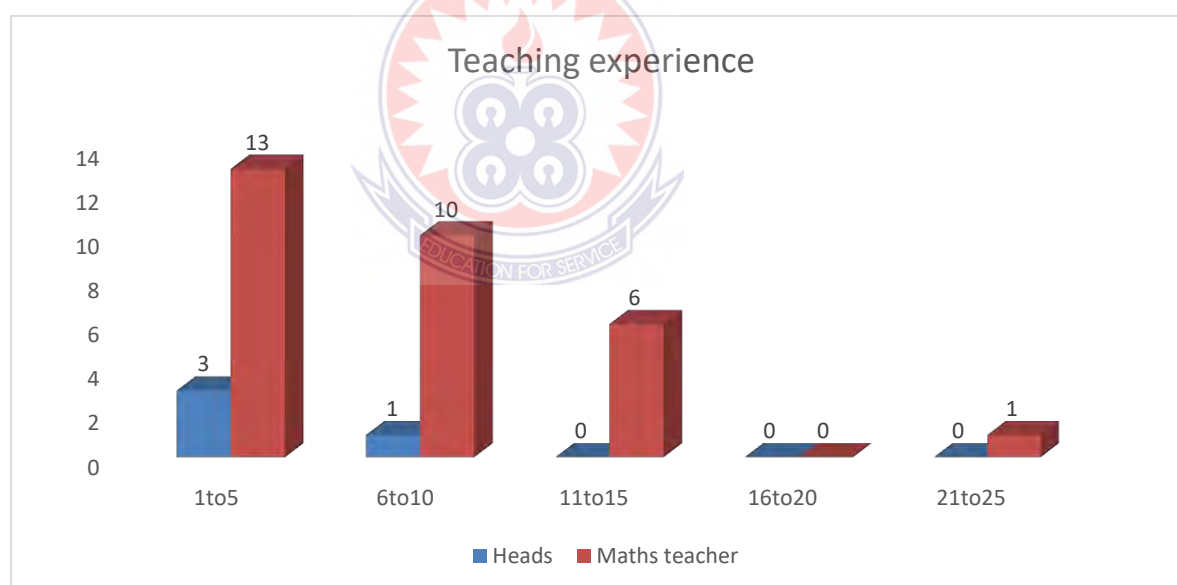
When respondents were asked about how long they have been teaching as professional in   Senior High School, 47% of the respondents said they have been at post between 1-5 years, 32.4% said they been teaching between 6-10 years and 17.6% indicated they have been teaching between 11-15 years. However, 2.9% of the teachers interviewed said they been at post 21 years and above (Figure 2). It can be

inferred that majority of the teachers at the sampled Districts Senior High Schools have less experience in the teaching profession and therefore can be said to have false authority over the subject area they teach.

Figure 3: Teachers teaching experience
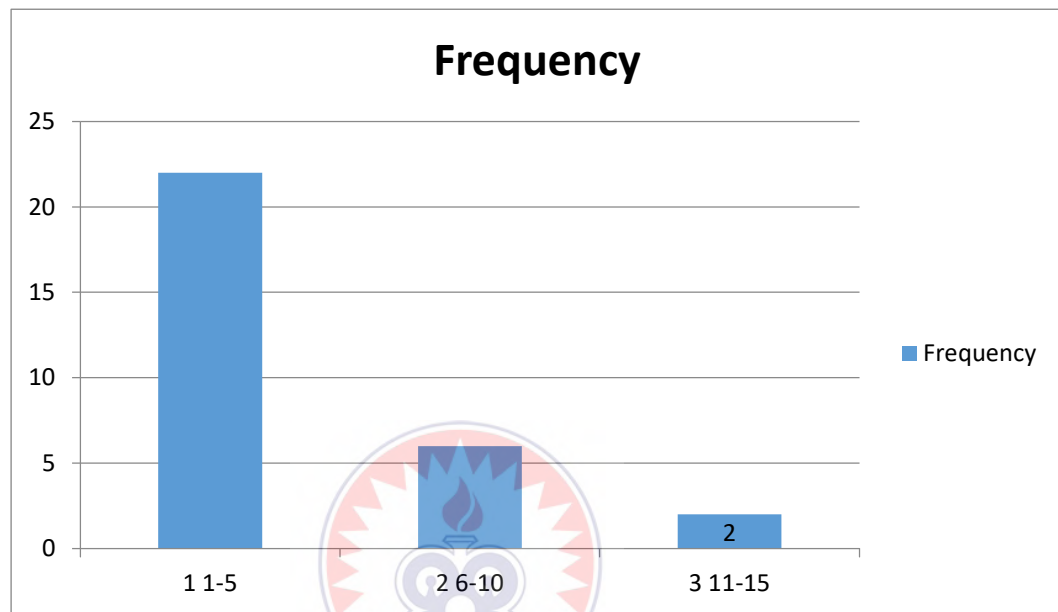
From the Figure 3 above, in the responses, the majority of teachers indicated that they had been teachers between 1-5 years and this category constituted 67% of the respondents. This group was followed by the category that served as teachers for 6-10 years which constituted 26%. Those who served above 11+ years also constituted 7%. This was very useful in itself because it meant that most of the teachers had been in those schools for a short period   not enough to be able to comment on the quantitative and qualitative trends in the provision of education in those schools. This means that through their experience they are able to tell when proper teaching is taking place by use of knowledge, skills and learning experiences.

Figure 4: Teachers Professional Qualification
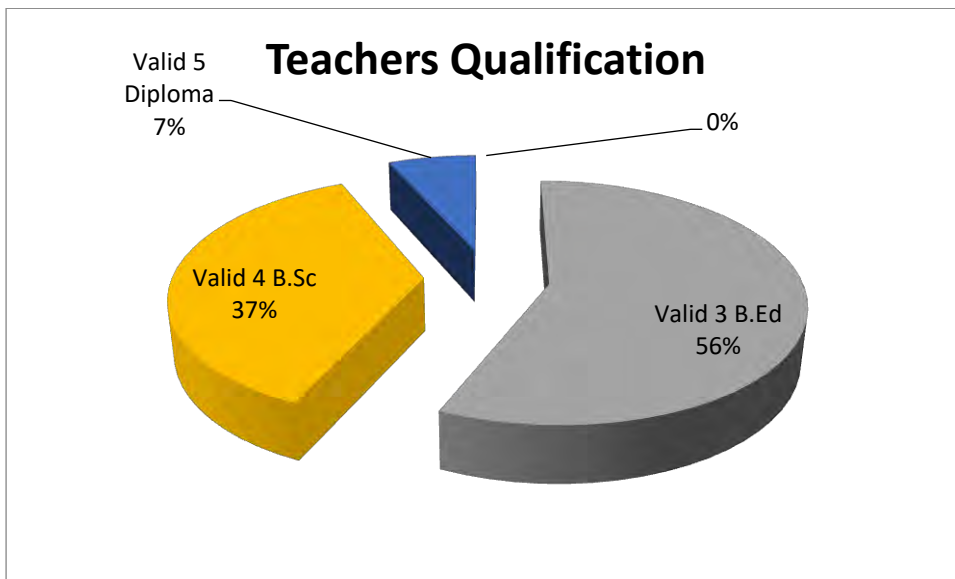
The findings indicated in Figure 4 Above reveals that majority of the teachers 56% are qualified with BED, while 37% are untrained teachers. It was notable that teachers qualified with Diploma certificates have 7%. The remaining categories of teacher qualification were in total. Most of the principals responded approving that academic teacher qualification influence teaching Mathematics. These findings on performance and teacher qualification concur with achievement tests than those taught by uncertified teachers.

Figure 5: Teachers' field of study
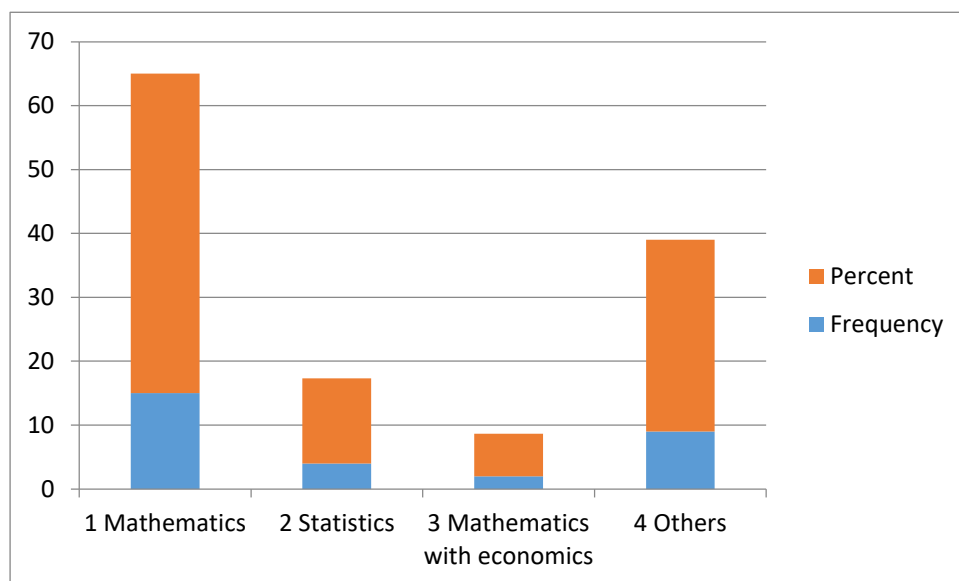
From figure 5 above give the distribution of teachers" field of study with the descriptive frequency in percentage, now we observe that majority of teachers for about 50% study mathematics and other 50% study mathematics related course. Hence we can conclude with much evidence that, the teacher is of strong mathematics background to explain or apply mathematics concept for student understanding.
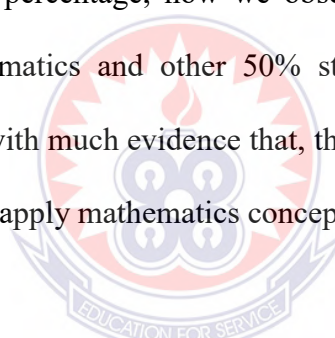
Figure 6: Teachers Age

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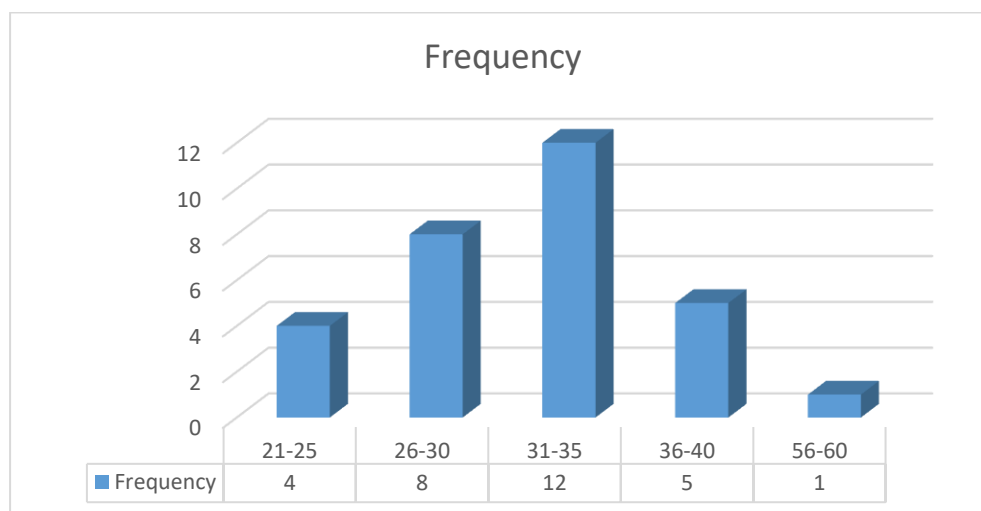
From the above figure it is observed that many of the teachers age ranges fall among working population due to these much is expected from teacher in order to improve the student academic performance. Other words teachers" age might not be a factor to student failure but rather the inexperience.

4.2.2 Students Demographic Information

Student demographic information included type of school, gender and age. With the type of school student attended it was observed that all sample schools were mixed boarding accounting for 100% for that category.

Table 6: Student gender

	Frequency	Student percent (%)
Male	187	55.3
Female	151	44.7
Total	**338**	**100**

Table 6 indicates that majority of students sampled for the study (187) accounting for 55.3% were males whilst the rest of 151 students accounting for 44.7% were females. The findings show that most (55.3%) of the students involved in the study were males.

Figure 7: Distribution of Students Age
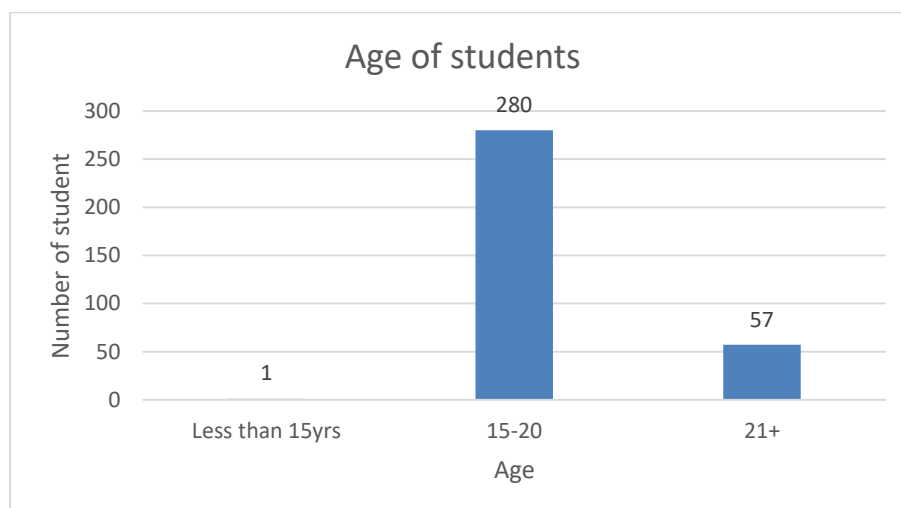
Figure 7 indicates that most (280) of students sampled for the study accounting for 82.8% were between 15-20 years of age, followed by (57) students whose age were 21 and above years accounting for 16.9% and one (1) student whose age was less than 15 years also accounting for 0.3%. Therefore, the statistics revealed in the findings show that most of the students involved in the study were within the age bracket of (15-20) years of age. This age group may be because the targeted students were in final year. The researcher feel the final year students are more familiar with information about the school based factors affect their performance.

Table 7: Analysis of sampled students' performance in mathematics at WASSCE

Year	Grade	Number	Percent	Remarks
	A1 - C6	31	9.17%	Good performance
2018	D7 - E8	106	31.36%	Poor performance
	F9	198	58.58%	Failed
	Missing	3	0.89%	Absent

Table 7 above show the analysis of candidates who can progress to tertiary (University) in terms of those who obtained the grade of (A1-C6) in core mathematics at 2018 West African Senior School Certificate Examinations. The result shows that a total of 338 candidates registered, for the 2018 WASSCE in the sampled schools, out

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of which 335 candidates finally sat the examination. Out of the total number of candidates that sat the examination, 31candidates representing 9.17% obtained credits and above (A1-C6); 106 candidates, representing 31.36% obtained (D7-E8). In addition 198 candidates, representing 58.58% obtained the grade of F9. 3 candidates did not turn out for the examination representing 0.89%. From the analyses it is clear that students who could progress to University are only 31 out of 335 representing 9.17%. this performance is abysimal.

4.3 Research question one

What influence does students" attitudes have on their academic performance in Mathematics?

Student perspective

Figure 8: Students Academic Ambition
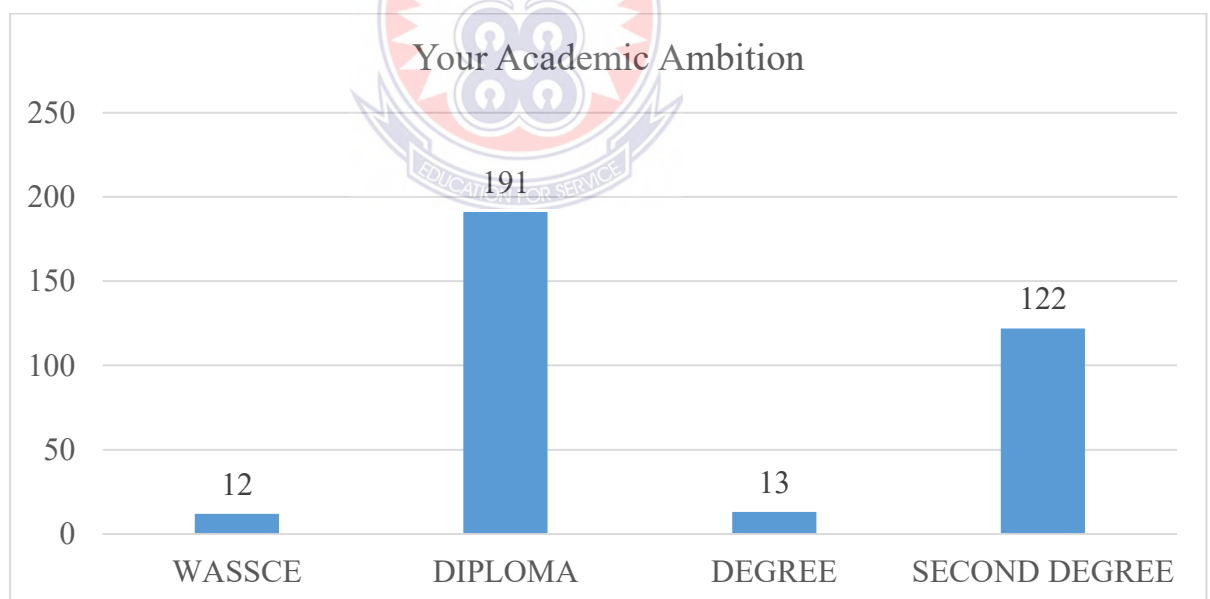
From figure 8 indicates that most (191) of students sampled for the study accounting for 82.8% said their academic ambition was to obtain diploma, followed by (122) students who said they want to obtain second degree in their various disciplines accounting for 16.9% and (13) students said they want to obtain first degree also

accounting for 0.3%. However, 12 students said they want to obtain WASSCE accounting for 34%. Therefore, the statistics revealed in the findings show that most of the students involved in the study has their academic ambition to obtain a diploma as their highest educational ladder.

Figure 9: Learning of Mathematics by Students
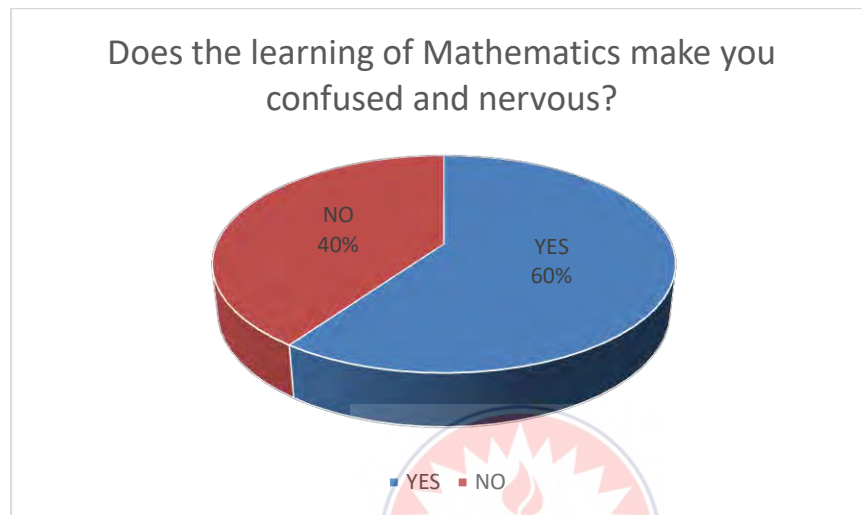
Findings of the study in figure 9 above reveals that most students admitted the fact that learning of mathematics makes them confused and nervous by responding to the option agree a little accounting for 37.7%. This is follow by a group of students who indicated that learning of mathematics make them very confuse and nervous by responding agree a lot accounting for 22.6%. Followed by those students who responded disagree a little accounting for 14.8%, others responded disagree a lot accounted for 14.2%, and the least were those who responded not at all (i.e. not knowing they are confuse or nervous) accounted for 10.7% with one student who did not answer the questionnaire item. From the table when we collapse the first two responses (i.e. agree a lot and agree a little), to actually understand students feeling when learning mathematics, it is obvious to conclude that students are confuse and

nervous when learning mathematics. This has accounted for 60% of the total respondents of the study.

Figure 10: How do Students find Mathematics as a Subject

bar chart showing students response on how they find maths as a subject in percent
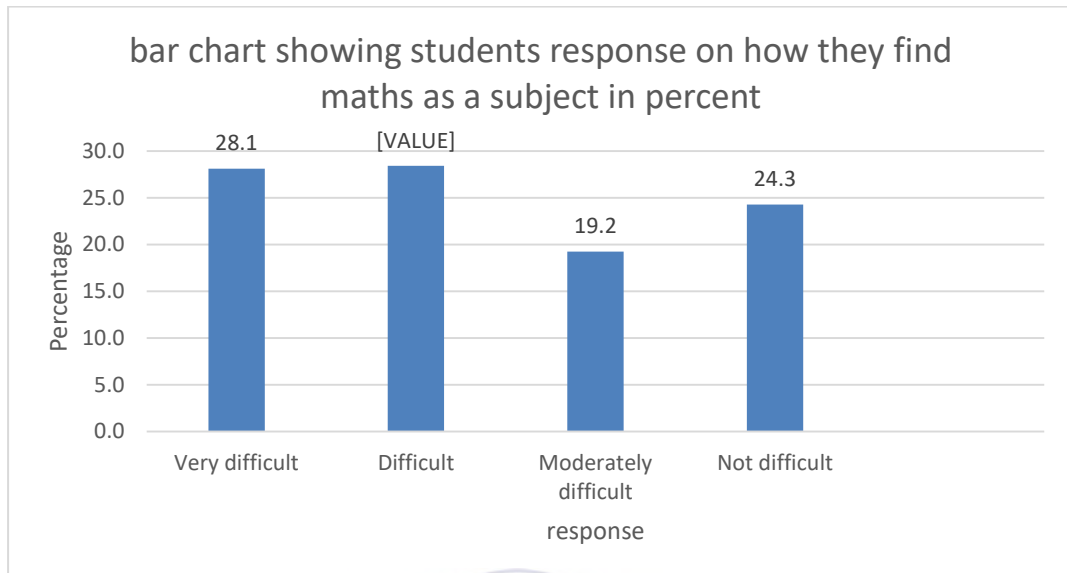
From the figure 10 above shows that most students established that mathematics is a difficult subject to learn accounting for 28.4%. Follow by a very close number who also established that mathematics is a very difficult to learn accounting for 28.1%. This follow by a reasonable number of students who indicated that mathematics is not difficult which accounted for 24.3% and the least were those who indicated that mathematics is moderately difficult accounting for 19.2%. This implies that when we collapse the first two responses (i.e. very difficult and difficult), to actually understand students view on how they find mathematics as a subject, it is obvious to conclude that majority of the students find mathematics as a difficult subject to learn. This has accounted for 56.5% of the total respondents of the study in Table 8.

Table 8: How do you find Mathematics as a subject

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	DIFFICULT	191	56.5	56.5	56.5
	NOT DIFFICULT	147	43.5	43.5	100.0
	Total	**338**	**100.0**	**100.0**	

Table 9: Analysis of teaching and learning materials in school

Facility	More than enough	Enough	Not enough	Very few	Not at all
Teachers guide	26.9%	23.1%	19.2%	23.1%	7.7%
Students" textbooks	15.5%	34.6%	15.4%	30.8%	3.8%
Lockers /chairs	3.8%	19.2%	46.2%	19.2%	11.5%
Classrooms	-	30.8%	42.3%	19.2%	7.7%
Library/laboratory	3.8%	15.4%	42.3%	7.7%	30.8%

Table 9 shows the descriptive statistics in percentage of responses gathered from the respondents (teachers) on availabilities of teaching and learning materials in schools they teach. Out of the 30 respondents interviewed, 46.2% of them indicated lack of enough lockers/chairs for both teaching staff and students" hindering performance, 42.3% said inadequacy of classrooms is a contribution factor to students" poor performance, 42.3% also indicated that lack of library/laboratory was a problem. However, a significant number of respondents indicated that there were more than enough teachers guide accounting for 26.9% while 34.6% also indicated that students" textbooks were enough in the schools they teach.

Table 10: Analysis of adequacy of physical facilities in school

S/N	Facility	More than enough	Enough	Not enough	Very few	Not at all
1	Classrooms	14.8%	21.3%	39.9%	19.8%	4.1%
2	Lockers/chairs	8.9%	13.3%	29.6%	29.0%	19.2%
3	Games facilities	9.5%	17.5%	24.3%	32.8%	16.0%
4	Library/ laboratory	4.4%	11.8%	24.3%	28.4%	31.1%
5	Dining hall	7.4%	10.4%	19.8%	18.0%	44.4%
6	School bus	6.5%	10.9%	26.6%	34.9%	21.0%
7	Students" textbooks	8.9%	14.2%	26.6%	25.4%	24.9%
8	Computers/Internet facility	5.0%	6.8%	16.6%	25.1%	46.4%

Table 10 shows the descriptive statistics in percentage of responses gathered from the respondents (students) on the adequacy of physical facilities in their schools. Out of the 338 respondents involved in the study, 39.9% of them which is the highest in the category indicated lack of enough classrooms for effective teaching and learning of students" hence hindering performance, 29.6% of the respondents said no enough lockers/chairs for students" leading to some students to pair with their colleagues during contact hours. 32.8% also indicated that there are very few game facilities at their school to help them physically and mentally for high academic achievement. 31.1% indicated that they do not have library/laboratory at all in their school hence a big problem to their academic success. 44.4% also indicated that they have no dining hall in their school. School buses were recorded to be very few accounting for 34.9%. While the teachers claim that there are enough students" textbooks, a significant number of students however indicated that there are no enough students" textbooks accounting for 26.6%. A good significant number of respondents also indicated that

their schools do not have Computers and Internet facilitates at all, this accounted for 46.4% hence all these can be contributing factors to poor performance of students. The most pressing factors identified were lack of Library and laboratory.

Table 11 show the number of cases processed for the analysis.

Table 11: Case Processing Summary

Unweighted Cases		N	Percent
Selected Cases	Included in Analysis	338	100
	Missing Cases	0	0
	Total	338	100
Unselected Cases		0	.0
Total		**338**	**100**

Table 11 shows the breakdown of the number of cases selected and those not selected cases included in the analysis. We observe that the selected case is 338 whiles the unselected case is 0 and missing value of 0 given a total of 338 cases.

Table 12: Dependent Variable Encoding

Original Value	Internal Value
FAIL	0
PASS	1

Table 12 gives the coding for the dependent variable as 1 = pass and 0 = Fail

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Table 13: Classification Table

			Predicted		
			Student Performance at WASSCE		Percentage Correct
	Observed		0 FAIL	1 PASS	
Step 0	Student Performance at WASSCE	0 FAIL	0	31	.0
		1 PASS	0	304	100.0
	Overall Percentage				90.7

Table 13 shows the overall percentage of cases for which the dependent variable has significantly predict in the model. From the outputs we see the null model of the overall percentage as 90.7%. And success cases as 31 which represent students who succeed at WASSCE exams and failure of 304 students as a result suffered in their academic at WASSCE.

Table 14 is the Wald test result. The test provides a test of significance for the coefficients in the logistics regression. A p-value less than 0.05 indicate that the coefficients are significant at 5% level in predicting the outcome variable.

Table 14: Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Constant	2.283	.189	146.628	1	.000	9.806

From table 14 there is only one degree of freedom is 1, this is because there is only one predictor variable present in the model of Wald Chi- square test. Exp(B) is 9.806 representing the exponentiation of the B coefficient of the ratio and the intercept is 2.283 and a sig. value of 0.00 which is also significant since it less than p- value of 0.05. The standard error (S.E) is seen to be .189.

Table 15 gives the result from the Omnibus tests of model coefficient. This test indicates whether the inclusion of some variables contribute negatively or positively to the model. The variable classroom was selected and tested.

Table 15: Omnibus Tests of Model Coefficients

	Chi-square	df	Sig.
Step	50.432	11	.000
Classrooms	50.432	11	.000
Model	50.432	11	.000

The omnibus Tests of Model Coefficient table gives the result of the Likelihood Ratio test which indicates whether the inclusion of this classrooms variables contributes significantly to model. A significant value of 0.00 which is less than p-value of 0.05 for the classroom, this means that the classroom is significant variable in improving the overall significant of the logistics regression model.

Table 16: Model Summary

-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
156.175[a]	.140	.304

In standard regression, the co-efficient of determination R-Square value gives an indication how much variation in Y is explained by the model. The „Model Summary" table gives the values for Cox & Snell R Square and Nagelkerke R Square values which try to measure predicted decisions. The correct classification rate has increased by 14% to 30.4% of variation in Performances can be explained by the model. This further supports how correctly the model is specified with -2 Log likelihood values of 156.175.

Table 17: Hosmer and Lemeshow Test

Chi-square	df	Sig.
10.089	8	.259

Hosmer and Lemeshow Test; Cases are arranged in order of their predicted probability on the criterion variable. The significant value is 0.259 which is greater than the critical value of 0.5, with Chi-square value of 10.089 and degree of freedom as 8. The Hosmer and Lemeshow test is a statistical test for goodness of fit for logistic regression model. It is used in prediction models. The test assesses whether or not the observed event rates match expected event rates in subgroups of the model population.

Table 18: Classification Table

	Observed		Predicted		
			Student Performance at WASSCE		Percentage Correct
			0 FAIL	1 PASS	
Step 1	Student Performance at WASSCE	0 FAIL	4	27	12.9
		1 PASS	3	301	99.0
	Overall Percentage				91.0

a. The cut value is .500

Table 18 gives the overall percentage which is 91% and is less than quarter to 100% meaning that the model is good. And it measures the predictive accuracy of the logistic regression model.

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Table 19: ANOVAb

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.924	11	.357	4.759	.000[a]
Residual	24.208	323	.075		
Total	28.131	334			

Table 19 show the ANOVA comparison of the independent variables, this table is use to compare the means of two or more independent variables and that helps us to measure whether the overall regression model is a good fit for the data. The table shows that independent variables are statistically significantly predict the dependent variable, $F_{(11,323)}$ value of 4.759 and sig- value of 0.00. Since the sig value is less than the p-value of 0.05 hence it is concluded that the model is a good fit.

Table 20 is the result from the logistics multiple regression. Logit regression was used rather than linear regression since the dependent variable (performance) is dichotomous, pass or fail.

Table 20: Variables in the Equation

Variable		B	S.E.	Wald	df	Sig.	Exp(B)	95.0% C.I. for EXP(B) Lower	Upper
Step	**Gender**	1.006	.666	2.282	1.000	.131	2.734	.741	10.083
	Age	-.696	.490	2.017	1.000	.156	.499	.191	1.303
	Parents visit	.158	.238	.444	1.000	.505	1.172	.735	1.866
	Head supervision	-1.080	.438	6.083	1.000	.014	.340	.144	.801
	General behavior	-.153	.188	.662	1.000	.416	.858	.594	1.240
	Find mathematics	.153	.498	.094	1.000	.759	1.165	.439	3.095
	Student textbooks	-.035	.484	.005	1.000	.943	.966	.374	2.495
	Lockers and Chairs	1.502	.497	9.142	1.000	.002	4.490	1.696	11.888
	Classrooms	1.133	.566	4.004	1.000	.045	.322	.106	.977
	Pre-test	-.935	.445	4.405	1.000	.036	2.547	1.064	6.099
	Time	2.126	.658	10.440	1.000	.001	8.378	2.308	30.417
	Constant	3.291	1.875	3.082	1.000	.019	26.881		

a. Variable(s) entered on step 1: Gender, Age, Parents visit, Head supervision, General behavior, Find mathematics, Student textbooks, Lockers and Chairs, Classrooms, pre-test, Time.

From table 20, the B-Column represents the coefficients or intercept for the variables in the model. Gender, Age, Parent Visit, Classrooms, General behavior, Time has 1.006, -.696, .158, -.153, 1.133, 2.126, respectively as intercept. The S.E represents the standard error of the coefficient in the table. The Wald statistic for a coefficient is the square of the result of dividing the coefficient by its standard error this number is distributed as chi-squared, which test the hypothesis that $\beta=0$. The Sig. values for Gender, Age, Parent Visit, Classrooms, General behavior, Time are .131, .156, .505, .045, .146, .001 respectively. Here only Classrooms and Time values are less than p-value of 0.05 and a constant significant value 0.019. In this table we observe df representing the degree of freedom for each variable is 1 because there is only one predictor variable. Exp(B) this is the exponentiation of the B coefficient, which is

known as the odds ratio and it is the log-odds units. 95.0% C.I. for EXP(B) in this table gives the confidence interval (95%) for Exp(B). the odds are shown as 2.734, .499, 1.172, .858, .322, 8.378. for Gender, Age, Parent Visit, Classrooms, General behavior and Time. Time is 2.308, for the Exp(B) indicating that any increment on any variable will give a smaller effect on the variable, the odds of their Performance becomes greater.

$$Y = \beta_0 + \beta_1 \text{ Time} + \beta_2 \text{ Classrooms} + \beta_3 \text{ Lockers and chairs}$$

By substituting to predict student performance in mathematics.

From the result it clear that the B-Column which represents the coefficients or intercept of the variables in the logistics multiple regression model. Age, head supervision, general behavior of students, students textbooks and pre-test has -0.695, -1.080, -0.153, -0.035, -0.935, respectively as coefficients. The negative intercept indicate that the variables do not contribute to student poor performance in mathematics whilst the positive betas" (coefficients), Gender, parents visit, how students find mathematics as a subject, availability of enough classrooms, lockers and chairs, time has 1.006, 0.158, 0.153, 1.133, 1.502 and 2.126 respectively indicating its positive contribution to the students" performance in mathematics

4.4 Discussion of findings

The purpose of this study was to establish school-based factors that affect Senior High School students" academic performance in Tamale Metropolis, Ghana. The findings reveal that the variables time and classroom have significant influence on students" academic performance. Majority of the students spent more time on other activities than they use to learn mathematics. It is believed strongly that the relationship between dependent variable and student attitude towards time allocation for studying mathematics are positively related. Therefore poor use of time will

negatively affect student academic performance in mathematics. The finding is in line with (Churcher, Asiedu-Owuba, & Adjabui, 2015).

Findings indicate that majority of the teachers (93%) are qualified with degrees to teach in the Ghanaian senior high school. This shows that most of the Tamale Metropolis public senior high schools" teaching personnel are qualified in accordance with the Ghana Education Service (GES) requirements that states that the majority of teachers in Ghana Senior High schools should be Bachelors or Master"s Degree holders. (See Table 4). This, however, calls for putting in place necessary training for these teachers to prepare them to handle teaching and learning more effectively in the senior high schools based on their fields of study. The findings for teacher utilization based on student-classroom ratio in the sampled schools is 64:1 which is twice higher than in the UNESCO standard and National Policy on Education except in a few cases where the students-classrooms ratios ranged between 39 and 47. The UNESCO standard and the National Policy on Education specify a maximum of 30 to 40 students per class. This finding confirms that of Awanta (2004), whose studies revealed that school size and class size was a powerful predictor of students" academic performance. On the issue of teachers" years of experience in the selected senior high schools in Tamale Metropolis, Table 5 shows that 13 teachers (43%) out of 30 teachers in the sampled schools fall in the category of 1-5 years of teaching experience. 10 (34%) had 6-10 years of teaching experience, while 6 (20%) acquired 11-15 years teaching experience. There was 1 teacher (3%) in the category of 21 years and above of teaching experience. This finding indicates that teachers" years of experience is a measure of quality and thus becomes very important in the achievement of students" academic performance. This supports those who advocate that experienced teachers need to be retained in schools if higher productivity is to be

obtained because learners achieved more from these teachers. This finding confirms the view of Darling-Hammond (2000) who opined that teachers" years of experience as a measure of quality is important in the achievement of students" academic performance. Again, when teachers were asked how they could improve their students" performance in the senior high school certificate examinations, the teachers who responded suggested that the provision of textbooks, staffing the school with qualified teachers, the effective use of instructional aides as well as constant practice of the subject by the students would go a long way to improve students" performance.

Figure 8 shows students" academic ambition in the sampled senior high schools in Tamale Metropolis. Out of the 338 students sampled, only 135 (39.9 %) students said their academic ambition was to obtain first degree and above. The remaining 203 students accounting for 60% said their academic ambition was to obtain WASSCE or Diploma. Therefore students" academic ambition affect their academic performance. Figure 9 also reveals that majority (60%) of the students claimed that learning of mathematics makes them confused and nervous. Obviously, students cannot pass well under the condition of being confused and nervous when learning mathematics. Findings also, indicates that majority (191) of the respondents accounting for 56.5% said mathematics is a difficult subject to learn while only 147 respondents representing 43.5% said mathematics is not difficult hence indicated their interest in learning it.

The statistics revealed that supervision in the sampled schools by the headmasters is woefully inadequate to yield the needed results. Majority (75%) headmasters rarely supervise teachers" scheme of work, lesson plans, progress records, teaching notes, class register among others. This finding confirms Darling-Hammond"s (2000) assertion that qualitative education is a function of quality and quantity of teaching

personnel within a system. It was also found that those responsible for the mass failure of students in WASSCE as perceived by the teachers were the students, teachers themselves, government, parents and schools. This shows that the teachers did not shy away from the fact that they were also partly responsible for the problem. It also reflects the multidimensional nature of the causes of abysmal students" academic performance in public examinations. It must be reiterated and emphasised that the students, teachers, government, parents and schools have crucial roles to play in the performance of students in WASSCE. On the role of the Parents Teachers Association (P.T.A) bringing about better academic performance of students in the schools, majority (83%) of the teachers suggested that the P.T.A could play vital roles in the schools in terms of financial assistance, the enrichment of the moral form of the school, etc. Parents should be actively involved in the decision-making process of the schools regarding the education of their children. They will be able to give the home/school relationship, which in effect bring about relationship between the members of the community and schools. Eighty percent (80%) of the respondents stressed the need for the employment of more qualified mathematics teachers in the schools, especially due to the fact that the workload of some of the teachers was so much, which inhibits their effectiveness in teaching.

The finding points out that the inadequate facilities in sampled schools affected students" academic performance in mathematics, among some were inadequate instructional materials, classrooms, furniture and other related resources such as reference books and guides for teachers. Some of the schools in the metropolis did not have adequate teachers. Cases of teachers being transferred from the schools without replacement led to inadequate teachers which affected teaching and learning and ultimately affecting students" performance in mathematics. Teachers gave

assignments often but were not able to mark the assignments due to much work load and large class size to teach. The study revealed that most of the schools had inadequate physical facilities like the libraries, laboratories, classrooms and dining hall.

In Conclusion, the students" academic performance in mathematics at WASSCE in Tamale Metropolis has been persistently poor. While the teachers felt they were partly responsible for the poor performance they strongly believed that the students, government, parents and schools could not be exonerated from the problem. In view of the multi-dimensional nature of the causes of mass failure of students in WASSCE, there is need for multi-dimensional solutions to the problem. To this end, the teachers, parents, schools and government should live up to expectation in creating the enabling environment for the students to perform well in the WASSCE. Moreover, the students should endeavour to study harder to be able to come out with flying colours in the WASSCE.
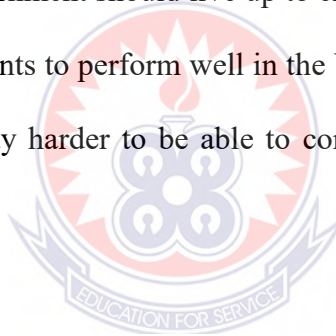
CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Overview

This chapter provides a brief summary of the study, conclusions and recommendations. Chapter one to four presented research problems and research questions, the related literature review, and research methodology and findings.

5.1 Summary of the study

The study sought to determine the effect of school-based factors on students" academic performance in Northern Region and also to determine the effect of some other factors on students" performance. A structured questionnaire was the main data collection tool used for the study. A total count of 338 respondents were engaged for the survey; the heads of schools and the teachers were involved because they are the most experienced in school in terms of administrative work. The study adopted exploratory approach using a descriptive survey design. Complaints about the poor performance in mathematics in Ghana certificate of senior high school Education examinations from parents, teachers and stakeholders made this area of study one of interest to the researcher.

5.2 Summary of Findings

For the null model, the output revealed a correct overall percentage of prediction as 91%. From the step 0 constant also depicts that the hypothesis was significant because the p-value was less than the critical p-value of 0.05 or 0.01. From the model with all predictors the p-value was less than 0.05, which means the model was statistically significant which helped significantly increased ability to predict the decisions made by the subject. Therefore, the data fit the model well in the Hosmer-Lemeshow tests

of the null hypothesis. The percentage increase from 90.7% for null model to 91.0% for the full model.

From the result, time and classrooms does have significant influence on the student academic performance. This study suggested one predictor of using to improve students' academic performance by time spent among students it can be observed that student spent more time on other activities than they use to study. The results acquired, it may be concluded that the academic knowledge with the majority of the participants but need to be control and manage well. Poor use of time negatively will have effect on the academic performance of students. However, Time is significant which more likely to influence student academic performance with a significant p – value less than 0.05.

Moreover, it is observed that many of the teachers age ranges fall among working population due to these much is expected from teacher in order to improve the student academic performance. Other words teachers" age might not be a factor to students" failure but rather the inexperience.

5.2.1 What influence does Students Attitude have on their Performance in mathematics?

The study established that most senior high school students have a very good relationship with their teachers. The findings further revealed that most teachers indicated that student"s attitude towards learning in general are negative. However, student also claim that their attitude towards learning is positive. Most students admitted that the learning of mathematics make them confuse and nervous which in my view, this supported the teachers claim that students" attitude towards the learning of mathematics is negative. For the issue of students and mathematics as a subject, the

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findings revealed that mathematics is a difficult subject for that matter the learning of mathematics is difficult. However, a significant number of students express their interest studying mathematics due to the fact that they want to become mathematicians, economists, accountants etc.

Most schools in the northern region have serious disciplinary issues affecting students" performance; Students leaving class/school before closing especially on Fridays in other to observe juma prayer. Rampant use of mobile phones by students especially during contact hours, disrespecting school authorities with impunity by students with many citing that they do not value education because many people in the society or communities" values livestock.

5.2.2 School Administration Influence on Students' Performance

The study established that, the northern region is one of the most understaffed regions with teachers. This has accounted for high teacher-student ratio in the region which might have been considerably affect students" performance. Despite the fact that headmasters play a significant role in the school administrative work and that the performance of schools is significantly depend on administrative style of a headmaster; the study revealed that the headmasters were astonished with the high teacher-student ratio in the region and for that matter their schools. However, the teachers on the other hand admitted that the teacher-student ratio in the northern region is very high and added that they blame the school authorities for high enrolment of students without any effort made to enrol new staff members.

The statistics revealed that supervision of schools by the headmasters is woefully not enough to yield the needed result. Most headmasters rarely supervise teachers scheme of work, lesson plans, progress records, teaching note, class register among others.

Case of teachers" workload led to teachers gave assignment often but were not able to mark them due to much workload and many classes with high number of students in each class. The study further revealed that cases of teachers being transferred from schools without or timely replace led to inadequate teachers which affected teaching and learning and ultimately affecting performance. Some headmasters indicated that most at times they teach to supplement teachers who are not available and also citing that they work overtime as well as dealing with communities which have negative attitudes towards education.

5.2.3 What influence does the availability of facilities in schools have on students' performance

Findings of the study revealed that the availability of facilities in schools affected students" performance in mathematics, among some were inadequate instructional materials and other related resources such as reference books and guides for teachers. Some of the schools in the metropolis did not have adequate teachers.

Cases of teachers being transferred from the schools without replacement led to inadequate teachers which affected teaching and learning and ultimately affecting students" performance in mathematics. Teachers gave assignments often but were not able to mark the assignments due to much work load and many classes to teach. The study revealed that most of the schools had inadequate physical facilities like the libraries, laboratories, classrooms and dining hall. The study indicates that school facilities are inadequate for the implementation of proper learning in some of the senior high schools in the Metropolis, selected for study which seems to have a direct bearing on students" performance unlike other schools in the Metropolis which have adequate learning resources they need. The study established that teachers" resources encourage learners to participate in the learning process, motivate them, and cater for

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their individual differences. The findings indicate that teaching and learning resources creates motivation in learning by supporting the learning process which enables learners to participate in assignments, support teaching as visual aids and increases teachers" attention to students. The findings further reveal that availability of resources played an important role in understanding of concepts and imparting skills to the learner.

5.2.4 Relationship between the Teacher professional qualification/teaching experience Influence Students' Performance.

The study established that age of teachers is instrumental to the teaching and learning process. Findings of the study revealed that the school-based factors which influence students" performance apart from inadequate of instructional and resources like laboratories and classrooms. Most schools in the districts did not have adequate mathematics teachers. Cases of teachers being transferred from the schools without replacement led to inadequate teachers which affected teaching and learning and ultimately affecting performance. Teachers gave assignments often but were not able to mark the assignments due to much work load and many classes to teach. The study revealed that most of the schools had inadequate physical facilities like the libraries, laboratories, classrooms and dormitories. The study also established that there are few opportunities for in service training for many teachers in the northern region which further undermine teachers" performance.

5.3 Conclusions

The study made the following conclusions. To begin with the study established that there are several schools based factors influencing senior high school"s students" performance in the Tamale Metropolis.

The study concluded that only Chairs and Time values are less than p- value of 0.05 indicating how significance the two indicators contribute to students" low performance in mathematics. Further, school administration influence students" performance in the four selected schools in the Tamale Metropolis. Many heads of schools and administrators have not been adequately supervising their teachers in terms of teaching methodology, preparation of scheme of work, lesson plans and students" progressive reports. Many of the school heads have been very permissive and using a detached administration style in school administration thereby affecting students" performance. Another conclusion was that the availability of physical resources like classrooms, laboratories and dining halls were also affecting students" performance in the metropolis, they are very few schools in the northern region with such facilities which was disadvantaging students as compared to other regions in the country. Another conclusion was that students" attitudes towards education and these also affected by their cultural and social economic background was also affecting students" performance in the districts and finally teachers" attitudes which has been found to be influenced by several factors including the teacher workload which has been caused by inadequate teaching staffs, high rate of absenteeism and transfers by teachers was also affecting students" performance in the northern region.

5.4 Recommendations

The researcher suggests the following recommendations in order to change the attitudes of teachers, learners, and the societies at large towards teaching and learning of mathematics in senior high schools for high academic achievement.

1. Students should be encouraged and educated by school management at all levels on the impact of mathematics on their academic performance and create a balance between academic activities and others activities.

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2. Students should be observed by teachers and parents on how they use their time. To ensure a decrease in the number of time waste by students when in school and with parents and ensure they use time management as a tool to improve the academic performance of students in schools.

3. The students should be motivated by parents and teachers to focus on the academic relevance of mathematics rather than having negative attitude towards the learning of mathematics.

4. Further research on the topic based on a large sample by using a survey research approach in order to generalize the findings obtained from a large data sample.

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APPENDIX I

HEADS OF INSTITUTIONS QUESTIONNAIRE

Dear headmaster/headmistress,

This questionnaire is for the purpose of writing a dissertation as a requirement for the award of Mphil in Mathematics Education at the University of Education, Winneba. This questionnaire is solely for academic purpose and all information given will be treated with utmost confidentiality. I therefore desire your objectivity and clarity to make this study a good one.

There are no wrong / correct answers.

Please respond to the questions by giving a very honest answer as much as possible.

SECTION A

Demographic Information

1.　　What is your gender?　　☐ Male　　　　　　　☐ Female

2.　　What is your age?

　☐ 21 – 25 years　☐ 26 – 30 years　☐31 – 35 years　☐36 – 40 years

　　　☐ 41 – 45 years　☐46 – 50 years　☐ 51 – 55 years　☐ 56- 60 years

3.　　What is your highest professional qualification?

　☐ PhD　☐ M.Ed　☐ B.Ed　☐Diploma

　Any other specify ……………………

4.　　For how long have you been a head teacher in your teaching career?

　☐ 1 – 5 years　　　　☐ 6 – 10 years　　　　☐ 11 – 15 years

　☐ 16 – 20 years　　　☐ 20 – 25 years　　　　☐ 25 - 30 years

　For how long have you been a head of institution in the current school?

　☐ 1–5 years ☐ 6–10 years　☐ 11 – 15 years　☐ 16 – 20 years ☐ 20 – 25 years

5.　　Have you ever attended an in-service course?　☐ Yes　　　　☐ No

6.　What is the size of your school?

　　☐ Single stream ☐ Double stream　☐ Three streams ☐ Four streams

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SECTION B: Factors Influencing Performance

7. Do you have enough teachers in your school?   ☐ Yes   ☐No

8. What is the average teacher-student ratio in your school?

....

9. (a) What is the average teaching load of your teachers per week?

    ☐ Below 20 lessons ☐20–24 lessons ☐25 –30 lessons ☐More than
  30 lessons

    (b) How do you rate this work load?

    ☐ Heavy   ☐ Moderate   ☐ Light   ☐ Not at all

    (c) What effect do you think the teaching load has on the performance
  of students?

  ………………………………………..…………………………………

………………………………………..…………………………………

10. How often do teachers give pupils assignments/homework?

    ☐ Daily   ☐ Once a week   ☐ Once a fortnight   ☐ Once a month

    ☐ Any other (specify) …….……………….…..............................

(a) Are teachers able to correct all the assignments given at the intended
time?

    ☐ Yes   ☐ No

11. How many times do you supervise the class register to ensure the
effective use of instructional time by the teacher?

    ☐ Once a week   ☐ Twice a month   ☐ Once a month ☐ Once a term
    ☐ Never

12. (a) Do you receive complaints of students not completing their
assignments

    as required?   ☐ Yes   ☐ No

    (b) If your answer above is yes, put a tick (√) against the reasons
    that students   give for not completing the work.

    ☐ Lack of adequate time ☐ Lack of textbooks   ☐ House chores

    ☐ Lightening   Any other reason………..…………

13. How many times do you go through teachers attendance register to
check   teacher absenteeism?

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☐ Once a month☐ Twice a month☐ Once a term ☐ Twice a term
☐Never

14. (a) Rate the attitude of students towards learning in your school.

☐ Positive ☐ Neutral ☐ Negative

(a) Please indicate whether your teachers prepare the following by ticking as many as applicable.

☐ Schemes of work ☐ Lesson plans ☐ Records of work

☐ Students" progress records ☐ Teachers notes / teaching notes

(b) How often do you check whether the teachers have prepared the above records?

☐ Once a week ☐ Once a term ☐ Once a month ☐ Twice a month ☐ Never

15. (a) Are there cases of teachers transferred from your school? ☐Yes ☐No

(b) If yes, (i) how often are they transferred?

☐ Quite often ☐ Often ☐ Rarely ☐ Not at all

(ii) when transferred, how often are they replaced?

☐ Quite often ☐ Often ☐ Rarely ☐ Not at all

(iii) How do the transfers affect performance of students in WASSC exams?

…………..……………………………………………………………………
…………..……………………………………………………………………
…………………..……………………………………………………………

16. Please indicate with a tick (√) the adequacy of the following teaching and learning materials in your school in the table provided below. The alternate choices are as follows: (a) Quite adequate-QA

(b) Adequate-A (c) Inadequate-I

(d) Quite Inadequate-QI (e) Not applicable- NA

	Teaching/learning Resources	QA	A	I	QI	NA
1	Teachers reference books and guides					
2	Students" textbooks					
3	Lockers/ chairs					
4	Classrooms/ library					
5	Laboratory					

17. How often do you supervise the following documents?

Documents	Not at all	Rarely	Often	Very often
Scheme of work				
Lesson plans				
Progress records /Class registers				

Thank you for your cooperation

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APPENDIX II

MATHEMATICS TEACHERS QUESTIONNAIRE

Dear teacher,
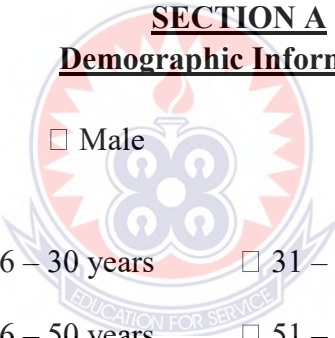
This questionnaire is for the purpose of writing a dissertation as a requirement for the award of Mphil in Mathematics Education at the University of Education, Winneba. This questionnaire is solely for academic purpose and all information given will be treated with utmost confidentiality. I therefore desire your objectivity and clarity to make this study a good one.

There are no wrong / correct answers.

Please respond to the questions by giving a very honest answer as much as possible.

SECTION A
Demographic Information

1. Gender? ☐ Male ☐ Female

2. Age?
☐ 21 – 25 years ☐ 26 – 30 years ☐ 31 – 35 years ☐ 36 – 40 years
☐ 41 – 45 years ☐ 46 – 50 years ☐ 51 – 55 years ☐ 56- 60 years

3. What is your highest professional qualification?
☐ PhD ☐ M.Ed ☐ B.Ed ☐ B.SC ☐Diploma
If other, please specify …………………………………

4. Your area of specialization

☐ Mathematics ☐ Statistics ☐ Mathematics with Economics ☐ Others

5. For how long have you been a teacher in your teaching career?
☐ 1–5 years ☐ 6 – 10 years ☐ 11 – 15 years ☐ 16 – 20 years ☐ 21 - 25 years

6. For how long have you been a teacher in this particular school?
☐1 – 5 years ☐ 6 – 10 years ☐ 11 – 15 years ☐ 16 – 20 years ☐21 - 25 years

7. Have you ever attended an in-service course? ☐ Yes ☐ No

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8. What is the size of your school?
    ☐ 500 or below   ☐ 501-1000   ☐ 1001-1500   ☐ 1501-2000
    ☐ 2001 and above

SECTION B: Factors influencing performance

9. Are there enough mathematics teachers in your school? ☐ Yes   ☐ No
10. (a) What is the average teacher-student ratio in your school?
    ……………………………………………………………………………

    (b) How does the teacher-student ratio affect students" poor performance?
    ……………………………………………………………………………
    ……………………………………………………………………………

11. (a) What is average teaching load per teacher per week?
    ☐ Below 20 lessons ☐ 20 –24 lessons ☐ 25 – 30 lessons   ☐More than 30

    lessons

    (b) How do you rate this work load? ☐ Heavy   ☐ Moderate ☐ Light
    ☐ Not at all

    (c) What effect do you think the teaching load has on the student performance?
    ……………………………………………………………………………
    ……………………………………………………………………………

12. How often do teachers give pupils assignments/homework to their students?
    ☐ Daily   ☐ Once a weeks   ☐ Once a fortnight   ☐ Once a month

13. Do teachers correct all the assignments at the intended time? ☐ Yes
    ☐ No

14. In teaching mathematics to this school, how confident do you feel to do the
    following?
    a)   Answer students" questions about mathematics
    ☐ Very confident   ☐ Somewhat confident   ☐ Not confident

    b)   Show students a variety of problem solving strategies
    ☐ Very confident   ☐ Somewhat confident   ☐ Not confident

    c)   Provide challenging tasks for capable students
    ☐ Very confident   ☐ Somewhat confident   ☐ Not confident

    d)   Adapt my teaching to engage students" interest
    ☐ Very confident   ☐ Somewhat confident   ☐ Not confident

e) Help students appreciate the value of learning mathematics
☐ Very confident ☐ Somewhat confident ☐ Not confident

15. (a) Do the students complete the assignments/home work as required?
☐ Yes ☐ No

(b) In your answer above if no, what reasons do the students give for not completing the work.
☐ Lack of adequate time ☐ Lack of textbooks ☐ House chores ☐ Lightening Any other reason …………………………...…………………

16. (a) What is the attitude of students towards learning in your school?
☐ Positive ☐ Neutral ☐ Negative

(b) Please explain your answer above
………………………………………………………………………………
………………………………………………………………………………

17. (a) Please indicate whether you prepare the following by ticking as many as applicable.
☐ Schemes of work ☐ Lesson plans ☐ Records of work ☐ Progress records

(b) How often does your head of institution check whether you have prepared the above records?
☐ Once a week ☐ Once a term ☐ Once a month ☐ Twice a month ☐ Never

18. How often does your head teacher supervise the following documents?

Documents	Not at all	Rarely	Often	Very often
Scheme of work				
Lesson plans				
Progress records				
Teaching notes				

19. What is the general behaviour of students in your school?
☐ Very good ☐ good ☐ average ☐ poor

20. How does students" behaviour affect performance in WASSC exams?
…………………………………………………………………………………

21. How does the head of institution ensure that teachers teach on daily basis?
…………………………………………………………………………...………
…………………………………………………………………………………

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22. Please indicate with a tick (√) the adequacy of the following teaching and learning materials in your school in the table provided below. The alternate choices are as follows:

More than enough (5)   Enough (4)   Not Enough (3)   Very few (2)   Not at all (1)

	Facilities and Resources	5	4	3	2	1
1	Teachers reference books and guides					
2	Students" textbooks					
3	Lockers/ chairs					
4	Classrooms					
5	Library/ laboratory					

23. Which of the disciplinary problem(s) exist in your school is so severe?
☐ Truancy   ☐ Lateness to class   ☐ Drug abuse   ☐ unnecessary movement to town
☐ Student leaving class before closing   ☐ others

24. What classroom related factors do you think contribute to poor performance of students in WASSC exams?
…...…………………………………………………….…………………
……...…………………………………………………….…………………

25. State at least three challenges that you face as a mathematics teacher in your school?
…...…………………………………………………………………………
……...…………………………………………………….…………………
……...…………………………………………………….…………………

Thank you for your cooperation.

…...…………………………………………………….…………………
…...…………………………………………………….…………………
……...…………………………………………………….…………………

…...…………………………………………………….…………………
…...…………………………………………………….…………………
……...…………………………………………………….…………………

APPENDIX III

STUDENTS QUESTIONNAIRE

Dear Student,

This questionnaire is for the purpose of writing a dissertation as a requirement for the award of Mphil in Mathematics Education at the University of Education, Winneba. This questionnaire is solely for academic purpose and all information given will be treated with utmost confidentiality. I therefore desire your objectivity and clarity to make this study a good one.

There are no wrong / correct answers.

Please respond to the questions by giving a very honest answer as much as possible.

SECTION A
Demographic Information

1. Gender ☐ Male   ☐ Female
2. Age   …………………… years.
3. The type of your school?
   ☐ Single Day school   ☐Single Boarding school   ☐ Mixed Day school
☐Mixed Boarding school

SECTION B: Factors influencing academic achievement

4. What is the relationship between students and their mathematics teachers in your school?
   ☐ Very good   ☐ Good   ☐ Averagely good   ☐ Poor   ☐ Very poor

5. Your academic ambition
   ☐ Finish SHS   ☐ Finish< College of Edu., Nursing College, Agric. College, HND>
   ☐ Finish first degree   ☐ Finish Second degree   ☐ I don't know

6. Does the learning of Mathematics make you confused and nervous?
   ☐ Agree a lot   ☐ Agree a little   ☐ Disagree a little   ☐ Disagree a lot   ☐ Not at all

7. Are you sometimes left without teachers in your classrooms? ☐ Yes ☐ No

8. About how many mathematics books are there in your home? (Do not count magazines, newspapers, or your school books.)
   ☐ None or very few [0-10 books]   ☐ Enough to fill one shelf [11-25 books]

☐ Enough to fill one bookcase [26-100] ☐ Enough to fill two bookcases [101-200]

9. How do you find mathematics as a subject?
   ☐ Very difficult   ☐ difficult   ☐ moderately difficult   ☐ not difficult

10. (a) Are there cases of teachers transfer from your school? ☐ Yes   ☐ No

    (b) If yes, (i) how often are they been transferred? ☐ Quite often ☐ Often ☐ Rarely

    (ii) When transferred, how often are they replaced?
         ☐ Quite often   ☐ Often   ☐ Rarely   ☐ Not at all

    (iii) How do the transfers affect performance of students in WASSCE?
    ……………...……………………………….......…………………………………
    ……………...……………………………….............…………………………………

11. Indicate the extent to which your school has the following physical facilities. The alternative choices are as follows:
    More than enough (5)   Enough (4)   Not Enough (3)   Very few (2)   Not at all (1)

	Physical facilities/Resources	5	4	3	2	1
1	Classrooms					
2	Lockers/Chairs					
3	Games facilities e.g. playgrounds, balls etc.					
4	Library / laboratory					
5	Dining hall					
6	School bus					
7	Students" textbooks					
8	Computers/Internet facility					

12. How often do teachers give you home assignment?
    ☐ Very often   ☐ Often   ☐Rarely   ☐ Very rarely

13. (a). How often do teachers mark your assignment?
    ☐ Quite Often   ☐ Often   ☐ Less Often ☐ Never
    (b) Do your teachers mark and give you feed back in good time? ☐ Yes ☐ No
    (c) Do you get time with your teachers to revise the assignments given? ☐Yes ☐ No

14. How does the head teacher ensure that teachers teach on daily basis?
    …………….……………………………….…………………………………………

…………………………………..……………………………………………

15. a) Do your parents visit you in school, check your work progress from your teacher?

☐ Yes   ☐ No

If yes, how often is it done?

☐ Once a term   ☐ Twice a term   ☐ Once in a year   ☐ Twice in a year

16. Does the head teacher check your exercise books?   ☐Yes   ☐ No

If yes, how often is it done? ☐ Twice a term ☐ Once a term ☐ Once a year ☐ Not at all

17. What is the general behaviour of students in your school?

☐ Very good   ☐ Good   ☐ Average   ☐ Fair   ☐ Poor

18. How does students" behaviour affect performance in WASSC exams?

…………………………………………………………………………………

19. In your opinion what three factors lower students" performance in your school?

…………………………………………………………………………………
…………………………………………………………………………………

20. What do you think could be done to improve students" performance in your school?

    …………………………………………………………………………………
…………………………………………………………………………………

21. Does your mathematics teacher available and accessible to student?

…………………………………………………………………………………
…………………………………………………………………………………

22. Does your mathematics teacher motivate you to learn the subject?

…………………………………………………………………………...…………………
…………………………………………………………………………....……………

23. How regular has your mathematics teacher come to class?

…………………………………………………………………………......…………
 …………………………………………………………………………....…………………

24. Does your mathematics teacher involve all students in active working class?

…………………………………………………………………………...……………………
…………………………………………………………………………....………………

25. Does your mathematics teacher give gift (money or materials) to good students for performing well?

……………………………………………………………………………………

Thank you for your cooperation

APPENDIX IV

MATHEMATICS ACHIEVEMENT TEST (MAT)

Dear student,

This questionnaire is for the purpose of writing a dissertation as a requirement for the award of Mphil in Mathematics Education at the University of Education, Winneba. This questionnaire is solely for academic purpose and all information given will be treated with utmost confidentiality. I therefore desire your objectivity and clarity to make this study a good one.

[100 MARKS]
__ANSWER ALL QUESTIONS FROM THIS TEST.__

1. Which of the following numbers is an irrational number?
   A. $0.0\dot{9}$ B. $\sqrt{25}$
   C. $2\sqrt{2}$ D. $\frac{1}{3}$

2. Which of the following sets of numbers is an integer (z)?
   A. $\{1, 2, 3 \ldots\}$ B. $\{0, 1, 2, 3 \ldots\}$
   C. $\{-1, -2, -3 \ldots\}$ D. $\{\ldots-2, -1, 0, 1, 2 \ldots\}$

3. What does $\{x:x\in R, -1 \leq x \leq 3\}$ represent of a number line?

   A.   B.
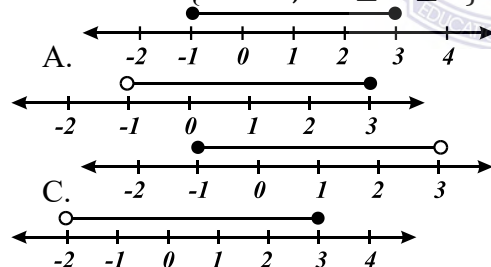
   C.   D.

4. How much is $\frac{5}{6}$ greater than $\frac{3}{4}$?
   A. $-\frac{1}{12}$ B. $\frac{1}{12}$
   C. $\frac{2}{3}$ D. $\frac{4}{5}$

5. Which of the following numbers corrects 29.995 to 1 (one) decimal place?
   A. 30.0 B. 29.9
   C. 29.0 D. 20.6

6. If $0.0000568 = 5.68 \times 10^n$, what is the value of n?
   A. 5 B. 4
   C. -4 D. -5

7. What is the sum of the following numbers 256_8 and 342_8.

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A. 598_8 B. 510_8
C. 620_8 D. 602_8

8. Convert 0.005854 to 2 significant figures
    A. 0.0058   B. 0.0059
    C. 0.0060   D. 0.0100

9. Simplify: $3\frac{1}{2} - 1\frac{1}{3} \times 2\frac{5}{8}$

    A. 0   B. $^{1}/_{2}$
    C. 1   D. 2

10. If $2\sqrt{5} + \sqrt{125} - \sqrt{45} + 4 = a + b\sqrt{c},\ evaluate\ (2a - b)$
    A. 8   B. 4
    C. 2   D. 0

11. A petrol tank will take a factory 30 weeks when it uses 150 litres per day. How many weeks will it take the factory if it decides to use 500 litres per day?
    A. 30 weeks   B. 25 weeks
    C. 15 weeks   D. 9 weeks

12. The nth term of the sequence 5, 8, …, is 383. Find n
    A. 125   B. 126
    C. 127   D. 124

13. If $3x - y = 5$ and $2x + y = 15$, evaluate $x^2 + 2y$.
    A. 29   B. 30
    C. 35   D. 42

14. What is the gradient of the line joining points (2, 5) and (5, 14)?
    A. 5   B. 4
    C. 3   D. 2

15. A car covers 180 m in $(t - 1)$ seconds and 324 m in $(t + 3)$ seconds. If it is travelling at a constant speed, calculate the value of t.
    A. 8   B. 6
    C. 5   D. 4

16. A ship sails 5km due west and then 7km due south. Find correct to the nearest degree, its bearing from the original position.
    A. 055°   B. 056°
    C. 215°   D. 216°

17. There are 20 men in a public bus. Of these, 15 wear glasses and 10 wear wrist watches. If one man is chosen at random from the bus, what is the probability that he wears both glasses and wrist watch?
    A. 1/5   B. ¼

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C. 3/5   D. ¾

18. Kwaku walked 8m up a slope and was 3m above the ground. If he walks 12m further up the slope, how far above the ground will he be?
   A. 4.5 m   B. 6.0 m
   C. 7.5 m   D. 9.0 m

19. The sum of the interior angles of n-sided polygon is 1620°. Find n
   A. 9   B. 10
   C. 11   D. 12

20. If $\frac{1}{2}p + q = 1$ and $p - \frac{1}{2}q = 7$. Find $(p + q)$
   A. -8 B. -4
   C. 4   D. 8

21. Given that P = {2, 4, 6, 7} and Q = {1, 2, 4, 8}. If a number is selected at random from $P \cup Q$, find the probability that it is only in set P.
   A. 2/3   B. $^1/_2$
   C. 1/3   D. 1/6

22. Simplify: $\sqrt{450} - \sqrt{200}$
   A. $25\sqrt{5}$ B. $25\sqrt{2}$
   C. $5\sqrt{2}$ D. $2\sqrt{5}$

23. A man spent ¼ of his monthly salary on rent, $\frac{2}{5}$ on food and $\frac{1}{6}$ on his children's education. What fraction of his salary is left?
   A. 11/60   B. 13/60
   C. 7/20   D. 19/30

24. If x is a whole number such that $2x + 1 = 4mod7$, find the least value of x.
   A. 2   B. 3
   C. 4   D. 5

25. A trader bought 5 bags of rice at GHS 210.00 each. If he sold them at a profit of 20%, what was the selling price per bag?
   A. GHS 175.00   B. GHS 230.00
   C. GHS 231.00   D. GHS 252.00

26. There are variables w, x and y such that x varies directly as w and inversely as the square of y. If $x = 4$ when $w = 3$ and $y = 6$, find the constant of variation.
   A. 20   B. 27
   C. 32   D. 48

27. Given that $2x + 3y = 6$ and $y - 3x = 1$, find the value of $(8x + y)$

A. 7
C. 5

B. 6
D. 4

28. Factorize $(m - n)(3m + 2n) - (m - n)^2$

   A. $(m - n)(2m - 3n)$
   C. $(m - n)(2m + 3n)$

B. $(2m - n)(m - n)$
D. $(2m + n)(m - n)$

29. Make z the subject of the relation $y = \sqrt{\frac{x+z}{x-z}}$

   A. $z = \frac{x(y^2+x)}{y^2-1}$
   C. $z = \frac{x(1-y^2)}{y^2+1}$

B. $z = \frac{y^2+1}{y^2+x}$
D. $z = \frac{x(y^2-1)}{y^2+1}$

30. A regular polygon has an interior angle of 108°. Find the number of its sides.

   A. 7
   C. 5

B. 6
D. 4

31. Find the equation of the straight line which passes through the point P(1, -5) and has gradient ¾.

   A. $3x - 4y - 23 = 0$
   C. $3x + 4y + 23 = 0$

B. $3x - 4y + 23 = 0$
D. $3x + 4y - 23 = 0$

32. The gradient of a line passing through the points P(6,7) and Q(x,8) is $\frac{1}{3}$.Find the value of x

   A. -3
   C. 9

B. 6
D. 12

33. If cos x = sin 39°, 0 < x < 90°, find x

   A. 39°
   C. 61°

B. 51°
D. 78°

34. Find the sum of the median and the range of these numbers: 6, 2, 4, 3, 8, 4 and 2

   A. 12
   C. 8

B. 10
D. 6

35. Out of the 20 girls in a class, 12 like music and 15 like movies. If a girl is selected at random from the class, what is the probability that she likes both hobbies?

   A. ¾
   C. $\frac{7}{20}$

B. $\frac{3}{5}$
D. $\frac{3}{10}$

36. If 23x + 101x = 130x , find x

   A. 7
   C. 5

B. 6
D. 4

37. Simplify $\left(\frac{3}{4} - \frac{2}{3}\right) \times 1\frac{1}{5}$

   A. $\frac{1}{60}$
   C. $\frac{1}{10}$

B. $\frac{5}{72}$
D. $1\frac{7}{10}$

38. Simplify $\left(\frac{10\sqrt{3}}{\sqrt{5}} - \sqrt{15}\right)$

A. 75   B. 15
C. 8.66   D. 3.87

Age (years)	13	14	15	16	17
Frequency	10	24	8	5	3

The table shows the ages of students in a club.
Use it to answer questions 39 and 40

39. How many students are in the club?

A. 50   B. 55
C. 60   D. 65

40. Find the median age

A. 13   B. 14
C. 15   D. 16

41. A fair die is thrown two times. What is the probability that the sum of the scores is at least   10?

A. $\frac{5}{36}$ B. $\frac{1}{6}$
C. $\frac{5}{18}$ D. $\frac{2}{3}$

42. The marks of eight students in a test are: 10, 4, 5, 3, 14, 13, 16 and 7. Find the range

A. 16   B. 14
C. 13   D. 11

43. If $\log_2(3x - 1) = 5$, find x.

A. 2.00   B. 3.67
C. 8.67   D. 11.00

44. A sphere of radius r cm has the same volume as a cylinder of radius 3 cm and height 4 cm, find the value of r.

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

45. Express 1975 correct to 2 significant figures

A. 20   B. 1900
C. 1980   D. 2000

46. The perimeter of a sector of a circle of radius 21 cm is 64 cm. Find the angle of the sector [Take $\pi = \frac{22}{7}$]

A. 70°   B. 60°
C. 55°   D. 42°

125

47. A bag contains 5 red and 4 blue identical balls. If two balls are selected at random from the bag, one after the other, with replacement, find the probability that the first is red and the second blue.

    A. 2/9   B. 5/18

    C. 20/81   D. 5/9

48. Find the next three terms of the sequence: 0, 1, 1, 2, 3, 5, 8, _, _, _

    A. 13, 19, 23,   B. 9, 11, 13

    C. 11, 15, 19   D. 13, 21, 34

49. Halima is n years old. Her brother's age is 5 years more than half of her age. How old is her brother?

    A. $\frac{n}{2} + \frac{5}{2}$ B. $\frac{n}{2} - 5$

    C. $5 - \frac{n}{2}$ D. $\frac{n}{2} + 5$

50. An object is 6m away from the base of a mast. If the angle of depression of the object from the top of the mast is 50°, find, correct to two decimal places, the height of the mast.

    A. 8.60 m   B. 7.83 m

    C. 7.51 m   D. 7.15 m

GOOD LUCK

APPENDIX V

INTERVIEW SCHEDULE

The following questions will be used to guide the researcher during interviewing sessions with some head of institutions and mathematics subject teachers as well as form three senior high school students in the selected Schools for the study.

1. What is your School type?

2. How often do teachers prepare professional documents in your school?

3. In your opinion, how is the general behavior of students in your school?

4. Are the physical facilities in your school adequate?

5. What are the school based factors that influence performance of students particularly in mathematics at WASSCE in your school?

6. What could be other causes of students" poor performance in mathematics in WASSCE in the northern region?

7. What is the disciplinary situation in your school in general?

8. What is the disciplinary situation in your school with regard to examination rules (malpractices)?

9. How far in your education do you expect to go?

10. What is your relationship with students you teach mathematics?