UNIVERSITY OF EDUCATION, WINNEBA

SENIOR HIGH SCHOOL STUDENTS‟ ATTITUDE TOWARDS MATHEMATICS AND PERCEPTION OF THEIR MATHEMATICS CLASSROOM LEARNING ENVIRONMENT

DANIEL APPIAH

2016

UNIVERSITY OF EDUCATION, WINNEBA

SENIOR HIGH SCHOOL STUDENTS‟ ATTITUDE TOWARDS MATHEMATICS AND PERCEPTION OF THEIR MATHEMATICS CLASSROOM LEARNING ENVIRONMENT

DANIEL APPIAH

A Thesis in the Department of MATHEMATICS EDUCATION, Faculty of SCIENCE EDUCATION, submitted to the School of Graduate Studies, University of Education, Winneba in partial fulfillment of the requirements for the award of the Degree of Master of Philosophy in Mathematics Education.

2016

DECLARATION

CANDIDATE DECLARATION

I DANIEL APPIAH DECLARE THAT THIS THESIS, WITH THE EXCEPTION OF QUOTATIONS AND REFERENCES CONTAINED IN PUBLISHED WORKS WHICH HAVE ALL BEEN IDENTIFIED AND 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 THE THESIS WERE SUPERVISED IN ACCORDANCE WITH THE GUIDELINES ON THE SUPERVISION OF THESIS LAID DOWN BY THE UNIVERSITY OF EDUCATION, WINNEBA

SUPERVISOR"S NAME:

SIGNATURE..... DATE.....

ACKNOWLEDGEMENT

First, I want to thank God for the opportunity given me to offer this course at the University.

I am very grateful to my supervisor, Professor C. A. Okpoti, whose direction and guidance this work has been a reality. I would sincerely like to express my heartfelt gratitude to him, for his patience, many in-depth constructive criticisms and valuable suggestions, which immensely contributed to the success of this work. God richly bless you.

I am also grateful to my lecturers Professor S. K. Asiedu-Addo (Dean, Faculty of Science), Professor D. K Mereku (Head of Department), Dr. C.K. Asuah, Dr. M. J. Nabie, all of the Department of Mathematics Education, UEW whose tuition and great thoughts have brought me this far in my academic ladder. My sincere thanks also goes to Helen Edzeani, Thomas Mensah-Wonkyi and Elizabeth Adu for their tremendous support in offering the needed information.

To my M.Phil. Mathematics 2014 colleagues, I say God bless you for your company and support.

DEDICATION

This thesis is dedicated to my father, Emmanuel Appiah, mother, Elizabeth Appiah, wife, Hameeda Haruna Appiah and sons, Fedellah Appiah, Fazar Appiah and Nayar Appiah.

Table of Contents

List of Tables

List of Figures

ABSTRACT

This study investigated senior high school students‟ attitude towards mathematics and how they perceive their mathematics classroom learning environments. Two-hundred (200) participants from five senior high schools (School A, B, C, D and E) in the Cape Coast Metropolis in the Central Region of Ghana consisted of the sample size. A descriptive survey design was used with a Mathematics Classroom Learning Environment Inventory (MCLEI) and Mathematics Attitude Questionnaire (MAQ) as data collection tools. The MAQ was given to senior high school students to identify their attitude towards mathematics. The results indicated that the senior high school students exhibited negative attitude towards mathematics. The MCLEI was also given to senior high school students to identify their perception of their mathematics classroom learning environment. The results also indicated that the senior high school students perceived their mathematics classroom learning environment positively. A correlation analysis performed identified a moderate positive significant relationship, $r\ (200) = .000\ p < .05$, two–tailed between the senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment. It was therefore recommended that mathematics educators at the high level of education, especially, at the senior high school, should implement teaching strategies that will improve upon their students‟ positive attitude and perception of their mathematics classroom learning environment.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter provides an introduction to the study. It discusses the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, delimitations, significance of the study, and organization of the study.

1.1 Background to the Study

Mathematics has become a compulsory subject up to a certain academic levels in almost every nation of the word. The need of people for reckoning in everyday life has caused a change in their attitude towards Mathematics. Herbert (1978) describes mathematics as the Queen and Servant of all the science subjects. It supports the learning of science subjects like Physics, Chemistry, Biology and Economics. Students‟ mathematical achievements in secondary school have an influential effect on their performance in school and their future careers. Having a solid background in mathematics helps students develop sophisticated perspectives and offers more career options. The mastery of mathematics is a key literacy component that influences children‟s success in education and in future society (Engle, Grantham-McGregor, Black, Walker, & Wachs, 2007). The focus on mathematics learning and mathematics ability development has been a recurrent topic in educational and psychological studies for over 100 years (Geary, 2006).

Asiedu-Addo and Yidana (2000) assert that mathematics builds individual‟s reasoning and problem solving abilities, and also develops his/her personal qualities which include

confidence, diligence, perseverance and cooperation. Students‟ achievement may be influenced by perception and attitude towards mathematics. Teaching of Mathematics and also Mathematics classroom learning environment hold valuable concern in the present era. Numerous research have been undertaken to investigate trends in mathematics achievement and the factors influencing mathematics learning and performance (Ma & Klinger, 2000; House & Telese, 2008). However, despite the importance placed on mathematics, it is very disappointing to note that students‟ performance in the subject at both internal and external examinations has remained consistently poor (Anamuah-Mensah & Mereku, 2005).

Teaching of Mathematics in the classroom requires certain types of specific roles and responsibilities of the teachers resulting in a particular learning environment. Such learning environment may shape attitudes that can differ from that of Co-ed situation. The quality of education depends upon not only the subjects taught and the level of achievement, but also on the learning environment of the particular class. Behavior of students may be reflected or influenced by the environment within or outside the school. The notion of classroom learning environment has been studied since the 1930s (Vacha, 1977; Goh & Fraser, 1998; Maat & Zakaria, 2010). According to Fraser (1998), previous researches have revealed that quality of classrooms‟ environment significantly influences students‟ learning and performance in mathematics.

The classroom is a place where students and teachers interact with one another and use different instructional tools, information and sources for learning activities (Wilson, 1996). Like many other aspects of social sciences, it is difficult to define the term „learning environment‟ precisely and accurately because it may vary according to

prevailing contexts, demographic situation and social norms. Learning environment usually consists of some observable characteristics such as school buildings, instructional tools, learning attitude of the students, teaching aptitude of the teachers and interactions among the learners and instructors (Brophy, 1999; Fraser & Walberg, 1991; Moos, 1979). Dorman (2002) defines it as the atmosphere, ambience, tone, or climate whereas; Henderson, Fisher, and Fraser (2000) confine it to only one aspect i.e. psychosocial classroom learning environment. Classroom learning environment is not a single entity but a combination of different aspects. Some important aspects like teacher support, student cohesiveness, involvement, co-operation, task orientation, and equity may help in developing positive classroom learning environment (Fraser, 2002).

In Ghana, teacher support is an important feature of classroom learning environment. It is the degree to help, trust and interest of the teachers for the students. Rawnsley and Fisher (1998) conclude that, students show positive attitude towards Mathematics when their teacher is supportive and cooperative. Also, students depend upon the supportive teachers who build up feelings of control and confidence among their students to learn in the class properly. The teacher‟s disposition affects the students‟ perception to modify their attitude.

Not-withstanding, student involvement is also a major component of classroom environment in Ghanaian Senior High Schools. It is the degree of participation of the students in discussions that enhances their work capacity and enjoyment. According to Huang and Waxman (1995), in single-sex classrooms female show more involvement, attentiveness, affiliation with their peers, and enjoy their Mathematics class more than males. Mobeen-ul-Islam (2012) stipulates that, cooperative and equity based classroom

learning environment is positively correlated with students‟ attitude towards Mathematics. This shows that students‟ achievements in Mathematics may be enhanced by cooperation and equity.

Not only does classroom learning environment affect Senior High School students mathematical achievement, it also affects their attitudes towards mathematics. Different researchers define different aspects of attitude. Ramsden (1998) states that, researchers use words like attitude, interest and motivation for different emotional states of human mind. There are different factors that affect the students‟ attitude towards mathematics. Some of these factors include parental and teacher support, societal factors, and the students‟ stimulus in general. In the same way, attitude is also described as the positive or negative degree of effect that is related to a specific subject McLeod (1992). It means that students‟ Mathematics related attitude is a positive or negative emotional disposition (Haladyna, Shaughnessy & Shaughnessy, 1983; McLeod, 1992). A review of school–based educational research has revealed that the majority of Ghanaian secondary school students find mathematics as the most difficult, abstract, deadly and boring subject (Amirali, 2010). In view of that, analysis of students‟ attitude towards mathematics, mathematics learning and their implications for mathematical instructions has long received attention from both mathematics educators and mathematicians. In particular, the relationship between attitudes towards mathematics and achievement in mathematics has traditionally been a major concern in mathematics education research (Lianghuo, 2005).

In Ghanaian context, student-teacher relationship, the fear harbored by many students in mathematics, the psychosocial of students‟ perception of their learning environment, and

the fact that perception influences human behavior as cited by Tel in (Ampiah, 2006.); (Eshun 2000) among others have all been hypothesized as the impediment to the teaching and learning of mathematics as far as students under achievement in mathematics is concerned. According to Asoma (2014), these influences in classroom practices may form a particular Ghanaian mathematics classroom culture that may in turn cause Ghanaian students to perceive their mathematics classroom learning environment differently.

1.2 Statement of the Problem

Ghanaian Senior High School students find mathematics as the most difficult, abstract and boring subject with its roots from the Junior High schools.

Globally, several studies and researches have been carried out in many countries to find the factors that influence students‟ achievement in mathematics. Among these factors, students‟ attitude towards mathematics and perception of their mathematics classroom learning environment emerges as the most important factors that have been consistently studied (Tahar, Ismail, Zamani & Adnan, 2010; Tezer & Karasel, 2010). For instance, Hammouri (2004) in a study of the effects of student-related variables on achievement in mathematics of 3736 Jordanian 8th-graders reports attitude as being among the effective variables that led to variation in mathematics achievement of the students. In Singapore, Goh, Young and Fraser (as cited in Fraser; 1998) notice associations between classroom environment and attitude based upon the perceived patterns of teacher-student interaction using 1,512 primary mathematics students in 39 classes. Furthermore, in Australia,

Fisher, Henderson and Fraser (as cited in Fraser, 1998) shows an association between students‟ outcomes and perceived patterns of teacher-student interaction.

In Africa, the situation is no different. Borasi (1990) reports that the conceptions, attitudes and expectations of African senior high school students regarding mathematics and teaching of mathematics are very significant factors underlying their school experience and subsequent achievement in the subject. In accordance with this notion, Hannula (2002) states that, the everyday notion of attitude refers to someone's basic liking or disliking of a familiar target, and that attitudes tend to become more negative as pupils move from elementary to secondary school. According to Schenkel (2009), the degree of affect associated with mathematics; i.e. attitude is the emotional disposition toward mathematics. Senior high school students who are anxious may avoid mathematics classes, and may be more likely to have negative perceptions and attitudes toward mathematic related activities.

Ghana is no exception from senior high school students‟ poor achievement in mathematics (WAEC 2011 & 2012), Over the years, Chief Examiner‟s report for the West African Examination Council (WAEC) in mathematics indicated that performance of students in mathematics had been rather weak (WAEC, 2012, 2010). These remarks from the chief examiners are a clear indication that some senior high school students have negative attitude and perception towards mathematics. Junior high school students who enter the senior high schools already have a negative attitude and perception concerning mathematics (Asoma, 2014), which at the long run manifest at the senior high school

level. In Ghana, some mathematics teaching and learning environments are unfavourable, or even „„impoverished"". Compared with small class sizes in most of the Western countries, class sizes are normally larger than 50 students in Ghana (Ministry of Education, 2013) which do not foster quality classroom learning environment.

Even though, several studies reported in the literature for Africa and beyond as well as Asoma (2014) in the Cape Coast Metropolis in Ghana reveals a positive correlation between students" attitude and perception for Junior high school students. Since it is these same students who enter the senior high school, there is therefore the need to explore senior high students" attitude towards mathematics and how they perceive their mathematics classroom learning Environment

1.3 Purpose of the study

The purpose of the study was to explore senior high school students" attitude towards mathematics and perception of their mathematics classroom learning environment.

1.4 objectives of the study

The objectives of the study were:

- To explore senior high school students" attitudes towards mathematics.
- To explore senior high school students" perception of their mathematics classroom learning environment.
- To investigate the relationship between senior high school students" attitudes towards mathematics and perception of their mathematics classroom learning environment.

1.5 Research Questions

The following research questions guided the study.

1. What attitudes do senior high school students hold toward mathematics?
2. What perception do senior high school students have about their mathematics classroom learning environment?
3. What relationship exist between senior high school students‟ attitude towards mathematics and perception of their mathematics classroom learning environment?

1.6 Significance of the Study

The significance of the study to policy makers, mathematics teachers and students are discussed below;

Significance to policy makers:

This study will provide useful information about what emphasis mathematics policy makers at the senior high schools would place on students‟ attitudes and perceptions towards mathematics to enhance effective teaching and learning of the subject at the secondary level. In addition, it will serve as a base-line study for policy makers in mathematics education to carry out other research work in a similar area.

Significance to mathematics teachers:

The study will assist mathematics teachers at the senior high school level to be aware of the effect of attitude and classroom learning environment on students‟ achievement in mathematics to design appropriate methodologies to enhance achievement in mathematics. It will also encourage mathematics teachers to vary their teaching style to be able to teach a concept (in mathematics) better to make learning easier.

Significance to students:

The study will help senior high school students to understand the importance of attitude towards mathematics. This will encourage them to develop positive attitude towards the subject to cause higher achievement.

1.7 Delimitations

The study was restricted to only five senior high schools within the Cape Coast Metropolis in the Central Region of Ghana because of time and proximity. It was also delimited to only final year students of those selected senior high schools. This was because the final year students have been exposed to almost all the contents in the mathematics curriculum and will be the best to respond to the questions on their perception and attitude towards the subject.

1.8 Organization of the Study

The study is organized in five different chapters consisting the following:

Chapter one discusses background of the study, statement of the problem, purpose of the study, research questions, significance of the study, delimitations and finally, organization of the study. Chapter two discusses review of the related literature on the study. Chapter three describes the methodology which comprise the research design,

population and sampling, research instruments, data collection procedure and data analysis plan. Chapter four discusses the results and discussion, while chapter five addresses the summary, conclusion and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter discusses review of related literature to the study. Thematic areas include theoretical framework, influence of perceptions of classroom environment on learning, "what is happening in this classroom instrument", classroom environment findings, attitude towards mathematics, empirical review of attitude research, classroom environment and attitude research findings and a summary.

2.1 Theoretical Framework

Several theories have been proposed in an attempt at explaining the process of change, which occurs in students" attitudes, and perception that affects their performance. Some of these theories include the Cognitive Dissonance Theory, the Yale Attitudinal Change Theory and the Group Dynamic Approach.

2.1.1The Cognitive Dissonance Theory

Festinger (1951) discovered the theory of Cognitive Dissonance. The word cognitive refers to the mind or thinking and Dissonance refers to a psychological conflict or inconsistency. Thus, Cognitive Dissonance is a psychological conflict from holding two or more incompatible beliefs of something. According to Festinger (1951), Cognitive

dissonance produces a feeling of discomfort leading to an alternation in attitudes. In this context, students may have cognitive dissonance towards a particular course of study leading to a change in performance. According to Festinger (1951), students can also change their attitude when they have conflicting beliefs about a topic. This is because students hold much cognition about the topics in mathematics which therefore evokes discrepancy resulting in a state of tension known as cognitive dissonance. Therefore, when students are forced to do something they really did not want to do; dissonance is created between their cognition and their behavior. In this context, Students who have such beliefs in mathematics feel they are being forced to comply with the study of that course at all cost.

2.1.2 The Yale Attitudinal Change Theory

The Yale Attitudinal change approach is the social psychological study of the condition under which people are most likely to change their attitudes. This theory was propounded by Philip Zimbardo at Yale University in the year 1991. Zimbardo (1991) defined attitudes as an evaluative disposition towards some object based upon cognitions and affective reactions that can change. He went on to say attitudes are latent and not directly observable. They are related to how people perceive the situations in which they find themselves. Attitudes vary in direction (either positive or negative) and intensity (the amount of commitment with which a position is held). This means that in this case, students‟ attitude towards mathematics changes differently in direction and intensity. The evaluative disposition that students have towards mathematics influences their attitudes and perception in the subject.

2.1.3 The Group Dynamic Approach

Homens (1992) propounded the Group Dynamic Approach. He defined a group as several individuals who come together to accomplish a particular task or goal. Group Dynamic refers to the attitudinal and behavioral characteristics of a group that is, their form, structure, process and function (Cherrington, 1994). Greenberg and Baron (2000) went on to say in an organizational setting such as schools, groups are very common. Groups develop based on sentiments, activities and interactions and basically when individuals share common activities. In this case, Senior High School Students share common attitude toward mathematics and this affects their perception in the subject.

2.2 Conceptual Framework

Several concepts are deduced and explored in relation to this study, thus, senior high school students‟ attitude towards mathematics and perception of their mathematics classroom learning environment. Below are some of them.

2.2.1 Attitudes Defined

This is a term frequently used in the field of Social Psychology. The word “attitude” is traced back to the Latin word “aptitude” meaning “fitness”, thus negative or positive mental and emotional positions people have towards certain facts or situations (Giambra, 2003). These mental and emotional positions towards something (attitudes) are formed as a result of experience or observation. According to the classic tripartite view offered by McGuire (1969) an attitude contains Cognitive, Affective and Behavioral structure. However, it should be noted that attitudes change because of either favorable or unfavorable beliefs or feelings that one holds toward an event or a situation (Smith and

Mackie, 2007). In this context, it refers to either negative or positive mental and emotional positions that students have towards mathematics. Psychologists such as Wood (2000) defines attitude is a positive or negative evaluation of people, events, activities, ideas or just about anything in your environment. This means that students have either a negative or a positive evaluation of the Subject in which they study.

2.2.2 Structure of Attitudes

According to McGuire (2001), attitudes can be divided into three structural components namely: The Cognitive component, Affective component and the Behavioral component. He goes on to explain the structure of attitudes as follows:

- **Cognitive component**.

  This refers to our thoughts, beliefs and ideas about something. This is said to be the opinion or belief segment of an attitude. In this context, students seem to hold certain thoughts, beliefs and ideas about the mathematics they study. These thoughts, beliefs, and ideas may be influenced by an external aspect to become negative or positive and they then influence behavior leading to good or poor perception of the subject.

- **Affective component**

  This is referred to as the feelings or emotions that something evokes. For example, fear, anger, hate and so on. This is also referred to as the emotional or feeling segment of an attitude. Therefore, students are influenced to hate mathematics as they perceive it to be difficult and as such do not take it serious.

- **Behavioral component**

This is the tendency to act in certain ways towards something. This is referred to as the action segment of an attitude. This is the extrinsic and observable component of attitudes that can help tell if an attitude is negative or positive. Thus Ghanaian students in this case seem to act negatively towards mathematics as evidenced by the West African Examination Council (WAEC) Chief Examiners report 2011 and 2012.

2.2.3 Attitude Formation

Myers (1999) propounds that attitudes form directly as a result of experience and may emerge due to direct personal experience or they may result from observation. In this case attitudes are being formed as a result of personal experience as each and every student is affected by their perception of mathematics. Liska (2001) went on to say that attitudes are created by first creating beliefs and student‟s beliefs are the knowledge that a student has about a particular course or subject. She elaborated that, student‟s beliefs are created by processing information – cognitive learning. Thus, in this setting student have their attitudes formed as a result of the knowledge they have about mathematics which might be negative or positive. According to Smith and Mackie (2007) the same influences that lead to attitude formation can also create attitude change. Thus, through experience, or observation.

The development of students‟ positive attitudes towards mathematics is a key intended outcome of mathematics curriculum at each grade level in most countries (Leung, 2006). In the literature, students‟ attitudes towards mathematics have been described as an important factor which will hinder or facilitate their mathematical learning and engagement (Hemmings, Grootenboer, & Kay, 2011). McLeod (1992) argued that

attitude towards mathematics is an important variable for predicting students‟ performance in other affective domains as well as mathematics achievement. Studies in educational psychology and mathematics education have identified strong relationships between attitudes and cognition, motivation, and mathematics achievement (e.g., Hannula, 2002; Muis, 2004).

The main factors that play a vital role in influencing students‟ attitudes towards mathematics are associated with the students themselves; the school, teachers, and teaching; and home environment and society (Mohamed & Waheed, 2011). Since teaching is a main factor, it is reasonable to conjecture that mathematics classroom learning environment is an also important for the development and change of students‟ attitudes toward mathematics. Indeed, Moos (1979) argued several decades ago that "the social ecological setting in which students function can affect their attitudes and moods, their behavior and performance and their self-concept and general sense of well-being" (p. 3). Since then, there has been an increasing interest to develop and employ instruments to assess students‟ perceptions of their classroom learning environments (e.g., Fraser, 1998, 2007, 2012). The strongest tradition in classroom learning environment research relates to the investigation of associations between students‟ perceptions of the psychosocial characteristics of their classrooms and their cognitive and affective outcomes (Fraser, 2012). This tradition has been extended to mathematics education in the recent years. Researchers from various backgrounds have investigated these associations in mathematics learning (Majeed, Fraser, & Aldridge, 2002) and academic efficacy (Dorman, 2001). For example, in Australia, Forgasz (1995) found that students who scored high in participation and investigation in mathematics class tend to

have high scores on confidence in mathematics and usefulness of mathematics, and Webster and Fisher (2003) found a significant and positive effect of instructional practices on secondary school students‟ attribution of success. A study in the U.S. (Ogbuehi & Fraser, 2007) identified a positive relationship between learning environment and attitudes towards mathematics at the middle school level. In Singapore, Goh and Fraser (1998) found that primary school students who perceived to have more student cohesiveness in their lessons tend to have more positive attitudes towards mathematics. At Grade 10 level in Singapore, students tend to have more positive attitudes if they perceived more support from their teachers and were treat equally by their teachers in mathematics class (Chionh & Fraser, 2009).

2.2 Classroom Learning Environment

According to Fraser (2012), classroom learning environment includes not only the physical space, but also the social, psychological and pedagogical contexts in which learning and teaching occur, and which in turn affect students‟ affective and cognitive outcomes. To Taylor (2004), classroom environment involves the shared perceptions of students and teachers in a particular environment. From Fraser‟s explanation, the learning environment is seen to be created by two main actors namely; the teacher and students who interact to form the climate. He further indicated that people in this learning environment are socially active people who do not only interact but more importantly react to whatever is going on around them. The environment in which an individual finds himself or herself plays an important role by influencing his or her educational outcomes. Classroom environment is not formed by an individual but rather all the people who find themselves in the classroom. These people play a complementary role in order to create

an atmosphere that promotes teaching and learning. Although the learning environment is seen as a crucial element as far as teaching and learning is concerned, Fraser (2007) cautions that it should be seen as one of the most important factors in a multifactor psychosocial model of educational productivity. Fraser (2007) proposed a model which holds that "learning is a multiplicative, diminishing-returns function of the following: student"s age, ability, and motivation, the psychosocial environments of the home, and the classroom, the peer group, and the mass media.

From the model, it was noted that if any of the factors is at zero point, then in principle, learning cannot take place. Also, it is always better to improve upon a factor that serves as a constraint to learning than to seek to raise a factor that is already high. However, in order to determine which of the factors is dominant in the learning process, it is expedient to examine each of these factors and that is the reason why the classroom environment is the focus of this study. Since the classroom environment has been identified from empirical studies to be one of the major factors as far as learning is concerned, it is therefore important to determine the factors that militate against the smooth operation of teaching and learning in the mathematics classroom environment to ensure that effective learning takes place.

Although classroom environment is perceived to be a subtle concept as a result of the multiplicity of factors that operate in there, this environment can be assessed and studied. Moos (as cited in Brok, Fisher & Waldrip, 2005), for example, identified three general dimensions into which all learning environment research should address, namely;

- relationship dimension which identifies the nature and intensity of personal relationship within the environment and assesses the extent to which people are involved in the environment and support and help each other.
- Personal development dimension which assesses personal growth and self-enhancement and
- System maintenance and system change dimension which involves the extent to which the environment is orderly, clear in expectations, maintains control, and is responsive to change.

Moos‟ categorization has helped a great deal as to what learning environment research should focus on and the subsequent development of instruments to address these three dimensions. In developing the mathematics classroom learning environment inventory (MCLEI), Moos‟ three dimensions informed the choice of the various subscales.

2.3 Students‟ perception about their mathematics learning environment

In Ghana, students‟ rating of teachers‟ instruction are widely used in colleges and universities. However, there are limited studies which have investigated teachers teaching practices by examining students‟ perceptions of their teacher‟s teaching at the basic and secondary education level. How individuals perceive an object, a person or the environment in which they find themselves has quite often tended to influence their subsequent behavior. Fisher and Webster (2003) noted that the social ecological setting in which students function could affect their attitudes and moods, their behavior and self-concept and general sense of well-being. These findings give an indication that how an individual perceives the learning environment may have certain consequences on the

individual‟s subsequent behavior and his achievement. According to the Theory of Reasoned Action (Ilevbare, 2008), "attitude is an independent measure of affect for or against the attitude object, which is a function of belief, strength and evaluative aspect associated with each attribute" (p.123). What this means is that any attempt to improve students‟ achievement in mathematics must take into account the classroom environment since the classroom environment can serve as an attitudinal object.

Results of studies conducted in the past three decades provided convincing evidence that the quality of classroom environment in schools is a significant determinant of student learning achievements (Fraser, 1994, 1998 as cited in Murugan, 2013). Past research in Indonesia by Margianti, Fraser and Aldridge (2001), Singapore (Fraser & Chionh, 2000; (Goh & Fraser, 1998) and (Riah & Fraser, 1998 as cited in Murugan, 2013) support this general view. These studies suggest that students learn better when they perceive the classroom environment positively.

In various studies, students‟ perceptions of the classroom environment accounts for appreciable amounts of variance in learning outcome, whereby this is due to factors beyond the student background characteristics. O‟Reilly (1975) as cited in (Murugan, 2013) investigated the relationship between achievement and classroom environment in 48 mathematics classes in Ontario and found that the set of 15 Learning Environment Inventory Scales (Fraser, 1987) as cited in (Murugan, 2013) accounted for 67% of variance in raw achievement scores. Fraser (1994) as cited in (Murugan, 2013) cites two meta-analysis researches which link environmental dimensions with achievement. He found that better achievement on a variety of outcome measures consistently in classes

perceived as having greater cohesiveness, satisfaction and goal direction and less disorganization and friction.

2.4 Influence of Perceptions of Classroom Environment on Learning

How individuals perceive an object, a person or the environment in which they find themselves has quite often tended to influence their subsequent behaviour. Attribution Theorists for instance are of the view that how an individual perceives causality have consequences on the individual‟s perceptions (Webster & Fisher, 2003). Attribution theory seeks to explain how an individual understands and reacts to personal achievement, that is, the factors that the individual judges to have influenced him or her be it internal or external. Furthermore, Webster and Fisher (2003) noted that "the social ecological setting in which students function can affect their attitudes and moods, their behavior and self-concept and general sense of well-being" (p.311). These findings give an indication that how an individual perceives the learning environment may have certain consequences on the individual‟s subsequent behaviour.

Furthermore, Goal Theorists indicate that the learning environment can have influence on learning goals and targets and assessment procedures as far teaching and learning is concerned. Goal theorists postulate that instructional practices, and the nature of educational tasks and assignments, can promote either mastery or helpless motivational patterns, which can have profound influence on student achievement (Mucherah, 2008). The net effect of this theory is that whether the learning environment is perceived as either positive or negative may influence the participants in the learning environment.

Studies conducted to determine the influence of learning environment on students seem to point to the idea of cause and effect relationship between learning environment and student behaviour as well as the teaching and learning process. Webster and Fisher (2003) have reported the influence of the learning environment on how teachers present the school curriculum. In their study conducted in 57 Australian secondary schools involving 620 teachers and 4,645 students, they reported that the way in which curriculum is presented by teachers is directly proportional to how they perceive the learning environment at the school level ($\gamma = 0.476$). They reported further that the more positive the learning environment was with regards to Affiliation, Professional Interest, Empowerment and Innovation, the more teacher-directed the instructions were presented in the classroom. In giving further support to the influence perception has on learning environment, Brekelmans, Sleegers and Fraser (2001) reported from their investigation of the relation between students‟ perceptions of teacher-student relationship that stronger perceptions of teacher influence increased according to the degree to which teachers got their students to be involved in the teaching-learning activities. Furthermore, Fraser and Kahle (2007) in a secondary analysis of data obtained from 7,000 students in 392 classes in 200 different schools concerning their perceptions of three environments; class, home, and peers as well as students‟ attitude reported that all three environments accounted for statistically significant amounts of unique variance in students‟ attitude.

2.5 Learning Environments Research

Research involving classroom learning environment has typically moved away from the use of a detached observer to describe the environment to a milieu of inhabitants. This movement towards the use of the main actors in the classroom, that is, students and

teachers is not without support. Fraser and Tobin (1991) argue that students are the best judges of their classroom environment since they are at an advantage position to make judgment having gone through varying learning environments to form an accurate impression. From Fraser and Tobin‟s argument, this study focused on how junior high school pupils in both form two and three in their mathematics classroom perceive their learning environment. This is because they have been in the mathematics learning environment for quite a long time and since perception takes a long time to be formed, they would be able to give an accurate account of whatever goes on in their classrooms based upon their experiences in different learning environments.

Earlier research studies involved the development and validation of instruments such as: learning environment inventory (LEI), classroom environment scale (CES), my class inventory (MCI), constructivist learning environment (CLE) and what is happening in this Class (WIHIC) questionnaires (Fraser, 1998; Taylor, 2004).

2.6 Classroom Environment Findings

Haertel, Walberg and Haertel (as cited in Fraser, 2007) in their studies concerning classroom environment comprising 17,805 students, revealed that, a variety of students‟ outcome measures were consistently higher in classes that were perceived as being high on cohesiveness, satisfaction and goal-direction and with relatively smaller amounts of disorganization and friction using the My Class Inventory (MCI) instrument. In another study conducted in Singapore by Goh, Young and Fraser (as cited in Fraser; 1998) using a sample of 1,512 primary mathematics students in 39 classes established associations between the classroom environment and attitude based upon the perceived patterns of

teacher-student interaction. Furthermore, in a study conducted in Australia by Fisher, Henderson and Fraser (as cited in Fraser, 1998) Involving 3,994 high school science and mathematics students using the Questionnaire on Teacher Interaction (QTI) reported associations between students‟ outcomes and perceived patterns of teacher-student interaction.

Aldridge, Fraser and Huang (1999), in their study of the ninth-grade mathematics learning environment in Hong Kong, reported that many students identified the teacher as the most crucial element in a positive classroom environment. These teachers, the report revealed, kept order and discipline while creating an atmosphere that was not boring or solemn. The influence teachers exert on students is further captured in a study conducted by Wubbels and Brekelmans (2005). The two researchers investigated students‟ and teachers‟ perceptions of the teacher-student relationships in secondary school classrooms and reported that teacher-student relationship appropriate for high student outcomes are characterized by a high degree of teacher influence and proximity towards students.

2.7 What Is Happening In this Classroom Instrument (WIHIC)

Questionnaires measuring students‟ or teachers‟ perceptions have been the most commonly-used method of assessing classroom learning environments (Fraser, 2012). Due to the importance of classroom learning environment, mathematics education researchers also have recently begun to investigate students‟ perceptions of their classroom learning environments using adaptations of instruments widely used in science education. The WIHIC instrument originally comprised eight scales but has been revised to seven scales and 56 items with eight items under each scale (Taylor, 2004). The

modified scales are: **p**upil cohesiveness, **t**eacher support**,** involvement**, i**nvestigation**, t**ask orientation**, c**ooperation and **e**quity.

While a "preferred" and an "actual" form of the instrument have been developed, in carrying out this study, the "actual" form of the WIHIC which serves as a guide in developing mathematics classroom learning environment inventory(MCLEI) was adopted from a modified form by Asoma (2014). This is because the "actual" form helps the researcher to identify the perceptions of the subjects involved in the study regarding the learning environment within which they are presently located. The "preferred" form on the other hand requires the respondents to indicate how they wish their classroom environment was; unlike the "actual" where they indicate how they perceive their present learning environment to be which is what this study sought to do, that is, find out how the respondents perceive their mathematics classroom environment to be.

Although the WIHIC instrument has seven scales, the mathematics classroom learning environment inventory (MCLEI) adopted from Asoma (2014) comprises five scales out of these seven, namely; pupil cohesiveness, teacher support, involvement, cooperation and equity.

2.8 Students Attitude towards Mathematics

Attitude has been defined in several ways by different researchers in the field. In his review of attitudinal studies, Reid (2006) reports that there are as many definitions of the term "attitude" as there are researchers. This situation he attributed to the difficulty associated with attempts aimed at providing a concise definition of the term "attitude" which has proved quite elusive. Koballa and Glynn (2007) define attitude as "a general

and enduring positive or negative feeling about some person, object, or issue" (p.6). This definition implies that attitude is always formed towards something or a person based upon how an individual perceives it and can be towards a subject of study or a teacher as in a classroom situation.

Neale (as cited in Ma & Kishor, 1997) defined attitude towards mathematics as an aggregated measure of "a liking or disliking of mathematics, a tendency to engage in or avoid mathematical activities, a belief that one is good or bad at mathematics, and a belief that mathematics is useful or useless" (p.27). From the definition offered by Neale, attitude is seen to be formed as a result of a multiplicity of factors which together influence the individual"s subsequent behaviour either positively or negatively.

Eshun (2000) defined attitude towards mathematics as "a disposition towards an aspect of mathematics that has been acquired by an individual through his or her beliefs and experiences but could be changed" (p.2). His definition implies that attitude is not all that permanent a situation which has been suspected all along. What is not known are the experiences which students can be taken through to positively shape their attitude towards mathematics? Di Martino and Zan (as cited in Hannula, 2002) looked at two basic approaches to defining attitude towards mathematics:

1. A "simple"" definition describes it as the degree of affect associated with mathematics; that is, attitude is the emotional disposition towards mathematics. This definition looks at attitude in terms of affect (emotions) ignoring other aspects of the term such as one"s perceptions, etc.

2. The second definition looks at attitude in terms of three components; emotional response, beliefs, and behaviour as components of attitude. Attitude towards mathematics has been studied with regards to finding associations between the construct and other variables of interest such as anxiety and achievement. Implicit in much of this research is the assumption that positive affect might lead to positive achievement and behaviour (McLeod, 1992).

For the purposes of this research, attitude towards mathematics is defined as the individual‟s propensity towards mathematics as a discipline that has been acquired consciously or unconsciously through his or her interaction and which through a well-informed deliberate process could be reversed. These weaknesses may be an attestation to one‟s perception of the learning environment and its consequent affect (emotions) attached to the study of mathematics.

The everyday notion of attitude refers to someone‟s basic like or dislike of a topic or idea. Attitude is a behavior that is measured by various evaluative processes. For example, the Minnesota Research and Evaluation Project identifies the following factors pertaining to attitude: attitude toward mathematics, anxiety toward mathematics, self-concept in mathematics, motivation to increase mathematical knowledge, perception of mathematics teachers, and the value of mathematics in society (Ellington, 2003). The Attitudes Toward Mathematics Inventory (Tapia & Marsh, 2004) investigates other areas of attitude toward mathematics. Specifically, it assesses confidence, anxiety, value, enjoyment, and motivation. Confidence measures students‟ confidence and how they perceive their performance in mathematics. Anxiety measures feelings of anxiety and the outcomes of those feelings. The value of mathematics refers to the students‟ beliefs on

the usefulness, relevance, and worth of mathematics in their personal and future professional lives. Enjoyment of mathematics measures how much students enjoy working with mathematics and attending mathematics classes. Motivation measures the interest a student has in mathematics and the desire to take more mathematical courses (Tapia & Marsh, 2004). Attitude can also be seen as an emotional disposition toward mathematics. This definition has four components: "1) the emotions the student experiences during mathematics related activities; 2) the emotions that the student automatically associates with the concept „mathematics"; 3) evaluations of situations that the student expects to follow as a consequence of doing mathematics; and 4) the value of mathematics-related goals in the student"s global goal structure" (Hannula, 2002, p. 26). This section discusses some of the factors that influence the attitudes of mathematical students. Research shows that attitudes can be changed when these factors contributing to the negative attitudes are addressed. However, the influence of instructors on students to create positive attitudes cannot stop at the high school level. Instructors at the senior high school level must be encouraged to constructively change student attitudes by changing teaching practices. Factors establishing negative attitudes students who will express like or dislike of mathematics have experiences that have controlled their emotions, expectations, and values with regard to the subject (Hannula, 2002). Several factors affect student attitudes or beliefs about themselves as learners. Previous experiences in mathematics courses influence their actions. Confidence in their ability to learn mathematics, their belief about the usefulness of mathematics, and their feelings about being able to „discover" mathematics all influence student actions (Koehler & Grouws, 1992). Actions are defined to be student reactions to subject topics, student willingness to

participate in-group activities, student contributions to successful achievement, or student disposition in the classroom. Several causes contribute to a negative attitude or perception of mathematics. Math anxiety is often stated as a factor that causes students to have a negative attitude toward mathematics. Mathematics anxiety is defined as an "irrational dread of mathematics that interferes with manipulating numbers and solving mathematical problems within a variety of everyday life and academic situations" (Furner & Berman, 2003, p. 170). In an overview of literature on math anxiety, Furner & Berman found that two thirds of American adults loathe and fear mathematics. Math anxiety usually develops from a lack of confidence when working in mathematical situations (Perina, 2002). When students are not comfortable with mathematics, the cultural attitude, which is where society presents mathematics as difficult and useless because of technology, discourages the students from finding the relevance and making sense of the mathematics. This idea has diminished the importance of mathematics. Many people view it as an abstract and difficult subject reserved for a select few (Turner et al., 2002). Research has found that specific instructional strategies produce more anxiety in students. For example, Hoyles (1981) reports that students recall more bad experiences in mathematics than in other subjects. Students were satisfied when they perceived themselves successful at their work. They blamed their dissatisfaction on their teachers. The dissatisfaction was a result of not being able to complete tasks successfully or failure to understand math. These bad experiences contributed to the students" anxiety, feelings of inadequacy, and shame. Stuart (2000) implemented various teaching methods into her fifth-grade class to reduce math anxiety. Over the year, she distributed surveys to see how the students felt about the different strategies. She found that when she used cooperative

learning her students felt more comfortable discussing problems with their peers. The journals allowed students to verbalize frustrations. Three-fourths of her students felt manipulatives were helpful. Stuart discovered that her students learned to share and accept more than one way to solve a problem. Their trust in each other developed and they were more comfortable in taking risks when solving problems. She concluded through their comments that their mathematics confidence increased. In a different study, Jackson and Leffingwell (1999) surveyed 157 students about their experiences with mathematics from kindergarten through college. They found that the most common explanation for developing math anxiety was lectures delivered too rapidly. They found that 27 percent of their respondents said their freshman year in college was when they first felt math anxiety. Another common explanation was that the language of mathematics commonly created barriers between the student and teacher. Uncaring instructors who asked them to leave class if they did not understand the material also disgruntled them. When students went for help, they were turned away because the instructor did not have time for them. The students should be given an opportunity in the class to ask questions in order to alleviate barriers in knowledge growth. Allowing students to ask questions will encourage them to become more comfortable with the subject and less anxious about discussing topics they do not understand. Delivery of Mathematics Instruction is different from math anxiety in that it is influenced more by the presentation of the material than the subject itself (Fiore, 1999; McLeod, 1992). Studies show that when students become comfortable within the class, their expectations and outcomes for the course change. Students become easily disgruntled by courses taught solely through textbooks and memorization. Cornell (1999) distributed several surveys to

graduate students to evaluate their feelings about mathematics. He found that students become disinterested with instruction that is highly focused on rote memorization rather than on the study of concepts. Textbook exercises, workbooks, and worksheets are rarely stimulating for students. They typically concentrate on the calculations of multiple problems rather than on conceptual understanding (Cornell, 1999).

In a similar study, Hannula (2002) studied the psychological emotions of mathematics among lower secondary level students (grades 7 to 9). Student behavior was documented through interviews and observation. Secondary level students expressed unpleasant emotions toward mathematics because of previous experiences that had given them a feeling of failure. These previous experiences included not understanding word problems, feeling academically inferior to other students in the course, and failure to make use of the mathematics outside the classroom. Over the course of the study, the students became active members of their group and began to show positive attitudes toward mathematics. Students who perceive their learning environments to model good teaching report greater satisfaction with the course.

Lizzio, Wilson, and Simons (2002) surveyed 5000 students within one university to obtain information about their perceptions of the learning environment. The students found more satisfaction in the courses which were less packed with drill and practice assignments and allowed time for analytic, problem solving, and interactive learning opportunities. When teachers emphasize understanding of mathematical concepts and provide interactive classroom environments, students tend to be more receptive and less anxious with regard to mathematical activities than when teachers stress rote activities and are perceived to be authoritarian (Middleton & Spanias, 1999). Students are aware of

their emotions and reflect on them to control a situation. Negative experiences with learning environments affect students' willingness to learn. If students feel that they are in a caring environment that nurtures them and allows them to freely ask questions, negative attitudes can be changed. The final factor addressed here is the lack of confidence students feel when working with mathematical problems. When students are not confident with their work, they will be less likely to complete the tasks and avoid the work. Turner, et al. (2002) studied 1,197 middle-school students in 65 classrooms to investigate the learning environment and avoidance strategies. They found that avoidance strategies are one way that students deal with their lack of confidence in mathematics. They are fearful of making mistakes in front of peers or looking incompetent by asking for help. To protect their pride, students who are uncertain about their ability to be successful at mathematics may develop strategies that take away the attention from their ability. Examples of avoidance strategies are avoiding seeking help, resisting simple approaches to work, and intentionally not exerting effort to make themselves appear math illiterate. These are used by students to discourage negative judgments made by others with regards to their knowledge of mathematics. Students begin to feel inferior to their peers and turn away from the subject that is intimidating.

Lizzio, Wilson, and Simons (2002) found that university students‟ perceptions of their learning environment influenced their approach to studying. The students‟ attitude toward the positive or negative learning environment had a direct correlation with learning outcomes. Professors at the college level may have a disadvantage because by the time students come to college, they are discouraged or apprehensive about mathematics (Gilroy, 2002). Students fail to see a connection between math and science and everyday

life. Instructors must accept the challenge to motivate students. If college students can see mathematics is interesting and useful, then these students might become more motivated to learn math (Deitte & Howe, 2003). These studies support the idea that student attitudes can improve in nontraditional classroom settings. Students enjoyed working with their peers, solving real-world problems, and finding value in mathematics. However, more research should be done that focuses on attitudes in the college mathematics courses when the pedagogy is standard-based. High school mathematics departments might find higher retention rates and improved student achievement.

2.9 Factors Reinforcing Attitudes and Perception of Mathematics

Wasiche (2006) defines attitude as a feeling towards something or somebody which is sometimes reflected in a person‟s behaviour. Attitudes formed by an individual mostly depends on his or her experience in the learning environment. Attitudes are further enhanced by interpersonal interaction. Njue (2005) explain that attitude is either positive or negative depending on whether a person likes or dislikes something or someone. The question which came to mind was what would be the likely sort of such attitudes among students in senior high schools and what could be the reinforcing factors? Sources of negative or positive attitudes may not be pin-pointed. Their source may overlap depending on an individual‟s learning environment. For the purpose of this review, the following were the identified likely reinforcing factors of attitudes towards learning in general.

2.9.1 Genetic predisposition

Cockcroft (1982) refers briefly to theories indicating that different attitudes could be as a result of genetic factors or hormonal influences or even differences in brain lateralization. Despite the report being credible, this assertion may not exactly be verified as to how a student, either a girl or a boy may be pre-disposed to like something or dislike it. Twoli (1986) agrees that there is no clear-cut evidence that a learner is pre-disposed genetically. But Twoli (1986) cited cases of documented differences in cognitive ability between girls and boys which in one way or another, the learner may form attitudes towards learning a particular subject. Orton (1987) agrees with the view that, ability, especially, in mathematics is not innate, and he qualifies his assertion by stating that: "*MATHEMATICS ABILITIES ARE NOT INNATE, BUT ARE PROPERTIES ACQUIRED IN LIFE THAT ARE FORMED ON THE BASIS OF CERTAIN INCLINATION… SOME HAVE INBORN CHARACTERISTICS IN STRUCTURE AND FUNCTIONAL FEATURES TO THE DEVELOPMENT OF MATHEMATICS ABILITIES… ANYONE CAN BECOME AN ORDINARY MATHEMATICIAN, (BUT) ONE MUST BE BORN AN OUTSTANDINGLY TALENTED ONE*" (p. 111).

While he is not completely dismissing the genetic factor, he agrees that other pertinent factors come into play. This researcher"s interaction with some of the high school students has shown that there are students who do well in other subjects but not in mathematics. Some openly resisted learning mathematics but in internal and external examinations, they had above average results in other subjects while performing dismally in mathematics. Orton (1987) in his research indicates that males excelled in spatial ability whilst females excelled in verbal ability. These differences may predispose the

students to view mathematics learning differently. Ying et al. (1991) disagreed that the difference in ability may not necessarily be genetic but could be due to other factors.

2.9.2 Individual student's experience

Twoli (1986) asserts in his work that there is a relationship between achieved grades in earlier examinations at same level and attitudes formed by students towards learning sciences and mathematics. Repeated low academic achievement might lead to negative attitudes towards the subject, which in turn may influence how a student will learn the subject in the subsequent years of education. The challenge though to this assertion is whether the repeated low grades achieved earlier influence attitudes formation or do attitudes formed earlier influence how a student learns mathematics and consequently how the student will perform. As boys and girls interact at school in general and particularly in class, they get to know of this scenario and form varied attitudes towards learning of mathematics. In support of this, a study by Costello (1991) on 11-16 year olds shows that students formed different attitudes towards mathematics. Some described mathematics as hard or difficult. Some girls in particular believed that mathematics is for boys. However, there was little identifiable difference in attitudes towards learning of mathematics amongst girls and boys below 11 years old (Costello, 1991). This implies that primary school children join Form One while having positive or neutral attitudes towards learning of mathematics. But one wonders what might be happening to these students as they learn in senior high schools. Such that by the time they prepare for WASSCE, they seem to have formed unfavourable attitudes towards mathematics. As students interact with each other in secondary schools, they influence each other with regard to their perception of mathematics. Peers may influence others, that mathematics

is unfeminine (Costello, 1991). At this stage of learning, image issue is so pertinent that a student will not wish to be different from his/her peer group. This could lead to formation of attitudes, which are also compounded by stereotyped slogan “bright girl fear success”, or “nice girls don‟t do mathematics” (Costello, 1991). Other unfounded statement is, “mathematics is done by real men”. This could be internalized in the students‟ minds; hence they view mathematics differently from other subjects. Similarly, provision of appropriate education for gifted children may not be easy. In Ghanaian senior high schools, no special attention is given to students with specific learning needs. Stanic (1995) stated that some boys enjoy more when learning mathematics than girls do. This is so depending on their earlier experience. But he asserted that if the learning environment created by the teacher is enabling, both sexes persist in doing mathematics. The various attitudes formed by students as they interact in school, have determined how they learn mathematics. Consequently, this determines their achievement in senior high school mathematics examinations. Whenever attitudes are formed, especially negative attitudes, girls are usually the ones who are on the receiving end. Research by Kaino (1998) in Botswana found out that girls had more negative attitudes than boys. He also found out that girls feel harassed by boys when they do not answer questions correctly in class. This was so in mixed classes, that, they feel shy when with the opposite sex, learning mathematics together. Boys on the other hand indicated that they cannot concentrate when they learn while sitting next to girls. Worse still, they claim girls make noise (Kaino, 1998). While this may be challenged, differences in achievement in mathematics amongst the sexes bear witness that attitudes formed may differently influence learning among the two sexes.

2.9.3 Societal influence

By the time a student joins Form One, he or she will have interacted with his or her parents, who to a great extent, influence his or her perception of learning in school in general and specifically learning of mathematics. Orton (1994) attributed the noticeable difference in learning among boys and girls to "societal attitudes and expectations". He asserted that influences of society and from the environment affect mathematical development of students at various levels amongst boys and girls. Boys and girls are socialized differently while playing children games. Boys are engaged in more vigorous activities while girls take more passive roles. This scenario is replayed in school and in class while learning. If no deliberate steps are undertaken to counter this mind-set, students may form unfavourable attitudes towards any learning activity and this may lead to variation in what is learned in a subject. On the other hand, difference in parental expectations and desires and pressure they exert at home on their sons and daughters has been attributed for attainment variations among the sexes (Orton, 1994). Society views mathematics as a male subject, especially, when parents reinforce daughters and sons differently (Costello, 1991). When their children do something mathematical, daughters are told "you've really tried" meaning nothing much is expected from the female child. But to their sons, they are told "you can do far much better" (Costello, 1991). Meaning male children are expected to do a lot more in mathematics. Such comments said by parents consciously or without much thought are registered in the sub-conscience of a child and may influence how he/she perceives mathematics. Hence formation of attitudes among students may have been unconsciously registered from parents particularly and from the society in general. Dislike of mathematics found in both adults and students is

associated with anxiety and fear. This anxiety and fear may elicit negative attitudes towards the subject among adults and these general unfavourable perceptions and attitudes about mathematics are passed on to children from adults. Society treats and views mathematics as an unknown territory made up of x‟s and y‟s. Society also views mathematics teachers as sarcastic and impatient, didactic and scornful (Macnab & Cummine, 1986). Students unconsciously pick these views and they come to mathematics classroom with an already distorted perception and attitudes towards learning of mathematics. Ying et al (1991) did a study comparing 894 students from 26 schools in Hong Kong. They undertook a study to identify correlations between mathematics achievement and expectations from parents and of students themselves. After conducting multiple regression analyses, it was revealed that parental expectation and students‟ achievement in mathematics had a strong correlation.

2.9.4 School influence

In every academic year, a student spends more time in school than at home. While at school, he or she goes through a planned school program. He or she is subjected to a curriculum of mathematics which is administered in a classroom. Eshiwani (1984) emphasized the need to have adequate resources in school to ensure students effectively learn mathematics. These resources include adequate and appropriate 3-dimensional models, geo-boards, and textbooks among others. Access to these learning resources will determine how students learn mathematics. If the school administration has not provided sufficient number of these resources, learners, especially girls, are likely to resent mathematics, viewing it as being too involving. Russell (1983) also found out that manipulative teaching models are preferred by boys. Hence in a mixed classroom, boys

"lord" over them while girls „lose out" in the use of these apparatus and materials (Twoli, 1986). Use of textbooks with sexist orientation has not helped things either (Costello, 1991). Textbooks written by some authors have examples of boys doing very well. Frequent use of boys names in the end-of-topic exercises make girls feel that they are "passengers" in mathematics learning. While in school, girls are given less airtime to express themselves while boys can rumble and mumble and yet the teacher stills waits for him to finish (Twoli, 1986). Fennema and Sherman (1976) while discussing on gender-difference in mathematics achievement suggested that successful programs need to be established in schools to ensure adequate access to learning resources. They also asserted that clubs and symposiums in school increase hands-on activities during mathematics session and suggested more mathematical questions that should be asked from hands-on activities. While these are good suggestions, and that hands-on activities have also been recommended for senior high school teaching and learning of mathematics, the students still perform dismally.

2.9.5 Mathematics teachers

New curriculum implementation and syllabus re-arrangement become a challenge to teachers to acquaint themselves and this impacts negatively on how students learn mathematics while in class (Russell, 1983). Fishbein and Ajzen (1975) argue that whenever a new concept is introduced in the syllabus or taught for the first time in class, an attitude towards it is formed both by the students and the teachers. The teacher‟s attitudes reinforce the attitudes formed by the students towards learning of the new concept or the consequent similar concepts. Twoli (1986) in his work on sex-difference in science achievement, found out that teachers‟ characteristics influence learning. A

teacher‟s way of looking at issues generally and in particular, mathematical concepts influence the learner. A student would like to learn a new concept depending on how the teacher presents it. Flanders (1965) also found that students of teachers who vary their teaching style have positive attitudes and these teachers are able to teach a concept (in mathematics) better and learning is made easier. She added that it is paramount for such a teacher to have a mastery of content being taught. If this be the case students‟ attitudes towards learning of mathematics may be enhanced. Flanders (1965) adds that teachers who show acceptance, clarifications of students‟ feelings have been associated with more positive attitudes towards a higher achievement by the students. Costello (1991) agrees that many teachers often unconsciously reinforce and validates students‟ perceptions of appropriate gender-related behaviour. He further asserts that boys are assigned assertive roles and when they do well they are told they have a talent. But girls may be assigned less assertive roles and when they do well in mathematics, they are reminded that they have at least worked hard to achieve such grades. Because of this unconscious reinforcement from teachers, boys and girls form different attitudes towards learning of mathematics. Costello (1991) also found out that advice given to girls by teachers is too restricted in scope, usually too little and given too late when a female student is almost completing her secondary school education. Teacher‟s gender may determine how he or she portrays mathematics. Unconsciously male and female teachers form attitudes towards the subject they are teaching. These attitudes formed by teachers depending on their own gender influence how their students will learn the subject being taught, mathematics included. Fennema and Sherman (1976) assert that teachers are major determinant in students‟ learning of mathematics and to a large extend determine what

the students might achieve (Eshiwani, 1984). Cockcroft (1982) noted aptly that there is no area in knowledge, where a teacher has more influence over the attitudes as well as the understanding of his/her pupils than he or she does in mathematics. During his or her professional life, a teacher of mathematics may influence for good or bad the attitudes towards mathematics of several students and decisively affect many of their career choices. Orton"s (1987) found out in London that teachers pay more attention to boys than girls while teaching mathematics because of their own prejudiced believe that boys achieve better than girls in mathematics. This could be so in a mixed class, but not in a single-sex class.

2.9.6 Gender factor

Stanic (1995) identified that sex-difference in achievement in mathematics was related to a sex difference favoring males in terms of confidence in doing mathematics. He asserts that teachers consciously or unconsciously reinforce the confidence of students while teaching mathematics. He further asserts that girls are reinforced differently from boys, an idea similarly shared by Costello (1988). Consequently, this will determine how the students will learn the subject and in turn reflect how they achieve in their end of the course examinations. Girls can perform as well as the boys, so long as they are given an enabling environment of learning of mathematics. Stereotyped perception of the gender should be discouraged by all education stakeholders. Attitudes may be formed by students particularly when they get to form one since research amongst 11 year olds and below indicate little or no difference in attitudes between boys and girls (Costello, 1991).

By the time some girls prepare for WASSCE in form three, they expect not to do well but are surprised by success or count themselves lucky to have passed when results are announced the following year. But when boys do well in WASSCE, it is taken as expected and not as a surprise. More specifically, difference between sexes in achievement varies depending on topic. Girls do significantly better than boys on questions demanding computational skills. But on the other hand, boys do better in areas dealing with measurement and problem-solving (Costello, 1991). Since marks in WASSCE or in whichever examination are awarded in total regardless of the topics tested, girls and boys should on average be performing equally well. But this is not the case. Gender difference in achievement in mathematics also comes as a result of sex difference in attitudes at senior high school where students‟ views of the difficulty of mathematics vary. Boys tend to underrate the level of difficulty, and over rate their own competence. Consequently, they do less well than they expected. But senior high school girls are more likely to over rate the difficulty and devalue their own expertise and they often achieve better results than they expected (Costello, 1991). Worth noting also is that students‟ emotional response to mathematics is more evident in girls than among boys. They exhibit intense anxiety and become vulnerable and may misunderstand questions in an examination. In general girls are doubtful of their competence in mathematics and are less confident in their mathematics ability (Fennema et al, 1976). Any academic decline in mathematics has got to do with a drop in self-confidence especially in girls as confirmed by Fennema and Sherman (1976). This decrease in self-confidence and lack of interest leading to formation of attitudes towards learning of mathematics is as a result of the differential treatment of girls and boys receive while in school. Females have been

found to be superior in manual dexterity and in rote learning ability while males do well in tests involving divergent thinking (Orton, 1987). Hence success should not be viewed only on what grade one achieves in examinations but should rather be how much mathematics one has learned while in secondary school. The unfortunate thing though, is that mathematics is being used as a "filter" in career choices (Kaino, 1998). Those who opt out of mathematics when joining university are denied some important opportunities. This may influence attitudes towards learning of mathematics in senior high schools.

2.10 Possible Interventions to Mathematics Classroom Learning Environment

Since attitude formation by students seems almost inevitable and since mathematics is one of the compulsory subjects in the Ghanaian educational curriculum and that the subject is examinable under WAEC regulations and policy; all education stakeholders might have no choice but to ensure that a better learning environment is created for the students.

2.10.1 Learning resources

Sufficient learning resources for mathematics and equal access to these resources by all students are important. They may include books, teaching aids, calculators and computers. The teacher involved may need to ensure proper use of the equipment. Where there is shortage, a well-set programme should be made to ensure all students access library, mathematics practical rooms and any other facility meant to promote

mathematics learning. The experience of this researcher in difference secondary schools indicated that, there are some well-equipped secondary schools, well-organized classrooms, students have enough books some at ratio 1:1, and yet in those schools, there are cases of students who perform dismally.

2.10.2 Role of the society

The general public should desist from viewing mathematics as if it were unknown territory where one is expected to venture without tools to guide. Mathematics should be viewed with a more positive attitude. The same public presumably views mathematics teachers as with little or no human feelings (Macnab and Cummine, 1986). Since the students are first in the society before they are in school, they unconsciously form attitudes towards mathematics and towards anyone who teaches mathematics. Unless deliberate effort was made to counter any unfavourable attitudes being formed by students as they enter Form one (Orora, 1986), the attitudes may overshadow a student‟s interest in mathematics. Parents should deliberately attempt to treat their children equally, make unbiased comments regarding learning of mathematics and give equal opportunities to both daughters and sons to pursue mathematics (Costello, 1991). This is with an effort to negate the unfavourable attitudes from being formed, especially by the girls.

2.10.3 Teacher-students' interaction

Students learning mathematics do so with assistance from their teachers. Teacher-learner interaction in classroom should be geared towards achieving a goal; to learn mathematics, teachers should be conscious of their own attitudes towards mathematics and other subjects and towards his or her students regardless of their gender. He or she should

provide guidance and counseling to students with repeated under-achievement. He or she should reinforce them accordingly and motivate them by providing for the individual differences. Teachers in Ghana are recruited and posted to teach in the senior high schools by ensuring that such teachers have received adequate training; are in-serviced where necessary and proper supervision is done in schools. Despite all these, learning of mathematics in the senior high schools is wanting.

2.10.4 Expected learning environment

Studies on students‟ attitudes towards learning of mathematics and perception of the subject indicate that attitudes play a major role in a student‟s effort to learn. Attitudes formed could genetically be predisposed (Orton, 1987) or influenced by societal expectation (Macnab and Cummine, 1986), especially parents (Ying, 1991), as a result of unconscious reinforcement by the teachers or could be as a product of student-student or teacher-students‟ interaction while in school (Costello, 1991). These attitudes formed could be positive or negative towards learning of mathematics. Whatever nature of attitudes formed by the students, they may determine their confidence in learning mathematics and may also help them perceive the usefulness of mathematics hence enjoy mathematics as they learn (Fennema & Sherman, 1976). There may be no simple and clear relationship between specific attitudes and achievement as Stanic (1995) asserts. But it seems attitudes influence how a student learns mathematics. It becomes even more difficult to describe clearly the connection between attitudes and perception of the subject. But attitudes can lead one to learn less mathematics and consequently achieve

little in the WASSCE. Costello (1991) and Mac nab (1986), both assert, though differently, that mathematics examinations are unique in providing the possibility of obtaining 0% or 100%. This, in the process of learning the subject, may cause much anxiety.

2.11 Empirical Review of Attitude Research

From the literature, a lot of attitudinal studies have been carried out which includes among others; attitude and its influence on students‟ achievement in mathematics and investigation of gender differences (Fennema & Sherman, 1976; Mason, 2003; Sandman, 1980 & Tapia; Marsh, 2004). McLeod (1992) indicated that affective background factors play a central role in learning mathematics and in maintaining a continued interest in the subject. With regards to the effect of attitude on students‟ learning, Mallam (1993) indicated that, "negative attitude … can powerfully inhibit intellect and curiosity and keep us from learning what is well within our power to understand" (p.223) which lends credence to the necessity in appreciating senior high school pupils‟ attitude towards mathematics as a discipline. Ruffell, Mason and Allen (1998) indicated that students who hold positive attitude towards mathematics tended to express a generally favourable perception towards mathematics although Fraser and Butts (as cited in Ruffell, et al, 1998) found no significant correlation among students‟ attitude and mathematics. Also, Hammouri (2004) in a study of the effects of student-related variables on achievement in mathematics of 3736 Jordanian 8th-graders reported that attitude was among the affective variables that led to variation in mathematics achievement of the students.

Whereas a lot of such studies have reported gender differences at the secondary school level, quite a few of these studies have found differences in attitude towards mathematics among early elementary students although noticeable differences begin to appear in their attitude as they age (Taylor, 2004). Rathbone (1989) noted that children at the elementary school like mathematics and that there are no significant differences in attitude of girls and boys, however, differences begin to appear as students‟ progress in school.

The Fourth National Assessment of Educational Progress (NAEP) Mathematics Assessment report indicated that males were more likely to report being good in mathematics, even though both genders were equally likely to report enjoying mathematics (Steinback & Gwizdala, 1995). They also reported significant gender differences in attitude towards mathematics, self-confidence, and perceived usefulness, in favour of males.

Taylor (2004) in a study of 745 students in four high schools in Southern California attitude towards mathematics reported that students‟ attitude towards mathematics was positive. This followed an investigation he carried out concerning students‟ attitude towards mathematics using The Test of Mathematics Related Attitude (TOMRA). Students‟ attitude towards mathematics was found to be influenced by two factors on the TOMRA namely enjoyment of mathematics and normality of mathematicians.

Mallam (2002) in a study involving 240 female students drawn from five co-educational and six all-girls‟ secondary schools in Plateau State, Nigeria, reported that females attending all-girls‟ schools had more positive attitude towards mathematics than females attending co-educational schools. This finding indicates that even among the same gender, differences in attitude towards mathematics may exist based upon school-type.

Eshun (2000) in a study of attitude of secondary school students involving 1419 students from 12 secondary schools in the Central and Western Regions of Ghana reported that students‟ attitude towards mathematics was positive on all the eight variables measured namely: usefulness of mathematics, confidence in learning mathematics, success in

mathematics, effective motivation, mathematics anxiety, mathematics as a male domain, understanding mathematics and, like doing mathematics.

The three highest responses were on the variables: like mathematics, confidence in learning mathematics and usefulness of mathematics in that order. The least positive response was for mathematics anxiety followed by motivation. He further reported differences in attitude towards mathematics based upon school-type. Girls in single-sex schools expressed more confidence in doing mathematics compared to boys in single-sex schools while girls in mixed schools expressed far less confidence than boys from single and mixed schools.

2.12 Classroom Environment and Attitude Research Findings

The belief that school students‟ perception of their learning environment has an influence on their attitude towards mathematics is championed by researchers such as Fraser and Fisher among many others. Dungan and Thurlow (1989) reporting from a meta-analysis of literature on attitude towards mathematics identified associations between students‟ attitude towards mathematics and teacher qualities, student personality or social factors, gender, parental influences, peer influences and intelligence. Pintrich (as cited in Koballa & Glynn, 2007) intimated that affective outcomes such as motivation and attitude are influenced by contextual factors such as classroom organization, teacher authority, the nature of classroom academic tasks, and evaluation which gives the impression that one of the major factors influencing students‟ attitude is the classroom environment.

Haladyna (as cited in Hannula, 2002) indicated that the general attitude of a class towards mathematics is related to the quality of the teaching and the social-psychological climate

of the class. This finding indicates that for students to form an attitude towards mathematics, it depends on what goes on in the classroom as far as teaching and learning is concerned, that is, whether the learning environment is deemed by the students to be conducive for learning or not. The belief that the learning environment an individual finds himself or herself in has an influence on students‟ learning is supported by Collis (1987) who indicated that single-sex school environments have tended to be more closely associated with positive attitude towards mathematics, particularly in favour of girls. The single-sex environment he believes reduces incidences of sexual harassment and bullying associated with mixed-sex classrooms. He reported further that girls tend to prefer lower levels of social competition and a warmer teaching style.

Again, Hembree and Tobias (as cited in Mensah, 2007) reported in their study which assessed students‟ predisposition towards mathematics using their autobiographical account that anxieties and internalized messages (positive and negative) affected students‟ attitude and confidence to engage in mathematics and science which are developed through the influence of teachers, classmates and family. Fraser and Chionh (2000) for example, established associations between the seven WIHIC scales such as Pupil Cohesiveness, involvement, teacher support and equity and three student outcomes including attitude of 2,310 mathematics and geography students in 75 classes. Empirical probes of the educational productivity model which is made up of factors such as quality and quantity of instruction; the psychosocial environments of the home, the classroom and the peer group by Fraser, Welch and Walberg (as cited in Fraser, 1998), revealed classroom and school environment as a strong predictor of both achievement and attitude even when a comprehensive set of other factors was held constant. These studies give an

indication that perhaps a more positive perception of the mathematics learning environment may lead to an appreciable change in attitude of students towards mathematics.

Taylor (2004) in a study of how 745 students in four high schools in Southern California perceived their mathematics reported that students‟ perceived their mathematics learning environment to be positive on all 7 WIHIC scales they were measured on as well as finding association between classroom environment and students‟ attitude towards mathematics. The strongest scale was equity with teacher support and involvement being the least perceived scale. He further reported significant gender differences on four of the WIHIC scales with females having significantly higher perceptions of the mathematics classroom environment in the areas of equity, Pupil Cohesiveness, task orientation and cooperation and teacher support.

Although quite a number of studies have reported associations among perception of classroom environment and students‟ attitude towards mathematics, a study conducted by Goh and Fraser (1998) in Singapore did not find any such association. Their study which combined two research instruments namely the MCI and QTI research instruments and focused on the achievement and attitude of 1512 primary mathematics students indicated that the two instruments each uniquely accounted for an appreciable proportion of the variance in achievement, but not in attitude. Aldridge et al (1999), also caution against results indicating association between perception of learning environment and attitude by stating that although classroom dimensions provide useful information as to dimensions that could be manipulated to improved student outcomes, they do not identify causal factors.

2.13 Determinants of Students' Attitude and Perception in Mathematics

The issue of students‟ attitude and perception in senior high school mathematics cannot really be attributable to a particular variable. There are several ways to evaluate a student‟s "quality" attributable to formal education but the most tractable is how he or she performs in tests. (World Bank, 2003). According to Nzabihimana (2010), teachers are central to any consideration of schools, and majority of education policy discussion focus directly or indirectly on the role of teachers. Some of the possible determinants of students‟ attitudes and perception in the context of mathematics are discussed below under three areas, which happens to be Teacher related determinants, School related determinants and Home related determinants of students‟ attitude and perception.

2.13.1 Teacher as determinants of students' attitude and perception in mathematics

The role or impact of teachers on the attitude and perception of students‟ in mathematics can hardly be doubted. Sanders (2000), in a study concluded that "differences in teacher effectiveness are the single largest factor affecting academic growth of the population of students". According to Betts, Zau & Rice (2003), the most important school resource is the teacher and the many dimensions of their training, including years of teaching experience, their official teacher certifications and Subject authorizations, their highest academic degree, and their filed(s) of study at college. The teacher related determinants to be discussed in this paper are gender and teacher academic qualifications.

The gender of teacher appears to be one variable to play a role in the students‟ attitude and perception in mathematics. Unfortunately, most of the earlier studies carried out on

the influence of gender and students‟ attitude and perception of students appear to be concentrated in mathematics and science either than other disciplines. Over the years, however, a number of studies have shown the perception that males do better than females in mathematics needs to be re-thought (Eniayeji, 2010 & Abubakar ,2011). Fitchett (2010) found that, previous researches on gender within mathematics have indicated that the male orientation of the mathematics dissuades many young women from entering the field. From the point of view of Fitchett, it may not be fair to compare the influence of female gender on attitude and perception of students‟ in mathematics when there is numerical advantage to the male gender. The discussion so far has given a clear indication of the influence of gender on students‟ attitude and perception of mathematics. Besides, it appears all the studies conducted to determine gender influence bother on mathematics and science. It may not be adequate based on this to state that a particular gender has a better influence on attitude and perception of students in senior high schools. According to Arain (2011), the importance of teacher is widely accepted because of their impact on students‟ attitude and perception. He contended further that, research has shown that improved teacher variables were most likely to produce substantial gains in students‟ attitude and perception in mathematics. One of these teacher related variables that could lead to gains in students‟ attitude and perception in mathematics is teachers‟ academic status. In a study to determine the effect of different teacher certification levels on students‟ achievement, Goldhaber & Brewer (2000), found that the type of certification a teacher held was related to students‟ outcomes. For instance, they found that students of teachers with standard certification in mathematics did better than students with teachers that had either no certification or private school

certification in mathematics. Goe and Stickler (2008) supported earlier findings from Lasater and Cooney (2005) which indicated that completion of an undergraduate or graduate major in mathematics was associated with higher students‟ achievement in high school and middle schools. These findings may not be conclusive as there are private senior high schools in Ghana who employ relatively unqualified teachers in terms of certification and yet their students‟ in some instances perform better than some public senior high school students with very qualified (certification wise) teachers. This therefore indicate that, certification aside there are other teacher related variables that account for the achievement of students‟ in mathematics in senior high schools in Ghana. It is important to add that, the problem of non – specialists‟ teachers teaching mathematics is not peculiar to Ghana.

2.13.2 School related variables as determinants of students' attitude and perception in mathematics

The school and the classroom are the laboratories from where the teacher operates. Therefore, the skills and knowledge a mathematics teacher carries to the classroom would make further impact if the school and classrooms(s) from where he / she teaches were conducive for teaching and learning. According to Lai, Sadoulet and Janvry (2009), common sense suggests that school quality should affect students‟ attitude and perception; however, there is limited rigorous supporting evidence. According to Lai, Sadoulet and Janvry (2009), in explaining students‟ performance, they predominantly explained teacher characteristics, leaving very little role for other school resources and peer quality. There have therefore been great challenges in rigorously assessing the impact of school quality on students‟ attitude and perception. According to Asikhia

(2010), the importance of the location of the school, the appearance of the physical structures of the school cannot be overemphasized in accounting for the attitude and perception of students in schools. The location of the school according to Asikhia (2010), will determine the patronage and to some extent the caliber of students and teachers, it will attract. It is common knowledge that students who perform well at the Junior High Schools (JHS) level may not be tempted to go to schools in an obscure location with poor physical structures. Indeed, schools such as these will most probably not attract highly qualified students and teachers. Betts, Zau and Rice (2003) found in an earlier research that, schools in less affluent areas tended to have less experienced, less educated teachers who were less likely to hold full academic credentials and these were schools likely to have the students with poor attitude and perception. Highly qualified and experienced teachers are more likely to move to schools with good – looking infrastructure and located in an area that is easily accessible. When this happens, the probability is that unqualified teachers and students with poor grades at the Junior High School level will be compelled to go to schools that are outlandish and have poor infrastructure. This will further de-motivate both teachers and learners leading to poor attitudes and perception in subjects taught. Although from research, teacher experience and qualifications are not the only determinants of students‟ attitude and perception, they play vital roles in determining the level of a student‟s performance in mathematics. The quality and level of teacher motivation will determine largely the performance of the students. A school that for one reason or the other has a crop of uncommitted teachers will suffer in terms of academic performance of the students. The school system determines largely the level of communication and cordiality that exist between teachers and students; teachers and

teachers; and finally also between students and students. When the school is run in a manner that teachers are dissatisfied, the students then become the ultimate losers, because, teachers are no longer paid by the result of their students as it used to happen in Ghana in the 1930‟s and 1940‟s where teacher‟s payment was linked to the percentage pass of students / pupils in schools. One other school factor that could trigger poor attitude and perception of students is the classroom environment. Sometimes when a school is reputed to be a good school because of the location, quality of teachers, appearance of the physical infrastructure among others, enrolments tend to be very high. With time, if not well managed, the learning environment will become unconducive as there will be overcrowding in the classroom. In a study, Porter (2002) found that, students made gains that were more academic when instruction was effectively connected to assessment. However, where there were large classes, teachers moved away from giving adequate assignment to students because of the workload of marking. It also affects classroom management and class discipline. Teachers cannot also individualize in their teaching. This according to Nzabihimana (2010), teaching subjects that need great concentration like Geography, Physics, Chemistry, Mathematics among others, are likely to be negatively influenced by a high pupil – teacher ratio. When this happens, students are not properly assessed and this affects them ultimately. Having explored some of the teacher and school related variables as determinants of students‟ attitude and perception of students‟ in mathematics in senior high schools, it will be also worthwhile looking at the extent to which some home factors that also determine students‟ attitude and perception of students‟ in senior high schools.

2.13.3 Home related variables as determinants of students' attitude and perception

The home of the students as a determinant of his or her attitude and perception in school is apparent. A close look at the types of home, the Socio- Economic Status (SES) of the family among others, will indicate that, there is a relationship between the home and students‟ attitudes. Brecko (2010) contended that, a key goal of education is to ensure that every student has a chance to excel, both in school and in life. She argued further that, children success in school determines their success as adults, determines whether and where they go to college, what profession they enter and how much they earn. According to Loop (2012) the actual schooling is not the only contributing factor that could assist a child‟s learning and achievement in school. Loop (2012) contended further that, although the academic environment is important, each student‟s individual home situation greatly influences educational goals and progress. Therefore, attitude and perception in high schools do not depend on a student‟s mental and physical abilities alone. The family and social background of students greatly influence student‟s attitude and perception (Paul, 2012). The relationship between the child and the parent is a crucial home factor that influences the child learning and achievement. Parents who are responsive to their children needs can influence the attitude and perception of their children in schools. Parents‟ educational aspirations exert a significant influence on students‟ achievement. Therefore, all other things being equal, parents who have aspiration that challenge, inspire and motivate their children should correlate with their children‟s attitude and perception in school. If a child comes from a home where parents are not responsive to their physical and emotional needs, such students become depressed

and if the situation is not handled well, it will go a long way to affect their performance. Students belong to home of different Socio- economic backgrounds and this affects them in diverse ways (Paul, 2012 & Loop, 2012). The school according to Paul (2012) is not doubt important in a student‟s achievement. Recent researches however indicate that, parents are even more important in terms of students‟ performance in schools. According to Paul, recent researches has shown that, parental involvement in checking the homework of their children, regular attendance of school meeting, discussing school activities with their children has more powerful influence on students‟ academic attitudes and perceptions, causing good academic performance than anything about the school the student attends. Students of varied family backgrounds attend educational institutions in Ghana like other countries. These differences range from parents‟ level of education, interests in education, support to their children among others. It is most probable that educated parents will be more inclined to giving good education by providing the needs of their children. It must however be added that, there are some parents who are well educated yet pay very little attention to the education of their own children. If this scenario persists, students of parents who pay little attention to their children education will perform poorly in schools due to negative attitude they might put forward. It must also be added that, there are situations where illiterate parents pay more attention to their children education even though they are illiterate themselves. Such illiterate parents, they do not want their children to suffer the deprivations they had to endure. It may therefore be that parents‟ level of education is a strong determinant of students‟ attitude and perception of students‟ in school. A home that encourages learning is perhaps the most accurate predictor of success at school.

2.14 Students Attitude and Classroom Learning Environment

Students who are successful in mathematics have a set of attitudes and beliefs that direct their learning. They see mathematics as a meaningful, interesting, and worthwhile subject. These students feel confident in working with mathematics and are motivated to work at becoming better learners (NRC, 2001). Children enter school eager to learn mathematics because they view it as important and they feel that they can learn the material. However, by the time they reach middle school and high school, their level of enjoyment for the subject has fallen drastically (Middleton & Spanias, 1999; McLeod, 1992). They still believe that mathematics is important, but they don"t want to take more math classes. By the time they reach college, students have generally formed stable attributions regarding their successes in mathematics (Middleton & Spanias, 1999). The decrease in positive feelings about mathematics can be paralleled to a decrease in enrollment of mathematics courses. University faculty consistently discourage unprepared students, or those perceived as lazy, from taking math and science courses. Those students already enrolled in math courses choose to leave because of the atmosphere of intimidation and the obvious discouragement for student participation (Daempfle, 2003;2004).

Creating an ideal learning environment begins with the teacher understanding students as learners. It is not only important for a teacher to have content knowledge, but also to develop awareness of how individual students learn. Teachers must make appropriate choices with regard to pedagogy to provide learning opportunities such that students are

able to construct their mathematical knowledge (NRC, 2000). Teachers can create environments where knowledge is constructed by the student. This environment enables students to build their mathematical knowledge and understanding of the subject. Such classroom is defined as a constructivist classroom (Pirie & Kieren, 1992; Capraro, 2001).

The learning environment a teacher establishes is crucial to the development of student knowledge. This learning environment boosts students‟ confidence in their ability to tackle difficult problems, excites them about discovering things on their own, gives them the desire to try more than one solution method while exploring math, and a willingness to persevere. When students work hard to solve or understand a problem, they feel successful and find themselves drawn to extend their work with mathematics (NCTM, 2000). When designed properly, these environments can positively influence both the way students approach the subject, and the outcomes they achieve.

Teachers in this environment are aware of what students know and can do as well as their interests. There is often discourse as it provides an opportunity for students to share what knowledge they have about the topic. One aid to gaining mathematical understanding is through classroom discourse. Discourse is a way that knowledge is constructed and shared in the classroom. Students engage in inquiry, explore ideas and concepts, and negotiate the meanings and connections of math concepts with fellow classmates (Manouchehri & Enderson, 1999). Students are actively engaged in doing mathematics through a process where they realize that mathematics is about questioning, conjecturing, and trial and error (Nickson, 1992). Students should have the opportunity to reflect upon and defend their 38 thinking. They should be able to express their ideas both orally and in written form. Since reading is an important tool for sound oral discussion, students

should be encouraged to read the textbook and other relevant materials. The use of small groups to promote discourse can be very effective. In an effort to look at the relation between instructional practices and students‟ attitude, Turner, Meyer, Midgley, and Patrick (2003) examined teacher and student discourse in a middle school mathematics classroom. Thirty-four students were observed over two semesters. The students were also asked to complete surveys that showed students had high support for discourse. The classroom supported the students‟ needs to correct their errors and develop the knowledge for understanding mathematics. Tanner and Casados (1998) researched a class of high school students for implementation of discourse in the curriculum. The students were given guideline questions regarding the math content. The more discussions the students were involved with, the less they relied on the teacher for direction. The study found that students enjoyed the discussions and learned from them. The researchers also noticed an improvement in students using proper vocabulary when speaking about mathematics. The students began talking through their ideas and feeling confident about the subject. Discourse provided a community of learners willing to engage in discussing mathematical topics. Students became comfortable with mathematical language and confident with their own understanding of the material. Students working in small groups work effectively to enhance discourse amongst the members. The evidence shows the thought processes students used facilitated the building of ideas. They were able to discuss and develop problem solving methods while resolving misconceptions.

Discourse can have a positive impact on student attitudes towards mathematics. Through inquiry and communication with other students, an understanding of mathematics concepts is attained. The language of mathematics is no longer a barrier to the students‟

skill of understanding concepts. If discourse is continued in high school courses, students‟ mathematical understandings will flourish as they progress through mathematics courses.

2.15 Summary of Literature Review

From the review, a lot of work has been done in the field of learning environment and attitude research. In the field of learning environment research, the concept "Learning Environment" is clearly measureable based upon Moos‟ three dimensions namely; relationship dimension, personal development dimension and system change and system maintenance dimension (Fraser, 1998).

As a result of Moos‟ classification the five subscales on the mathematics classroom learning environment inventory (MCLEI) was each designed to measure a specific dimension in order to capture the senior high school students‟ mathematics environment. The various mathematics classroom learning environment inventory (MCLEI) subscales and the dimension they each fall under are as follows: relationship dimension- pupil cohesiveness, teacher support and involvement, personal development dimension-cooperation, system change and system maintenance dimension-equity

Again, it was evident that a lot of instruments have been developed by past researchers such as My Class Inventory (MCI), Learning Environment Inventory (LEI) and What Is Happening In this Class (WIHIC) to measure various aspects of the learning environment. These studies have included investigations of teacher-student differences, evaluations of educational innovations and associations between student outcomes and learning environment (Taylor, 2004). Despite the availability of numerous learning

environment instruments, a new instrument, named mathematics classroom learning environment inventory (MCLEI), was adopted from Asoma (2014) since the already existing ones were developed in culturally different settings making their adoption into the Ghanaian setting virtually impossible.

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter discusses the research design, population, sample and sampling procedure, research instruments, validity and reliability procedure, data collection and data analysis procedures.

3.1 Research Design

Research designs are plans and the procedures for research that span the decisions from broad assumptions to detailed methods of data collection and analysis (Creswell, 2009).

Descriptive survey design was employed for the study. According to McMillan and Schumacher (2010), it is a design whereby responses of participants are presented statistically involving the collection and analysis of data, and finding out the answers concerning the current status of the subject. Also, it is a study of variables in their natural setting or under usual circumstances. This comprises observation of facts, formulation of hypothesis, collection and classification of data, interpretation of data, formulation of theories, application of facts and predictions. Denscombe (2003) underscored this by intimating that the notion of a survey suggests that the researcher intends to get

information "straight from the horse"s own mouth" and is purposeful and structured. He maintains that surveys are associated with large scale research covering many people.

The descriptive survey was therefore employed to help produce a good amount of responses from the sampled Senior High School students within the Cape Coast Metropolis. The strategy allowed the use of questionnaires which generated large volumes of data that were analyzed statistically and also enabled the researcher to observe, describe and document certain occurrences that existed. It is as a result of this that Best and Khan (1993) postulate that descriptive statistical analysis limits generalization to the particular group of individuals observed and that no conclusions are extended beyond this group. Further, the researcher employed descriptive statistical tools such as percentages, frequencies and the mean in the analysis of data collected. McMillan (2000) agrees that descriptive study simply describes and provides an understanding of a phenomenon usually with simple descriptive statistics and it is particularly valuable when an area is first investigated. He further elaborated that, descriptive survey seeks at describing, observing and documenting aspects of a situation as it naturally occurs rather than explaining it. The wide and suitable coverage gave credibility to generalized statements made on the basis of the research.

3.2 Population

The population for the study was all final year senior high school students within the Cape Coast Metropolis in the Central Region of Ghana. Final year students were selected because they had gone through almost all the topics in the mathematics curriculum and were the right people to provide vivid responses about their perception

and attitudes towards mathematics. In the Cape Coast Metropolis, there are ten senior high schools. Four of them are single- sex schools, while the other six are co-educational. The ages of the Senior High School students were between 14 to 20 years. Almost every ethnicity in Ghana is found in each Senior High School. The Senior High School students in Ghana are trained with the same curriculum and run the same academic calendar. All certificates on successful completion of programmes are awarded by the West African Examination Council (WAEC).

3.3 Sample

A sample according to Gerrish and Lacey (2010), is a subset of a target population, normally defined by the sampling process. Samples were selected from Senior High Schools within the Cape Coast Metropolis in the Central Region of Ghana. The Cape Coast Metropolis was selected based on convenience and proximity. The sample consisted of two intact classes from five sampled Senior High Schools within the Cape Coast Metropolis. The five sampled Senior High Schools consisted of High schools A, B, C, D and E. Two intact classes were selected from each of Senior High School. An intact class from each of these Senior High Schools consisted of forty-five students. Thus, a sample of two-hundred participants were used for this study.

3.4 Sampling Procedure

Two major sampling procedures were employed for the study, thus; convenience and simple random sampling techniques. Convenience sampling is a non-probability sampling technique where subjects are selected because of their convenient accessibility

and proximity to the researcher (Castillo, 2009). On the other hand, a simple random sample is a process of selecting a sample from a population in a way that every different possible sample of the desired size has the same chance of being selected (Devore & Peck, 2005).

The study employed these two techniques at various levels. Thus, Central Region was conveniently selected. This was because the researcher has stayed and taught in that region for ten years and is familiar with the region. This helped the researcher to obtain the necessary data required for this study. A simple random technique was also used to select the five Senior High Schools and the two intact classes from each school. This was also used to avoid bias in selecting the schools and the classes. There were ten senior high schools in the central region of Ghana. These senior high schools were coded numerically from one to ten. The coded numbers were keyed into a random number generated calculator to randomly select the five senior high schools used for this study. All the five sampled Senior High Schools had classes for the programmes of General Arts, General Science, Business, Agriculture, Home Economics and Visual Arts. These classes were also coded according to each selected school. The coded numbers were also keyed into the random number generated calculator to select the classes to be used for this study. For high school A, 3Sc1 and 3B2 classes were selected. For high school B, 3A2 and 3A1 were selected. High school C also had 3Visual and 3B1 as their selected classes. High school D had 3A2 and 3 Home Economics as their selected classes whilst 3B2 and 3A3 classes were chosen at random for high school E. In all, one hundred and thirty-three (133) males and sixty -seven (67) females were selected.

3.5 Research Instrument

Two main types of questionnaires were employed for the study. Thus, a Mathematics Classroom Learning Environment Inventory (MCLEI) and Mathematics Attitude Questionnaire (MAQ). All were adopted from Asoma (2014).

The Mathematics Classroom Learning Environment Inventory (MCLEI) was based on seven scales of "what is happening in this classroom" (WIHIC) questionnaire developed by Fraser, Mcrobbie and Fisher (1996). The scales used in the mathematics classroom learning environment inventory (MCLEI) were student cohesiveness, teacher support, involvement, co-operation and equity. The mathematics classroom learning environment inventory (MCLEI) had five subscales, with each subscale having five items, bringing the total number of items on the mathematics classroom learning environment inventory (MCLEI) to twenty-five. The questionnaire was constructed using a five-point Likert-type response scale to indicate the degree to which Senior High School students agreed with each statement made: (1) Never; (2) seldom; (3) Sometimes; (4) Often; (5) Always. The mean score of participants‟ level of agreement with respect to their perception of their mathematics classroom learning environment were also computed. Items obtaining a score less than 3.0 on the scale were labeled as being a negative perception whilst those items obtaining 3.0 and above were labeled as being a positive perception. A detailed description of the five modified WIHIC subscales as adopted from Asoma (2014) are presented in Table 3.1.

Table 3. 1

Description and Sample item for each subscale scale in the modified WIHIC

Subscale	Description	Sample Item
Pupil Cohesiveness	Extent, to which pupils should know, is friendly to, and supportive of each other.	I am friend to members in my mathematics class.
Teacher Support	Extent to which teacher helps, relate to and show interest in their students	My mathematics teacher listens to and accepts my comments on how he/she teaches
Involvement	Extent to which pupils have attentive interest, participate in discussions and explain their solutions	My ideas and suggestions are used during mathematics classroom discussions
Co-operation	Extent to which students are prepared to help each other rather than compete with each other selfishly	In my mathematics class there is high competition among us which leads to selfishness.
Equity	Extent to which pupils view the treatment they receive from the teacher to be equitable	My mathematics teacher treats me the same way he/she treat other pupils in this class.

The second instrument, the Mathematics Attitude Questionnaire (MAQ) was also to measure the Senior High School students‟ attitude towards mathematics using the Test of Mathematics-Related-Attitude (TOMRA) developed by Taylor (2004) and modified by Asoma (2014). The TOMRA measures students‟ attitude in four areas namely; normality of mathematics, attitude towards mathematics Inquiry, adoption of mathematics Attitude and enjoyment of mathematics lesson.

A five-point Likert-scale was used in measuring the mathematics attitude questionnaire (MAQ) and the items on it were developed by using two subscales namely; Attitude towards mathematics Inquiry and Enjoyment of Mathematics Lessons of the test of mathematics related activity (TOMRA). These two subscales were used because they were perceived to be acquired in the learning environment. There were 10 items in all on

the mathematics attitude questionnaire (MAQ) with responses ranging from Strongly Disagree (SD), Disagree (D), Undecided (U), Agree(A), Strongly Agree(SA), Positive responses were assigned the following values; Strongly Disagree-1, Disagree-2, Undecided-3, Agree-4 and Strongly Agree-5. Negative responses were also assigned the following values; Strongly Disagree-5, Disagree-4, Undecided-3, Agree-2 and Strongly Agree-1.The mean score of participants‟ level of agreement with respect to their attitudes towards mathematics were computed. Items obtaining a score less than 3.0 on the scale were labeled as being a negative attitude. However, those items obtaining 3.0 and above were labeled as being a positive attitude. A detailed description of test of mathematics related activity (TOMRA) as adopted from Asoma (2014), is presented in table 3.2.

Table 3. 2

Description and sample item for each Dimension of the mathematic Attitude Questionnaire (MAQ)

Dimension	Description	Sample Item
Normality of Mathematics	Extent to which pupils see mathematics as normal	It is better to search for information concerning mathematics on my own than resort to my mathematics class teacher
Attitude towards mathematics Inquiry	Extent to which pupils are prepared to go extra mile to find solution to mathematics problem	I would rather agree with other mathematics pupils in class as to the solution to a problem than investigate it myself
Adoption of mathematics attitude	Extent to which pupils are ready to accept mathematics without any reservation.	Mathematics is one of the most interesting school subjects.
Enjoyment of mathematics lessons	Extent to which pupils work/learn mathematics with ease, excitement and enthusiasm.	I really expect more mathematics lessons.

3.6 Validity and Reliability

Validity is a measure that a particular research instrument in fact measures what it purports to measure (Durrheim, 1999). Reliability on the other hand refers to the extent to which a measuring instrument; a questionnaire, a test yields the same results on repeated applications (Durrheim, 1999). The reliability estimates obtained using the Cronbach Alpha ranged 0.71 to 0.89 on the mathematics classroom environment inventory (mathematics classroom learning environment inventory (MCLEI)) subscales (as shown in table 3.3). On the mathematics attitude questionnaire (MAQ) instrument, the alpha reliability estimate obtained was 0.71. Table 5 gives the reliability estimates of the subscales on the mathematics classroom learning environment inventory (MCLEI) after piloting the instruments in the central region of Ghana.

Table 3. 3

Reliability Estimates of the Subscales on the mathematics classroom learning environment inventory (MCLEI)

Subscale	Reliability Estimate	No. of Items
Pupil Cohesiveness	0.75	5
Teacher Support	0.86	5
Involvement	0.79	5
Co-operation	0.71	5
Equity	0.89	5

These reliability estimates were considered appropriate based upon the threshold of 0.60 suggested by Nunnaly (as cited in Ampiah, 2006) in determining whether a research instrument is reliable or not and revealed that these subscales were reliable.

The questionnaire were validated by giving to my supervisor to crosscheck the items one after the other.

3.7 Data Collection Procedure

The researcher visited the senior high school in the early part of the first term of the 2016/2017 academic year. The visit was to enable the researcher discuss the purpose of the study and to seek permission from the headmasters of the Senior High Schools to administer the questionnaire. The administration of the questionnaire took place during the third week of the term. A day was used to administer the questionnaire in each school. In all, five days were used.

3.8 Data Analysis Procedure

The data used for the study were responses from the questionnaires. The responses from the questionnaires were analyzed quantitatively. Basically, quantitative analysis in educational research is of two types; descriptive data analysis and inferential data analysis (Daramola, 1998; Durrheim, 1999). Descriptive analysis seeks to organize and describe the data by investigating how the responses are distributed on each construct, and by determining whether the responses on different constructs are related to each other (Durrheim, 1999). In this study, both descriptive and inferential statistics were employed in the analysis of data collected. The descriptives (percentages, means and standard deviations) were used to analyze the Senior High School students‟ attitudes towards mathematics and their perception of their mathematics classroom-learning environment. The inferential statistics (correlation analysis) with 5% significant level was used to determine if a significant relationship existed between the senior High School students‟ attitude towards mathematics and their perception of their mathematics classroom-learning environment.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.0 Overview

The purpose of the study was to investigate senior high school students‟ attitude towards mathematics and their perception of their mathematics classroom learning environment. In this chapter, findings from the study are presented and discussed in relation to the three research questions, namely:

1. What attitudes do senior high school students hold toward mathematics?
2. What perception do senior high school students have about their mathematics classroom learning environment?
3. Does a relationship exist between senior high school students‟ attitude towards mathematics and perception of their mathematics classroom learning environment?

Discussions on these research questions were based on the analysis of data collected from questionnaires. The chapter focuses on the following areas: (i) demographic information of senior high school students (ii) findings related to research questions.

4.1 Demographic Information of Senior High School Students

Demographic information of senior high school students addressed their gender status and age. The coverage of all these areas was to ascertain if they contributed to senior high school students‟ attitudes towards mathematics and their perception of their

mathematics classroom learning environment. Below in figure 4.1 is the gender status of sampled senior high school students.

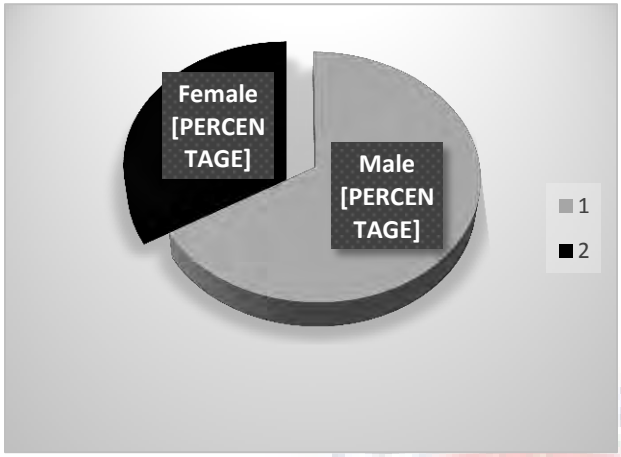

Figure 4. 1 *Gender Status of senior high school students*

Figure 4.1 shows the gender status of sampled senior high school students. Statistics gathered in Figure 4.1 showed that 66% (133) of the senior high school students sampled were male and 34% (67) were female. Two of the five schools sampled for the study were mixed whilst the other three were single sex (male) schools. This probably could have contributed to the lower number of females as compared to the higher number of males. Below in figure 4.2 is the age of the senior high school students.

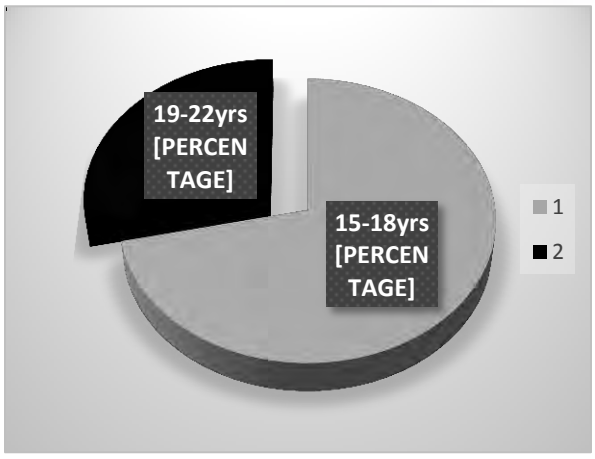

Figure 4. 2 *Age of senior high school students*

Figure 4.2 shows the age of senior high school students. Information shown on Figure 4.2 revealed that majority of them which constituted 71% (143) were between the ages of 15 and 18 years whilst 29% (57) were also between 19 and 22 years. This means that none of them was below 15 years and also above 22 years.

4.2 Research Question1: What attitudes do senior high school students hold toward mathematics?

Research question 1 sought to identify the senior high school students‟ attitude towards mathematics. The senior high school students were presented with a Mathematics Attitude Questionnaire and their responses were rated on a five point Likert scale. For senior high school students‟ responses on the Likert scale, see appendix C. Below in Table 4.1 is the means and standard deviations of the senior high school students‟ responses on their attitude towards mathematics on the Likert type rating scale.

Table 4. 1

Means and Standard Deviations of Senior High School Students‟ Attitude towards Mathematics

	Mean	S.D
I would prefer to find out why something is true by solving a mathematics problem than being told.	3.33	1.23
Mathematics lessons are not fun.	3.05	1.48
It is better to search for information concerning mathematics problems on my own than from my mathematics class teacher.	2.66	1.54
I dislike mathematics lessons.	2.74	1.51
There should be more mathematics lessons each week.	3.45	1.29
Mathematics is one of the most interesting school subjects.	3.16	1.41
I really enjoy mathematics lesson periods.	3.63	1.25
The topics covered in mathematics lesson are not interesting.	3.71	1.23
I do not really expect more mathematics lessons.	2.06	1.09
I would enjoy school more if there were no mathematics lessons.	3.66	1.26
Overall	3.15	1.33

From the results in Table 4.1, item one was used to find out whether participants persevere on a mathematical problem until they have solved it themselves. The senior high school students recorded a mean score of 3.33 indicating that, they “Agree” or at

best “strongly agree” to have persevered on mathematical problems posed to them in their mathematical classroom learning environment, until such problems have been solved. Moreover, from the distribution of responses, 53(26.5%) and 47(23.5%) out of the 200 participants from the senior high schools responded agree and strongly agree respectively (see appendix C). Again, a positive dispositional attitude was recorded by the senior high school students towards mathematics as a subject on item 2. This item sought to elicit from the participants whether they see mathematics lessons as being fun. A mean score of 3.05 was recorded by the senior high school students. This gives an indication that, the students see mathematics lessons as being fun. Moreover, from the distribution of their responses, majority of them 34(17.0%) and 74(37.0%) strongly agreed or agreed respectively. The senior high school students also showed that they will not search for information concerning mathematics problems on their own than from their mathematics class teacher as indicated in item 3. They recorded a mean of 2.66 indicating that strongly disagree or disagree to the assertion that they will search for information concerning mathematics problems on their own than from their mathematics class teacher. The distribution of responses indicated that 61(30.5%) and 60(30.0%) strongly agreed or disagreed respectively (as shown in Appendix B).

It could also be deduced from Table 4.1 that, the senior high school students like mathematics. They responded “disagree” or at best “strongly disagree” and recorded a mean of 2.74 to the assertion that they dislike mathematics. Even though the senior high school students like mathematics, they also showed more interest of expecting more mathematics lessons each week. From the distribution of their responses, majority of them 32(16.0%) and 67(33.5%) responded “disagree” and “strongly disagree”

respectively (see appendix B). They also recorded a mean of 3.16 indicating they really expect more mathematics lessons.

Finally, the item 10 on the mathematics attitude questionnaire (MAQ) was used to find out from the participants whether they would enjoy school more if there were no mathematical lessons. The distribution of responses indicated a very impressive disposition by the senior high school students towards mathematics. Majority of them agreed to enjoy school more if there were no mathematics. From the distribution of their responses, 48(24.0%) strongly agreed whilst 101(50.5%) agreed to enjoying school more, if there were no mathematical lessons (as shown in Appendix B). They recorded a mean of 3.66 indicating a positive response to the item 10.

Considering the overall mean score of the senior high school students‟ attitude towards mathematics, they recorded a mean of 3.15 and a standard deviation of 1.33. This indicated that the senior high school students generally have positive attitude towards mathematics. The assertion that they have positive attitude towards mathematics is that, their overall mean score was above the average mean score of 3.0 from the Likert-type rating scale.

4.3 Discussion of findings

Research question 1 identifies senior high school students‟ attitude towards mathematics. Participants were presented with a Mathematics Attitude Questionnaire and their responses were rated on a five point Likert scale. Mallam (1993) indicates that, negative attitude can powerfully inhibit intellect and curiosity and keep us from learning what is well within our power to understand. From the results, it was revealed that the senior high school students generally have positive attitude towards mathematics. This was ascertaining to the fact that their overall mean score of 3.15 was above the average mean score of 3.0 from the Likert-type rating scale. This finding conform to Taylor (2004) in a study of 745 students in four high schools in Southern California attitude towards mathematics, which he reported that students‟ attitude towards mathematics was positive.

4.4 Research Question 2: What perception do senior high school students have about their mathematics classroom learning environment?

Research Question 2 sought to identify senior high school students‟ perception of their mathematics classroom learning environment. A Mathematics Classroom Learning Environment Inventory (MCLEI) was administered to the senior high school students to respond to their perception of their mathematics classroom learning environment. The MCLEI consisted of five aspects of mathematics classroom learning environment which happens to be students‟ cohesiveness, teacher support, student involvement, co-operation and equity. Considering students‟ cohesiveness, students responded to five items on the questionnaire with a Likert-type rating scale. For the distribution of students‟ responses on their cohesiveness on the five point Likert scale see appendix C. Below in Table 4.2 is

the means and standard deviations of students‟ responses to the items on their cohesiveness in their mathematics classroom learning environment.

Table 4. 2

Means and Standard Deviations of Students' Cohesiveness in their Mathematics Classroom Learning Environment

	Mean	S.D.
It is easy to form discussion groups in my mathematics class	2.43	1.43
I am not afraid to respond to mathematics questions asked by my teacher during mathematics lessons.	2.55	1.54
I am friendly to members in my mathematics class	3.35	1.55
I enjoy being in the mathematics class	3.67	1.54
I am able to study well with other colleague mathematics students in my class.	2.13	1.08

From the table, majority of the students‟ responded negatively towards cohesiveness in their mathematics classroom learning environment. Item 1 was to find out how easy it is to form discussion groups in their mathematics classroom. The students responded negatively with a mean of 2.43 and a standard deviation of 1.43. The students were also afraid to respond to mathematics questions asked by their teachers during mathematics lesson and also were not able to study well with other colleague mathematics students in their class with mean of 2.55 and 2.13 respectively with standard deviations 1.54 and 1.08. Irrespective of students‟ negative perception about students‟ cohesiveness in their class, they enjoy being in the mathematics class and also were friends with other

members in the mathematics class of which they recorded a mean of 3.67 and 3.35 respectively with standard deviations 1.54 and 1.55. Below in 4.3 is the means and standard deviations of students‟ responses to the items on teacher support in their mathematics classroom learning environment.

Table 4. 3

Means and Standard Deviations of Students' Responses to Teacher Support in their Mathematics Classroom Learning Environment

Variable	Mean	S.D.
My mathematics teacher takes a personal interest in my studies in mathematics.	3.27	1.36
My mathematics teacher listens to and accepts my comments on how he/she teaches.	3.27	1.30
My mathematics teacher is willing to explain things again when asked to do so by any student during mathematics lessons.	4.01	1.27
My mathematics teacher helps me when I have a difficulty in studying mathematics	4.08	1.23
When I have difficulty in studying mathematics, I get help from my mathematics teacher.	3.67	1.35

Table 4.3 shows the means and standard deviations of students‟ responses on teacher support in their mathematics classroom learning environment. From the table. All the items recorded favourable responses on teacher support with means above the stipulated mean of 3.0. The students responded that their mathematics teachers take personal

interest in their studies in mathematics, listens and accept comments on how they teach, willing to explain things when asked to do so by any students during mathematics lessons and helps student when they have difficulty in studying mathematics. The assertion that they had favourable responses was that they had means 3.27, 3.27, 4.01, 4.08 and 3.67 with standard deviations 1.36, 1.30, 1.27, 1.23 and 1.35 respectively, which were above the sub- scale average of 3.0. Below in Table 4.4 is the means and standard deviations of students‟ responses on students‟ involvement in their mathematics classroom learning environment.

Table 4. 4

Means and Standard Deviations of Students' Responses on Students Involvement in their Mathematics Classroom Learning Environment

	Mean	S.D.
I take part (participate) in class discussions during mathematics lessons.	3.62	1.30
My mathematics class teacher asks me questions during the lessons	3.29	1.23
I make suggestions during mathematics lessons.	2.91	1.48
My mathematics class teacher involves me in making decisions concerning mathematics.	2.63	1.55
My ideas and suggestions are used during mathematics classroom discussions.	3.23	1.52

Table 4.4 shows the means and standard deviations of students‟ responses on students‟ involvement in their mathematics classroom learning environment. From the table, most of the items received favourable responses with means above the stipulated mean of 3.0.

The students positively perceived that they take part in class discussions during mathematics lessons, their mathematics class teacher asked them questions during mathematics lessons and their ideas and suggestions were used during mathematics classroom discussions with means 3.62, 3.29 and 3.23 respectively with standard deviations 1.30, 1.23 and1.53. Moreover, they negatively perceive that they make suggestions during mathematics lessons and also their mathematics class teacher involves them in making decisions concerning mathematics. The assertion that they perceived these items negatively was that they had means 2.91 and2.63 with standard deviations 1.48 and 155 respectively which was below the overall sub-scale average of 3.0. Below in Table 4.5 is the means and standard deviations of students‟ responses on students‟ co-operation in their mathematics classroom learning environment.

Table 4. 5

Means and Standard Deviations of Students' Responses on Students Co-operation in their Mathematics Classroom Learning Environment

Variable	Mean	S.D.
I get help from other students when I have difficulty in solving mathematics questions.	3.47	1.33
I co-operate with other mathematics students when doing mathematics assignment.	3.23	1.40
When studying mathematics in the form of group discussions with other students in my class, there is team work.	3.71	1.20
I learn from other mathematics students in my class.	2.36	1.30
I work happily with other students in my mathematics class.	1.99	1.04

Table 4.5 shows the means and standard deviations of students‟ responses on students‟ co-operation in their mathematics classroom learning environment. From the table, most of the items received favourable responses with means above the stipulated mean of 3.0. The students positively perceived that get help from other students when they have difficulty in solving mathematics questions, co-operate with other mathematics students when doing mathematics assignment and when studying mathematics in the form of group discussions with other students in the class, there is team work. The assertion that students perceive these items positively was that they recorded a mean of 3.47, 3.23 and 3.71 with standard deviations 1.33, 1.40 and 1.20 respectively which were above the sub-scale of 3.0. However, they negatively responded that they learn from other mathematics students in their class and also work happily with other students in their mathematics

class with means 2.36 and1.99 with standard deviations 1.30 and 1.04 respectively which were also below de sub scale average of 3.0 Below in Table 4.6 is the means and standard deviations of students‟ responses on students‟ co- operation in their mathematics classroom learning environment.

Table 4. 6

Means and Standard Deviations of Students' Responses on Students Equity in their Mathematics Classroom Learning Environment

	Mean	S.D.
My mathematics class teacher gives as much attention to my question as he/she gives to other students.	2.26	1.26
I get the same amount of help from my mathematics class teacher as the other students in this class	2.32	1.18
I receive the same encouragement as the other mathematics students in this class.	2.76	1.25
My work receives as much praise as the other mathematics students‟ in this class.	3.31	1.23
I get the same opportunity to answer questions during mathematics lessons as the other students in the class.	2.55	1.16

Table 4.6 shows the means and standard deviations of students‟ responses on students‟ equity in their mathematics classroom learning environment. From the table, most of the items received unfavourable responses with means below the stipulated mean of 3.0. The students negatively perceived that their mathematics class teacher gives as much attention to their questions as he/she gives to other students, get the same amount of help from their mathematics class teacher as the other students in the class and receive the same

encouragement as the other mathematics students in the class. The assertion that students perceive these items negatively was that they recorded means 2.26 ,2.32, 2.76 and 2.55 with standard deviations 1.26, 1.18, 1.25 and 1.16 respectively which were below the sub-scale average of 3.0. On the other hand, the senior high school students positively perceived that their work receives as much praise as the other mathematics students‟ in the class which recorded a mean of 3.31and a standard deviation 1.23. Below in Table 4.9 is the overall subscale mean and standard deviation of senior high school students‟ perception of their mathematics classroom learning environment.

Table 4. 7

Overall Subscale Mean and Standard Deviation of SHS Students' perception of Their MCLE

	Mean	S.D
Cohesiveness	2.83	1.43
Teacher Support	3.67	1.30
Student Involvement	3.14	1.42
Co-operation	2.95	1.25
Equity	2.64	1.22
Overall/Weighted	3.05	1.32

Table 4.7 shows the overall subscale mean and standard deviation of senior high school students‟ perception of their mathematics classroom learning environment. Students perception were based on five domains of Cohesiveness, Teacher Support, Student Involvement, Co-operation and Equity.

On all the five domains, the senior high school students had positive perception on teacher support and student involvement with means of 3.67 and 3.14 respectively with standard deviations 1.30 and 1.42. They also had negative perception for cohesiveness, co-operation and equity with means of 2.83, 2.95 and 2.64 respectively with standard deviations1.43, 1.25 and 1.22. The overall mean perception recorded was 3.05 with a standard deviation of 1.32. This

indicated that, the senior high school students generally have positive perception of their mathematics classroom learning environment.

4.5 Discussion of findings

Research Question 2 identifies senior high school students‟ perception of their mathematics classroom learning environment. A Mathematics Classroom Learning Environment Inventory (MCLEI) was administered to the senior high school students to respond to their perception of their mathematics classroom learning environment. Students perception of their mathematics classroom learning environment which was based on five domains of Cohesiveness, Teacher Support, Student Involvement, Co-operation and Equity. The senior high school students on all the five domains showed positive perception on teacher support and student involvement with means of 3.67 and 3.14 respectively. Aldridge, Fraser and Huang (1999), in their study of the ninth-grade mathematics learning environment in Hong Kong, reported that many students identified the teacher as the most crucial element in a positive classroom environment. The senior high school students from the study also had negative perception for cohesiveness, co-operation and equity with means of 2.83, 2.95 and 2.64 respectively. The overall mean perception recorded was 3.05 with a standard deviation of 1.32. This indicated that, the senior high school students generally had positive perception of their mathematics classroom learning environment and this confirmed Haertel, Walberg and Haertel (as cited in Fraser, 2007) in their studies concerning classroom environment comprising 17,805 students, which revealed that, a variety of students‟ outcome measures were consistently higher in classes that were perceived as being high on cohesiveness, satisfaction and goal-direction.

4.6 Research Question 3: What is the relationship between senior high school students‟ attitude towards mathematics and perception of their mathematics classroom learning environment?

Research Question 3 sought to identify if any relationship exist between the senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment. A correlation analysis was performed to identify if such relationship exists. The following hypothesis was formulated to guide the analysis.

H_0: There is no significant relationship between the senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment.

H_1: There is a significant relationship between the senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment.

Below in Table 4.8 is the descriptive statistics for the senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment.

Table 4. 8

Descriptive Statistics for the senior high school students' attitudes towards mathematics and their perception of their mathematics classroom learning environment

	Mean	Std. Deviation	N
Students‟ Perception	3.04	0.53	200
Students‟ Attitude	3.14	0.38	200

Table 4.8 shows the descriptive statistics for the senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment The results from Table 4.8 shows that the senior high school students‟ perception had mean 3.04 with standard deviation 0.53 whiles their attitude recorded a mean of 3.14 with a standard deviation 0.38.

The scatter plot for the relationship between senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment is shown below in figure 4.3.

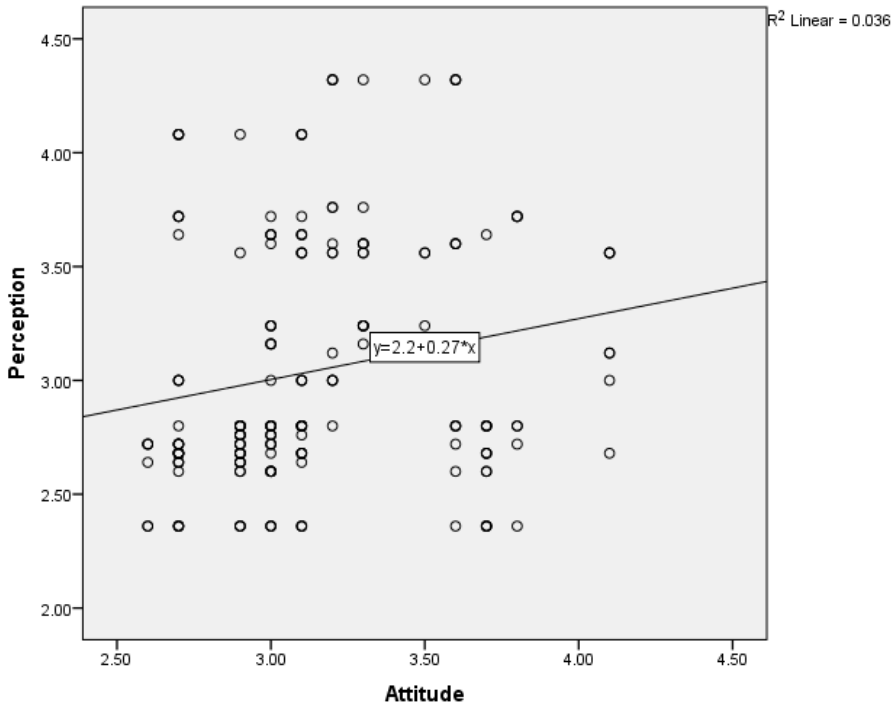

Figure 4.3 Scatter Plot for the Relationship between senior high school students' attitudes towards mathematics and their perception of their mathematics classroom learning environment

Figure 4.3 shows the Scatter Plot for the relationship between senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment. The figure above shows a linear relationship between senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment. Below is the Pearson correlation for the senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment.

Table **4. 9**

Spearman's Correlation for Senior high school students' attitudes towards mathematics and their perception of their mathematics classroom learning environment

Relationship between	N	Spearman"s Correlation	Sig.(2-tailed)
Students Attitude and Perception	200	**.**285	.000

Correlation is significant at the .01 level (2-tailed)

From Table 4.9, a correlation analysis was used to determine the relationship between senior high school students" attitudes towards mathematics and their perception of their mathematics classroom learning environment. The results indicated a weak positive significant relationship between senior high school students" attitudes towards mathematics and their perception of their mathematics classroom learning environment, with the p- value less than the alpha level. This suggests that we reject the null hypothesis that; "there is no significant relationship between senior high school students" attitudes towards mathematics and their perception of their mathematics classroom learning environment. and accept the alternate hypothesis that "there is a significant relationship between senior high school students" attitudes towards mathematics and their perception of their mathematics classroom learning environment.

It can be concluded that senior high school students selected for this study will have a positive perception of their mathematics classroom learning environment when they have a positive attitude towards mathematics.

4.7 Discussion of findings

Haladyna (as cited in Hannula, 2002) indicates that the general attitude of a class towards mathematics is related to the quality of the teaching and the social-psychological climate of the class. This indicates that for students to form an attitude towards mathematics, it depends on what goes on in the classroom as far as teaching and learning is concerned, that is, whether the learning environment is deemed by the students to be conducive for learning or not. Also, Aldridge et al (1999), caution against results indicating association between perception of learning environment and attitude by stating that although classroom dimensions provide useful information as to dimensions that could be manipulated to improved student outcomes, they do not identify causal factors. From this study, a correlation analysis was used to determine the relationship between senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment. The results indicated a weak positive significant relationship between senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment, with the p- value less than the alpha level. This suggested that senior high school students with positive perception of their mathematics classroom learning environment will also have a positive attitude towards mathematics and vice versa. This finding confirms a study conducted by Fraser, Welch and Walberg (as cited in Fraser, 1998) which revealed classroom and school environment to be a strong predictor of both achievement and attitude even when a comprehensive set of other factors was held constant. Their studies further gave an indication that perhaps a more positive perception of the mathematics learning

environment may lead to an appreciable change in attitude of students towards mathematics.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, RECOMMENDATIONS

5.0 Overview

This chapter provides conclusion for the study. It includes summary of the study, conclusion, limitations, recommendations and avenues for further research.

5.1 Summary of the study

The study investigated senior high school students‟ attitude towards mathematics and how they perceive their mathematics classroom learning environments. It also considered the relationship between senior high school students‟ attitude towards mathematics and perception of their mathematics classroom learning environment. A descriptive survey design was used as the research design for the study. Data collected for the study were quantitative and were used to investigate the senior high school students‟ attitude towards mathematics and perception of their mathematics classroom learning environment.

The target population for this study was final year senior high school students in the Cape Coast Metropolis of the Central Region of Ghana. The sample size for the study consisted of 200 participants from five senior high schools, which happens to be high school A, B, C, D and E. A Mathematics Classroom Learning Environment Inventory (MCLEI) and Mathematics Attitude Questionnaire (MAQ) were the

instruments for data collection. Analysis of data was based on descriptive (means, standard deviations and percentages) and inferential statistics (correlation analysis).

5.1.1 Summary of key findings

Several findings evolved from this study. Below is a summary of the findings with their respective research questions.

Research question 1: What attitudes do senior high school students hold toward mathematics?

The research question 1 was to find out the attitudes of the senior high school students towards mathematics. A Mathematics Attitude Questionnaire (MAQ) was used to obtained the data. The researcher identified that, the senior high school students exhibited positive attitude towards mathematics. This was ascertaining to the fact that most of the items from the MAQ received favourable responses with an overall average of 3.15 with standard deviation of 1.33 which was above the sub scale average of 3.0.

Research Question 2: What perception do senior high school students have about their mathematics classroom learning environment?

The research question 2 was also to find out how the senior high school students perceive their mathematics classroom learning environment. A Mathematics Classroom Learning Environment Inventory (MCLEI) was used to collect data. The results revealed that, the senior high school students perceived their mathematics classroom learning environment positively with an overall mean perception of 3.05 with a standard deviation of 1.32.

Research Question 3: What is the relationship between the senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment?

The research question three was to identify if there exist any relationship between the senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment. A correlation analysis was performed and the researcher identified a weak positive significant relationship between senior high school students‟ attitudes towards mathematics and their perception of their mathematics classroom learning environment, with the p- value less than the alpha level. It was therefore concluded that the senior high school students with positive attitude towards mathematics have positive perception of their mathematics classroom learning environment.

5.2 Conclusion

From the study, the senior high school students‟ attitude towards mathematics was found to be positive. However, common sense reveals that one is likely to achieve higher in something one enjoys doing, has confidence in learning or finds useful. Thus a favourable attitude towards various aspects of mathematics is desirable. Attitude towards mathematics may influence the readiness and willingness with which an individual would learn and benefit from mathematics instruction. Furthermore, the senior high school students‟ perception of their mathematics classroom learning environment was found to be positive. It also seems to suggest that senior high school students from the selected schools perceived their mathematics classroom learning environment to be greatly

influenced by Teacher Support and Student Involvement either than Cohesiveness, Co-operation and Equity. As a result of this, mathematics teachers in these schools should employ the appropriate pedagogical skills and the most effective teaching strategies that will continually enhance the teaching and learning of mathematics as well as improve the senior high school students‟ perception. Moreover, owing to the positively weak relationship established between the students‟ attitude towards mathematics and perception of their mathematics classroom learning environment, it can be concluded that, perception of ones‟ learning environment is to some extent depend on their attitude towards mathematics. Hence the need to introduce into mathematics classroom learning environment, readily available mathematics teaching and learning materials (TLMs) so as to enhance the students‟ interest in mathematics.

5.3 Limitations

According to Best and Kham (1993), limitations are conditions beyond the control of the researcher that place restrictions on the conclusion of the study and its application. The major limitation placed on this study was the inability to generalise the results of the study to all Senior High Schools in Ghana. The researcher could not cover all Senior High Schools in Ghana due to lack of finance and time. Therefore, the researcher used only five Senior High Schools which represented a very small portion of the entire population.

5.4 Recommendations

From the findings of this study, the following recommendations are offered:

1. As a result of the findings on the relationship between the students‟ perception on mathematics classroom learning environment and their attitude towards mathematics, mathematics educators at the senior high level of education especially at the senior high school should implement teaching strategies that will improve upon their students‟ positive perception of their mathematics classroom learning environment.

2. Since the senior high school students indicated that the level of Cohesiveness, Co-operation and Equity among themselves in their respective mathematics lessons were below average, mathematics educators are encouraged to introduce more suitable teacher learner activities with the appropriate corresponding teaching learning materials (TLMs) in their mathematics classroom learning environment. This will help achieve maximum Cohesion, Co-operation and Equity among the students during the mathematics lessons.

3. Since senior high school students had favourable attitude towards mathematics, mathematics educators should capitalize on this favourable attitude to help students appreciate the learning of mathematics.

5.5 Suggestions for Further Research

In order to continue building upon the literature on senior high school students‟ perceptions of their mathematics classroom learning environment and any possible influence this learning environment may have on the students‟ attitude towards mathematics, the following suggestions are put forward:

1. Future studies could investigate rural senior high school students‟ perceptions of their mathematics classroom learning environments and compare them with urban school students‟ perceptions; such a study could provide meaningful information for the understanding of how particular sub-cultures influence students‟ perceptions and attitudes towards mathematics.
2. The study covered only five senior high schools in the Cape Coast Metropolis in the Central Region of Ghana because of proximity, time to complete the study and finance. The research design could be modified so that more senior high schools could be used to give a wider view on senior high school students‟ attitude towards mathematics and how they perceive their mathematics classroom learning environments.

REFERENCES

Akey, M. (2006). *School context, students' attitudes and behavior and academic achievement: an exploratory analysis,* Tech. Rep., MDRC.

Aldridge, J. M., Fraser, B. J., & Huang, T-C, I. (1999).Investigating classroom environments in Taiwan and Australia with multiple research methods.*The Journal of Educational Research, 93* (1), 45-62.

Amirali, M. (2010). Students‟ conceptions of the nature of mathematics and attitudes towards mathematics learning. *Journal of Research and Reflections in Education.* 4(1), 27-41.

Ampiah, J. G. (2006). Students‟ psychosocial perception of their science laboratory environment in Ghanaian Senior Secondary Schools. *Ife psychologia 14* (2), 136-137

Ampiah, J. G. (2004). *An investigation into science practical work in senior secondary schools: Attitudes and perceptions*. Unpublished Masters, Thesis, University of Cape Coast, Cape Coast.

Anamuah-Mensah, J., & Mereku, K. (2005). Ghanaian JSS2 students' abysmal mathematics achievement in TIMSS-2003: a consequence of the basic school mathematics curriculum. *Mathematics Connections, 5*, 1-13.

Anamuah-Mensah, J., & Mereku, K. D. (2005). On what foundation is Africa building its science and technology base? Africa‟s participation in TIMSS-2003. *African Journal of Educational Studies in Mathematics and Sciences, 3*(3), 1-8.

Anderson, G., & Walberg, H. (1974). Evaluating educational performance. In H. J. Walberg (Ed.), *Evaluating educational performance: A sourcebook of methods, instruments, and examples.* Berkley, CA: McCutchan.

Anamuah-Mensah, J. (2007). *Relevant data collected for practical project plan.* Paper Presented at the PRACTICAL Project Workshop, Elmina, 18-20 December, 2007.

Asabere-Ameyaw, A., & Mmereku, D. K. (2009). Comparative analysis of performance of eight graders from six African Countries. *Mathematics Connection, 8(2), 17-26*

Asiedu-Addo S. K., & Yidana I. (2000). Mathematics Teachers‟ Knowledge of the Subject.

Asoma, K. (2014). *Junior High school Pupils' Perception of their Mathematics Classroom Learning Environment and Attitudes towards* Mathematics. Unpublished Masters' Thesis, University of Cape Coast. Cape Coast.

Baker, D., & Jacobs, K. (1999). *Winners and losers in single-sex science and mathematics classrooms.* Boston: Rep.

Best, J. W., & Kahn, J. V. (2007). *Research in Education.* New Delhi: Prentice Hall of India .

Bono, D. (1991). The impact of cooperative learning on suzy and janie"s attitude about math. *Research report in Virginia*, 137-167.

Borasi, R. (1990). The invisible hand operating on mathematics instruction; Students conceptions and expectations. In T.J. Cooney, (Ed.), *Teaching and learning mathematics in the 1990s*, (NCTM Yearbook), pp.174-182. Reston: NCTM.

Brekelmans, M., Sleegers, P., & Fraser, B. (2001).Teaching for active learning. In R.J. Simons, J. van der Linden, & T. Duffy (Eds.), *New Learning,* pp 527-564. Dordrecht, The Netherlands: Kluwer Academic Publishers. 91

Brok, D. P., Fisher, D. L., & Waldrip, B. (2005). *Primary teachers' interpersonal behaviour and cultural elements of the classroom environment*. Paper presented at the Fourth International Conference on Science, Mathematics and Technology Education, Victoria, 25-28 August, 2005.

Brophy, J. (1999). *Teaching.* Brussels: International Academy of Education

Bruner, J. (1996). *The culture of education*. Cambridge, MA: Harvard University Press.

Capraro, M. (2001). *Defining constructivism: Its influence on the problem solving skills of students*. Paper presented at the Annual Meeting of the Southwest Educational Research Association, New Orleans, LA.

Castillo, J. (2009, November 12). Retrieved March 11, 2015, from www.experiment-resources.com: http://www.experiment-resources.com/convenience-sampling.htm

Chionh, Y. H., & Fraser, B. J. (2009). Classroom environment, achievement, attitudes and self esteem in geography and mathematics in Singapore. *International Research in Geographical and Environmental Education*, *18*, 29-44.

Cockcroft, W.H (1982). *Mathematics Counts*. London: H.M. Stationery Office.

Cohen, L., Manion, L., & Morrison, K. (2000).*Research methods in education*, (5th ed). London: Routledge Falmer Publishers.

Collis, B. (1987). Sex differences in the association between secondary school students attitude toward mathematics and toward computers. *Journal for Research in Mathematics Education, 18*(5), 394-402.

Costello, J. (1991). *Teaching and Learning Mathematics 11-16*. London: Routledge.

Creswell, J. (1999). *Qualitative Inquiry and Research Design.* London: SAGE Publiations.

Curriculum Research and Development Division. (2002). *Teaching syllabus for mathematics (Junior High School)*. Accra, Ghana.

Curriculum Research and Development Division. (2007). *Teaching syllabus for mathematics (Junior High School)*. Accra, Ghana.

Daempfle, P.A. (2004). An analysis of the high attrition rates among first year college science, math, and engineering majors. *Journal of College Student Retention*, 5 (1), 37-52.

Daramola, S. (1998). *Statistical analysis in education.* Llorin: Lekan Press.

Descombe, M. (2003). *The good research guide for small-scale social research projects.* Open University Press.

Devore. (2005). *Statistics- The exploration and analysis of data.* USA: Thomson Learning Inc.

Di Martino, P., & Zan, R. (2001). Attitude toward mathematics: some theoretical issues. In M. vanden Heuvel-Panhuizen (Ed.), *Proceedings of the 25th annual conference of the International Group for the Psychology of Mathematics Education* (Vol. 3, pp. 351-358). Utrecht, The Netherlands: PME.

Dorman, J.P. (2002). *Classroom environment research: Progress and possibilities.* Retrieved from http://www.iier.org.au/qjer/qjer18/dorman.html

Dorman, J. P. (2001). Associations between classroom environment and academic efficacy. *Learning Environments Research, 4*, 243-257.

Durrheim, K. (1999). Quantitative Measurement. In M. T. Blanche, & K. Durrheim, *Research in practise: Applied methods for the social sciences.* (pp. 72-95). Cape Town: University of Cape Town press.

Duedu, C. B. (2008). Attitude of junior secondary school students in the cape Coast Metropolitan area towards mathematics, mathematical connection.7.1-3

Dungan, J. F., &Thurlow, G. R. (1989).Students attitude towards mathematics: A review of the Literature. *Australian Mathematics Teacher*, 45, 8-11.

Eshun, B.A. (1999). The pattern of mathematical achievement of secondary school students in Ghana. *Journal of Science and Mathematics Education*, *2*(1), 22-33.Curriculum Research and Development Division. (2007). *Teaching syllabus for mathematics (Senior High School)*. Accra, Ghana.

Eshun, B.A. (2000). Sex-Differences in attitude of students towards mathematics in secondary schools. *Journal of the Mathematical Association of Ghana,* 12, 1-13.

Fisher, D. L., & Webster, B. J. (2003). School-level environment and student outcomes in mathematics. *Learning Environments Research*, 6, 309-326. 92

Eshiwani, G. S (1984). "A study of Women Access to Higher Education in Kenya with a Special Reference to Mathematics and Science Education" *Bureau of Education Research.* Nairobi: Kenyatta University

Engle, P., Grantham-McGregor, S., Black, M., Walker, S., & Wachs, T. (2007). *How to avoid the loss of potential in over 200 million young children in the developing world. Child health and education* (1(2)).

Fennema, E., & Sherman, J. A. (1976). "Fennema-Sherman" Mathematics Attitudes" *ISAS Catalog of Selected Documents in Psychology 6, 31* (MS No. 1225).

Festinger, L. (1959). *Cognitive Dissonance:An Introduction,*. London: Stanford University Press.

Fishbein, M. Ajzen, J (1975) *Belief, Attitude intension and behaviour: an introduction to theory and research reading.* London: Wesley Inc.

Flanders, N. A. (1965). "The Influence Pupils Attitudes and Achievement" *Co-operative Research Monograph No. 128.* Washington D.C (Publisher not Indicated)

Forgasz, H. J. (1995). Gender and the relationship between affective beliefs and perceptions of grade 7 mathematics classroom learning environments. *Educational Studies in Mathematics*, *20*, 219-239.

Fraser, B.J., & Tobin, K. (1991). Combining qualitative and quantitative methods in classroom environment research. In B.J. Fraser & H. J. Walberg (Eds.), *Educational environments: Evaluation, antecedents and Consequences,* pp 271-291. London: Pergamon Press.

Fraser, B. J., & Walberg, H. J. (1991). *Educational environments: Evaluation, antecedents and consequences.* Oxford, GB: Pergamon.

Fraser, B. J. (1994). Research on classroom and school climate. In D. L. Gabel (Ed.), *Handbook of research on science teaching and learning* (pp.493-541). New York: Macmillan.

Fraser, B. J., McRobbie, C. J., & Fisher, D. L. (1996). *Development, validation and use of personal and class forms of a new classroom environment instrument.* Paper presented at the Annual Meeting of the American Educational Research Association, Chicago 13-17, May, 2005.

Fraser, B. J. (1998). Science learning environments: Assessment, effects and determinants. In B.J. Fraser & K. G. Tob (Eds.), *The international handbook of science education* (pp. 527-564). Dordrecht: Kluwer Academic Publishers.

Fraser, B. J. (1998). Classroom environment instruments: Development, validity and applications. *Learning Environment Research*, 1, 7–33.

Fraser, B. J. (2001). Twenty thousand hours. *Learning Environment Research,* 4*,* 1-5.

Fraser, B. J., & Chionh, Y. H. (2000).*Classroom environment, self-esteem, achievement and attitude in geography and mathematics in Singapore*. Paper presented at the Annual meeting of the American Educational Research Association, New Orleans, 13-17, May 2005.

Fraser, B. J. (2002). Learning environments research: yesterday, today and tomorrow. In C.Goh & M. S. Khine (Eds.), *Studies in educational learning environments: an interpersonal perspective* (pp. 1-27). Singapore: World Scientific Publishers.

Fraser, B. J. (2007). Classroom learning environments. In S.K. Abell & N. G. Lederman (Eds.), *Handbook of research on science education* (pp. 103–124). Mahwah, NJ: Lawrence Erlbaum.

Fraser, B. J. (2012). Classroom learning environments: Retrospect, context and prospect. In B. J. Fraser, K. G. Tobin, & C. J. McRobbie (Eds.), *Second international handbook of science education* (pp. 1191–1239). New York: Springer

Fraenkel, J. R., & Wallen, N. E. (2000).*How to design and evaluate research in education* (4thed.). USA: McGraw-Hill Company Inc. Fraser, B. J. (1998a). Validity and Use of Classroom Environment Instruments. *Journal of Classroom Interactions*, *26*(2), 5-11.

Fennema, E., & Sherman, J. A. (1976). Fennema-Sherman mathematics attitude scales: Instruments designed to measure attitude towards the learning of mathematics by males and females. *JSAS Catalog of Selected Documents in Psychology*, *6* (1), 3b.

Gerrish, K., & Lacey, M. (2010). *The Research Process in Nursing.* Oxford: Wiley-Blackwell.

Galbraith, M. W. (1990). Attributes and skills of an adult educator. In M. W. Galbraith (Ed.), *Adult Learning Methods*, Fla: Robert E. Krieger.

Geary, D. C. (2006). Development of mathematical understanding. In D. Kuhl & R. S.

Siegler (Vol. Eds.), *Cognition, perception, and language, Vol 2* (pp. 777–810).

W. Damon (Gen. Ed.), *Handbook of child psychology (6th Ed.)*. New York: John Wiley & Sons.

Githua, B. N., & Mwangi, J. G. (2003). Students mathematics self-concept and motivation to learn mathematics: relationship and gender differences among Kenyas Secondary- School students in Nairobi and Rift Valley Provinces. *International Journal of Educational Development*, 23, 487-499.

Giambra. (2003). *Effects of Organizational Restructuring on Employee Attitudes.* London: Wesley Publishers.

Goh, S. C., & Fraser, B. J. (1998).Teacher interpersonal behaviour, classroom environment and student outcomes in primary mathematics in Singapore. *Learning Environments Research*, *1,* 199-229.

Goh, S.C., & Khine, M.S.(Eds.). (2002). *Studies in educational learning environments: An international perspective.* Singapore: World Scientific.

Haladyna, T., Shaughnessy, J., Shaughnessy, M. (1983). A causal analysis of attitude toward mathematics. *Journal for Research in mathematics Education, 14 (1),* 19-29.

Hammouri, H. A. (2004). Attitudinal and motivational variables related to mathematics achievement in Jordan: findings from the Third International Mathematics and Science Study (TIMSS). *Educational Research*, 46 (3), 241-257.

Hannula, M. S. (2002). Attitude towards mathematics: emotions, expectations and values. *Educational Studies in Mathematics 49 (1),* 25-46

Hatfield, M. M., Edwards, N. T., & Bitter, G. G. (1997).Mathematics methods for elementary and middle school teachers. Boston: Allyn and Bacon.

Helding, K. A. (2006). *Effectiveness of National Board Certified Teachers in terms of classroom environment, attitudes and achievement among secondary science student.* PhD thesis submitted to Curtin University of Technology, Australia.

Hemmings, B., Grootenboer, P., & Kay, R. (2010). Predicting mathematics achievement: The influence of prior achievement and attitudes. *International Journal of Science and Mathematics Education*, *9*, 691-705.

Henderson, D., Fisher, D., & Fraser, B. (2000). Interpersonal behaviour, Laboratory learning environments, and student outcomes in senior biology classes. *Journal of Research in Science Teaching, 37(1), 26-43*.

Herbert, K. (1978). *The new book of popular science daribury,* Connecticut: Grolier Inc.

House J. D., & Telese J. A. (2008). Relationships between student and instructional factors and algebra achievement of students in the United States and Japan: an analysis of TIMSS 2003. *Educational Research and Evaluation*, 14(1), 101 –112.

Huang, S. L., & Waxman, H. C. (1995b). Motivation and learning environment differences between Asian American and white middle school students in mathematics. *Journal of Research and Development in Education*, *28*, 208–219.

Ilevbare, F. M. (2008). Psychosocial factors influencing attitudes towards internet piracy among Nigerian university students. *Ife Psychologia 16* (2), 136- 151.

International Study Center, Lynch School of Education College.Volet, S. E. (1997). Cognitive and affective variables in academic learning: The significance of direction and effort in Students goals. *Learning and Instruction*, 17, 235-254.

Kaino, L. M. (1998). Some Swaziland high school students‟ attitudes towards the study of mathematics. *Journal of the Southern African Association for Research in Mathematics and Science Education, pg. 33-38, vol.2, no.1.*

Khalil, M. & Saar, V. (2009). The classroom learning environment as perceived by students in Arab elementary schools. *Learning Environments Research*, *12,143–*156.

Khoo, H., & Fraser, B. J. (1998). *Using classroom environment dimensions in the evaluation of adult computer courses*. Paper presented at the annual meeting of the National Association for Research in Science Teaching, San Diego, CA.

Kim, H. B., Fisher, D. L., & Fraser, B. J. (2000). Classroom environment and teacher interpersonal behaviour in secondary science classes in Korea. *Evaluation and Research in Education,* 14, 3-22.

Koballa, T. R. Jr., & Glynn, S. M. (2007). Attitudinal and motivational constructs in science learning. In Abell, S .K & Lederman, N.G. (Eds.), *Handbook of Research on Science Education,* pp.3-29. London: Lawrence Erlbaum Associates.

Koul, R. B., & Fisher, D. L. (2005). *An investigation into teacher interaction, perceptions of learning environment, cultural differences and science achievement in India.* Paper presented at the Fourth International Conference on Science, Mathematics and Technology Education, Victoria, 25-28 August, 2005.

Lawrenz, F. (1987). Sex effects for student perception of the classroom psychosocial environment. *Journal of Research in Science Teaching 24, 689–97*

Leung, F. K. S. (2006). Mathematics education in East Asia and the West: Does culture matter? In F. K. S. Leung, K.-D. Graf, & F. Lopez-Real (Eds.),

Mathematics education in different cultural tradition: A comparative study of East Asia and the West (pp. 21-46). New York, NY: Springer.

Lianghuo, F. Seng, Q, K. Yan, Z. Me1 Y, S. & Yee, L. P (2005). *Assessing Singapore Students Attitudes towards Mathematics and Mathematics learning*. Retrieved from http:math.ecnu.edu.cn/earcome3/TSG6/4-Fan%20L ().doc.

Liska, R. (2001). *Handbook of Social Psychology: The Cognitive Perspective.* London: Micener Publishers.

Ma, X., & Kishor, N. (1997). Attitude toward self, social factors, and achievement in mathematics: A meta-analytic review. *Educational Psychology Review*, *9* (2), 89-120.

Ma, X., & Klinger, D. A. (2000). Hierarchical linear modeling of student and school effects on academic achievement. *Canadian Journal of Education*, 25, 41 – 55.

Maat, & Zakaria, E. (2010).The learning environment, teacher‟s factor and student‟s attitudes towards mathematics amongst engineering technology students. *International Journal of Academic Research, vol. 2, no. 2*, pp. 16–20.

Macnab, D. S., & Cummine, J. A (1986). Teaching Mathematics 11-16 A Difficult-Centered Approach. London: Basil Blackwell Ltd.

McGuire J. (1969). *Attitudes*. New York: D. Van Nostrand

Majeed, A., Fraser, B. J., & Aldridge, J. M. (2002). Learning environment and its associations with student satisfaction among mathematics students in Brunei Darussalam. *Learning Environments Research, 5*, 203-226.

Mallam, W. A. (1993). Impact of school-type and sex of the teacher on female students attitudes towards mathematics in Nigerian secondary schools. *Educational Studies in Mathematics*, 24, 223-229.

Manouchehri, A., & Enderson, M. C. (1999). Promoting mathematical discourse: Learning from classroom examples. *Mathematics Teaching in the Middle School*, 4 (4), 216-222.

Mason, L. (2003). High school students beliefs about mathematics, Mathematical problem solving and their achievement in mathematics: A cross-sectional study. *Educational psychology*, 23, 73-85.

McGuire W, J. (1969). *The Psychology, the Nature of Attitudes and Attitude Change in theHandbook of Social Psychology.* London: Addison-WesleyPublishers.

McLeod, D. B. (1992). Research on affect in mathematics education: A reconceptualization. In *handbook of research on mathematics teaching and learning*, edited by D. A. Grouws. New York: Macmillan.

McLeod, D. (1994). Research on affect and mathematics learning in the JRME: 1970 to the present. *Journal for research in Mathematics Education*, *25*(6), 637–647. Retrieved from http://www.jstor.org/stable/10.2307/749576.

McMillan, J. (2000). *Educational research: Fundamentals for the consummers (3rd Ed).* New York: Addison Wesley.

McMillan, J., & Schumacher, S. (2010). *Research in Education: Evidence-Based Inquiry.* Boston: MA:Pearson.

Mensah, F. (2007).Gender and developmental differences towards science between senior secondary school year one students and year three students. *Ife Psychologia*, *5*(2), 1240-1247.

Mitchell, M. L., & Jolley, J. M. (2004). *Research design explained* (5th ed.). Wadsworth: Thompson Learning Inc.

Middleton, J. A., & Spanias, P. A. (1999). Motivation for achievement in mathematics: Finding, generalizations, and criticisms of the research. *Journal for Research in Mathematics Education*, 30, 1, 65-88.

Ministry of Education, Youth and Sports. (2004). *Government's white paper on educational review committee report*. Accra, Ghana.

Ministry of Education. (2007). Republic of Ghana junior high school mathematics syllabus. Accra: Curriculum Research and Development Division

Mobeenul Islam, (2012). *Impact of students' perceptions about teacher interaction and classroom learning environment on attitude towards mathematics and achievement.* Unpublished Doctoral Thesis. Lahore: IER, University of the Punjab.

Mohamed, L., & Waheed, H. (2011). Secondary students" attitude towards mathematics in a selected school of Maldives. *International Journal of Humanities and Social Science, 1(15), 277-281.*

Moos, R. (1974). *The social climate scales: An overview.* Palo Alto, CA: Consulting Psychologists Press.

Moos, R. H. (1979). *Evaluating educational environments: Procedures, measures, findings, and policy implications*. San Francisco, CA: Jossey-Bass.

Moos, R. H. (1979). *Evaluating environments: Measures, procedures, findings and policy implications.* San Francisco, CA: Jossey-Bass.

Mucherah, W. (2008).Classroom climate and students goal structures in high school biology classrooms in Kenya. *Learning Environment Research,* 11, 63-81.

Muis, K. R. (2004). Personal epistemology and mathematics: A critical review and synthesis of research. *Review of Educational Research*, *74*, 317-377.

Myint, S. K., & Goh, S. C. (2001). *Investigation of tertiary classroom learning environment in Singapore.* Paper presented at the International Educational Conference, Australian Association for Educational Research (AARE), University of Notre Dame, Fremantle, Western Australia, 2-6 December, 2001.

National Council of Teachers of Mathematics. (2000). Principles and standards for school mathematics. Reston, VA.

National Research Council. (2001). *Adding it up.* Washington, D.C.: National Academy Press.

Nickson, M. (1992). The culture of the mathematics classroom: An unknown quantity? In D.A. Grouws (Eds), *Handbook of Research on Mathematics Teaching and Learning* (pp. 101-114). Reston, VA.

Njue, F. M. (2005). Analysis of Teachers‟ Attitudes towards Proposed Introduction of Sex – Education in Kenya: A Case of Special Schools in Central Province. Unpublished M.Ed. Project. Kenyatta University.

Ntow, F. D. (2009). *Senior Secondary School Students' perception of their core mathematics classroom environment and attitude towards core mathematics*. Unpublished Thesis, University of Cape Coast, Cape Coast.

Nworgu, B. G. (2006). *Educational Research: Basic issues and methodology.* Ibadan: Wisdom Publishers Limited.

Ogbuehi, P. I., & Fraser, B. J. (2007). Learning environment, attitudes and conceptual development associated with innovative strategies in middle-school mathematics. *Learning Environments Research*, *10*, 101-114.

Opolot-Okurut, C. (2010). Classroom learning environment and motivation towards mathematics among secondary school students in Uganda. *Learning Environments Research, 13(3)*, 267–277

Orora, I. M. (1986). A study of Attitudes of Teachers and Pupils Towards Teaching and Learning of Mathematics Respectively in Upper Primary Schools in Masimba Educational Zone, Irianyi Division, Kisii District, Kenya. Unpublished M. Ed project. Kenyatta University.

Orton, A. &., Wain, G. (1994). *Issues in Teaching Mathematics.* London: Cassel Wellingon House.

Orton, A. (1987). *Learning Mathematics Issues Theory and Classroom Practice.* London: Cassel Education Ltd.

Osborne, J., Simon, S., & Collins, S. (2003). Attitudes towards science: A Review of literature and its implications. *International Journal of Science Education*, *25* (9), 1049-1079.

Pirie, S., & Kieren, T. (1992). Creating constructivist environments and constructing creative mathematics. *Educational Studies in Mathematics*, 23, 505-528.

Ramsden, J. (1998). Mission impossible? Can anything be done about attitudes to science? *International Journal of Science Education, 20,* 125-137.

Rathbone, S. A. (1989). *Gender differences in attitude towards mathematics between low-achieving and high-achieving fifth grade elementary students*. Paper presented at the Annual Meeting of the Eastern Educational Research Association, Savannah, G. A.

Rawnsley, D. & Fisher, D. L. (1997). Using personal and class forms of a learning environment questionnaire in mathematics classroom. In D. L. Fisher & T. Rickard (Eds.), *Science, mathematics and Technology Education and National Development: Proceedings of the Vietnam Conference* (pp. 52-63). Hanoi: Vietnam.

Rawnsley, D., & Fisher, D. (1998). Learning environments in mathematics classrooms and their associations with students‟ attitudes and learning. Paper presented at the Australian Association for Research in Education Conference, Adelaide, Australia. Retrieved from http://www.aare.edu.au/98pap/fis98269.htm

Reid, N. (2006). Thoughts on attitude measurement. *Research in Science and Technological Education*, *24* (1), 3-27.

Ruffell, M., Mason, J., & Allen, B. (1998).Studying attitude towards mathematics. *Educational Studies in Mathematics*, *35*(1), 1-8.

Russell, S (1983). Factors Influencing the Choice of Advanced Level Mathematics by Boys and Girls. London: University of Leeds.

Sandman, R. S. (1980). The Mathematics attitude inventory: Instrument and user‟s manual. *Journal for Research in Mathematics Education*, *11* (2), 148-149.

Schenkel, B. (2009). *The impact of an attitude toward mathematics on mathematics performance*. Unpublished MA Thesis, Mariette College.

Singh, K., Granville, M., Dika, S. (2002). Mathematics and science achievement: effects of motivation, interest, and academic engagement. *Journal of Educational Research*, *95* (6), 323-332.

Smith, E. R. (2007). *Social Psychology.* London: Psychology Press.

Stanic, G.M.A & Hart, L.E (1995). Attitudes, Persistence and Mathematics Achievement: Qualifying Race and Sex Difference in Secada, W.G, Fennema, E and Adajiana, L.B (eds.). *New Directions for Equity in Mathematics Educations.* (pp 258-276) New York: Cambridge University Press.

Tahar, N. F., Ismail, Z., Zamani, N. D., & Adnan, N. (2010). Students‟ Attitude Toward Mathematics: The Use of Factor Analysis in Determining the Criteria. *Procedia-Social and Behavioral Sciences*, *8*, 476–481.

Tanner, M.L., & Casados, L. (1998). Promoting and studying discussions in math classes. *Journal of Adolescent & Adult Literacy*, 41 (5), 342-352.

Tapia, M., & Marsh, G. E. (2004).An instrument to measure mathematics attitude. *Academic Exchange Quarterly*, *8* (2), 120-129.

Taylor, B. J. (2004). *The influence of classroom environment on high school students' mathematics anxiety and attitudes*. Unpublished PHD thesis submitted to Curtin University of Technology, Australia.

Tezer, M. & Karasel, N. (2010). Attitudes of primary school 2nd and 3rd grade students towards mathematics course. *Procedia Social and Behavioural Sciences, 2,* 5808-5812.

The West African Examinations Council.(2010). *Chief examiners' report on the basic education certificate examination*. Accra: Wisdom Press.

Trends in International Mathematics & Science Study. (2003). *International student achievement in mathematics*. Boston: TIMSS &Pirls.

Turner, J.C., Meyer, D.K., Midgley, C., & Patrick, H. (2003). Teacher discourse and sixth graders‟ reported affect and achievement behaviors in two high mastery/high-performance mathematics classrooms. *The Elementary School Journal*, 103 (4), 357-382.

Twoli, N.W. (1986). Sex difference in Science Achievement Among Secondary School students in Kenya. Unpublished PhD Thesis. Flinders University of South Australia.

Vacha, E. (1977). *Improving the classroom social climate*. Orcutt, CA: Holt, Rinehart & Winston.

Van der Linde, I (2005). *Performance scores in international maths and science study: Reflective of South African inequalities*. Retrieved from http://www.hsrc.ac.za/Media.

Wasiche, J. L (2006). *Teaching Techniques That Enhance Students Performance in Mathematics in Selected Public secondary schools in Butere-Mumias District. Kenya. Unpublished M.Ed Thesis. Kenyatta University.*

Webster, B. J., & Fisher, D. L. (2003).School-level environment and student outcomes in mathematics. *Learning Environments Research*, 6, 309-329.

Wilson, B. G. (1996). Introduction: What is a constructivist learning environment? In B. G. Wilson (Ed.).*Constructivist Learning Environment* (pp. 38). Englewood Cliffs, N.J: Educational Technology Publications.

Wood, W. (2000). *Attitude Change:Persuasion and Social Influence.* London: Psychology Press.

Wubbels, T., & Brekelmans, M. (2005). Two decades of research on teacher- student relationships in class. *International Journal of Educational Research*, 43, 6-24.

Yang, X. (2013).*Investigation of Junior Secondary Students' Perceptions of Mathematics Classroom Learning Environments in China*. Eurasia Journal of Mathematics, Science &Technology Education, 9(3), 273-284.

Yilmaz, H., & Cavas, H. (2006).The effect of the 4-E learning cycle method on students understanding of electricity. *Journal of Turkish Science Education*, *3* (1), 1-5.

Ying, W.N & Ching, C.S (1991). "Attitudes Towards Learning Mathematics Among Secondary School Students in Hong Kong*" Educational Journal vol 19 (No.1) pp 13-18*

Zimbardo, P. a. (1991). *The Psychology of Attitude Change and Social Influence.* Newyork: McGrawHill.

APPENDICES

APPENDIX A STUDENT QUESTIONNAIRE

UNIVERSITY OF EDUCATION, WINNEBA

FACULTY OF SCIENCE EDUCATION

Department of Mathematics Education

STUDENT QUESTIONNAIRE

Dear Student,

This questionnaire contains statements about practices which could take place in your mathematics class. There are no 'right' or 'wrong' answers. Your responses will be treated as confidential and will only be used for the purposes of this research. Please give your opinion about all statements by ticking [√] in the box against your response.

Thank you for your maximum co-operation.

Section A: Demographic Data

1. Sex:

A. Male [ ] B. Female [ ]

2. Age:

A. 15-18 [ ] B. 19-22 [ ]

Section B: Mathematics Classroom Environment Inventory Instrument (MCLEI)

On a scale of 1 - 5 (1 = Never, 2 = Seldom (not often), 3 = Sometimes, 4 = Often, 5 = Always), how would you rate your agreement to the following statements about how you learn mathematics? (Please rate EVERY option according to the scale).

Statements about the mathematics you learn in school	**Never**	**Seldom**	**Sometimes**	**Often**	**Always**
Student Cohesiveness					
It is easy to form discussion groups in my mathematics class					
I am not afraid to respond to mathematics questions asked by my teacher during mathematics lessons.					
I am friendly to members in my mathematics class					
I enjoy being in the mathematics class					
I am able to study well with other colleague mathematics students in my class.					
Teacher Support					
My mathematics teacher takes a personal interest in my studies in mathematics.					
My mathematics teacher listens to and accepts my comments on how he/she teaches.					
My mathematics teacher is willing to explain things again when asked to do so by any student during mathematics lessons.					

Statements about the mathematics you learn in school	Never	Seldom	Sometimes	Often	Always
My mathematics teacher helps me when I have a difficulty in studying mathematics					
When I have difficulty in studying mathematics, I get help from my mathematics teacher.					
Student Involvement					
I take part (participate) in class discussions during mathematics lessons.					
My mathematics class teacher asks me questions during the lessons					
I make suggestions during mathematics lessons.					
My mathematics class teacher involves me in making decisions concerning mathematics.					
My ideas and suggestions are used during mathematics classroom discussions.					
Cooperation					
I get help from other students when I have difficulty in solving mathematics questions.					
I co-operate with other mathematics students when doing mathematics assignment.					
When studying mathematics in the form of group discussions					

Statements about the mathematics you learn in school	**Never**	**Seldom**	**Sometimes**	**Often**	**Always**
with other students in my class, there is team work.					
I learn from other mathematics students in my class.					
I work happily with other students in my mathematics class.					
Equity					
My mathematics class teacher gives as much attention to my question as he/she gives to other students.					
I get the same amount of help from my mathematics class teacher as the other students in this class					
I receive the same encouragement as the other mathematics students in this class.					
My work receives as much praise as the other mathematics students" in this class.					
I get the same opportunity to answer questions during mathematics lessons as the other students in the class.					

APPENDIX B

STUDENT QUESTIONNAIRE

Section C: Mathematics Attitude Questionnaire (MAQ)

On a scale of 1 - 5 (1 = Strongly Disagree, 2 = Disagree, 3 =Undecided, 4 = Agree, 5 = Strongly Agree), how would you rate your agreement to the following statements about how you learn mathematics? (Please rate EVERY option according to the scale).

Statements about the mathematics you learn in school	**Strongly Disagree**	**Disagree**	**Undecided**	**Agree**	**Strongly Agree**
I would prefer to find out why something is true by solving a mathematics problem than being told.					
Mathematics lessons are not fun.					
It is better to search for information concerning mathematics problems on my own than from my mathematics class teacher.					
I dislike mathematics lessons.					
There should be more mathematics lessons each week.					
Mathematics is one of the most interesting school subjects.					
I really enjoy mathematics lesson periods.					
The topics covered in mathematics lesson are not interesting.					
I really expect more mathematics lessons.					
I would enjoy school more if there were no mathematics lessons.					

APPENDIX C

Distribution of Responses (%) of Students' Perception on the Likert-Type Rating Scale

COHESIVENESS

	Never N (%)	Seldom N (%)	Sometimes N (%)	Often N (%)	Always N (%)
It is easy to form discussion groups in my mathematics class	72 (36.0)	53 (26.5)	16 (8.0)	35 (17.5)	24 (12.0)
I am not afraid to respond to mathematics questions asked by my teacher during mathematics lessons.	85 (42.5)	22 (11.0)	16 (8.0)	53 (26.5)	24 (12.0)
I am friendly to members in my mathematics class	39 (19.5)	36 (18.0)	5 (2.5)	56 (28.0)	64 (32.0)
I enjoy being in the mathematics class	35 (17.5)	14 (7.0)	29 (14.5)	26 (13.0)	96 (48.0)
I am able to study well with other colleague mathematics students in my class.	59 (29.5)	93 (46.5)	19 (9.5)	21 (10.5)	8 (4.0)

TEACHER SUPPORT

	Never N (%)	Seldom N (%)	Sometimes N (%)	Often N (%)	Always N (%)
My mathematics teacher takes a personal interest in my studies in mathematics.	24 (12.0)	48 (24.0)	21 (10.5)	64 (32.0)	43 (21.5)
My mathematics teacher listens to and accepts my comments on how he/she teaches.	8 (4.0)	77 (38.5)	16 (8.0)	51 (25.5)	48 (24.0)
My mathematics teacher is willing to explain things again when asked to do so by any student during mathematics lessons.	8 (4.0)	32 (16.0)	16 (8.0)	38 (19.0)	106(53.0)
My mathematics teacher helps me when I have a difficulty in studying mathematics	16 (8.0)	16 (8.0)	13 (6.5)	46 (23.0)	109(54.5)
When I have difficulty in studying mathematics, I get help from my mathematics teacher.	24 (12)	11 (5.5)	47 (23.5)	43 (21.5)	75 (37.5)

STUDENT INVOLVEMENT

	Never N (%)	Seldom N (%)	Sometimes N (%)	Often N (%)	Always N (%)
I take part (participate) in class discussions during mathematics lessons.	0 (0.0)	69 (34.5)	13 (6.5)	43 (21.5)	75 (37.5)
My mathematics class teacher asks me questions during the lessons	0 (0.0)	85 (42.5)	18 (9.0)	51 (22.5)	46 (23.0)
I make suggestions during mathematics lessons.	35 (17.5)	77 (38.5)	5 (2.5)	37 (18.5)	46 (23.0)
My mathematics class teacher involves me in making decisions concerning mathematics.	64 (32.0)	59 (29.5)	5 (2.5)	32 (16.0)	40 (20.0)
My ideas and suggestions are used during mathematics classroom discussions.	27 (13.5)	63 (31.5)	16 (8.0)	25 (12.5)	69 (34.5)

CO-OPERATION

	Never N (%)	Seldom N (%)	Sometimes N (%)	Often N (%)	Always N (%)
I get help from other students when I have difficulty in solving mathematics questions.	16 (8.0)	50 (25.0)	11 (5.5)	70 (35.0)	53 (26.5)
I co-operate with other mathematics students when doing mathematics assignment.	27 (13.5)	50 (25.0)	19 (9.5)	59 (29.5)	45 (22.5)
When studying mathematics in the form of group discussions with other students in my class, there is team work.	3 (1.5)	50 (25.0)	13 (6.3)	70 (35.0)	64 (32.0)
I learn from other mathematics students in my class.	56 (28.0)	88 (44.0)	0 (0.0)	40 (20.0)	16(8.0)
I work happily with other students in my mathematics class.	69 (34.5)	98 (49.0)	8 (4.0)	17 (8.5)	8 (4.0)

EQUITY

	Never N (%)	Seldom N (%)	Sometimes N (%)	Often N (%)	Always N (%)
My mathematics class teacher gives as much attention to my question as he/she gives to other students.	53 (26.0)	104(52.0)	5 (2.5)	14 (7.0)	24 (12.0)
I get the same amount of help from my mathematics class teacher as the other students in this class	50 (25.0)	96 (48.0)	0 (0.0)	48 (24.0)	6 (3.0)
I receive the same encouragement as the other mathematics students in this class.	27 (13.5)	85 (42.5)	16 (8.0)	53 (26.5)	19 (9.5)
My work receives as much praise as the other mathematics students‟ in this class.	11 (5.5)	67 (33.50	0 (0.0)	93 (46.5)	29 (14.5)
I get the same opportunity to answer questions during mathematics lessons as the other students in the class.	18 (9.0)	128(64.0)	0 (0 .0)	35 (17.5)	19 (9.5)

ATTITUDE

	S.D N (%)	**D N (%)**	**U N (%)**	**A N (%)**	**S.A N (%)**
I would prefer to find out why something is true by solving a mathematics problem than being told.	0 (0.0)	81 (40.5)	19 (9.5)	53 (26.5)	47 (23.5)
Mathematics lessons are not fun.	47 (23.5)	39 (19.5)	6 (3.0)	74 (37.0)	34 (17.0)
It is better to search for information concerning mathematics problems on my own than from my mathematics class teacher.	61 (30.5)	60 (30.0)	6 (3.0)	33 (16.5)	40 (20.0)
I dislike mathematics lessons.	67 (33.5)	32 (16.0)	14 (7.0)	60 (30.0)	27 (13.5)
There should be more mathematics lessons each week.	14 (7.0)	52 (26.0)	13 (6.5)	73 (36.5)	48 (24.0)
Mathematics is one of the most interesting school subjects.	32 (16.0)	47 (23.5)	20 (10.0)	60 (30.0)	41 (20.5)
I really enjoy mathematics lesson periods.	6 (3.0)	52 (26.0)	13 (6.5)	68 (34.0)	61 (30.5)
The topics covered in mathematics lesson are not interesting.	14 (7.0)	35 (17.0)	0 (0.0)	97 (48.5)	14 (7.0)

I really do not expect more mathematics lessons.	67 (33.5)	94 (47.0)	7 (3.5)	25 (12.5)	7 (3.5)
I would enjoy school more if there were no mathematics lessons.	21 (10.5)	24 (12.0)	6 (3.0)	101 (50.5)	48 (24.0)

N=200 Scale: 1= Not at all (N.A) 2 =Very Little (V.L) 3=Not Sure (N.S) 4=Well (W) 5=Very Well (V.W)