UNIVERSITY OF EDUCATION, WINNEBA

A COMPARISON OF FEMALE STUDENTS' ATTITUDE TOWARDS MATHEMATICS ACHIEVEMENT IN SINGLE-SEX AND MIXED-SEX SENIOR HIGH SCHOOLS

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DECLARATION

STUDENTS DECLARATION

I, **VALENTINA PHILIPINE AFI KAFUI DZESHIE,** declare that this thesis, with the exception of quotations and references contained in published works which have all been identified and dully acknowledged, is entirely my own original work, and it has not been submitted, either in part or whole, for another degree elsewhere.

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SUPERVISOR'S DECLARATION

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

Supervisor: PROFESSOR C. K. ASSUAH

Signature: ……

Date: ……

DEDICATION

To my beloved son Makafui, Andrew and husband, John Kelvin Ameworwor

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I express my profound gratitude to my supervisor, Professor Charles K. Assuah, who despite his heavy schedules allotted time to guide, direct, advice, encourage and support me to successfully complete this work. I owe you a lot of appreciation.

To my beloved son who gave me all the freedom by happily accepting to stay with his aunties, may God bless you beyond reasonable doubt.

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ABBREVIATIONS

SHS:	Senior High School
JHS:	Junior High School
GEU:	Girls Education Unit
ICT:	Information Communication and Technology
SEM:	Structural Equation Modeling
CTP:	Comprehensive Testing Program
STEM:	Science, Technology, Engineering, and Mathematics
SPSS:	Statistical Package for Social Sciences
WAEC:	West African Examination Council
NGO'S:	Non-Governmental Organizations
WASSCE:	West African Senior Secondary Certificate Examination
CAMFED:	Campaign for Female Education
ACER:	Australian Council for Educational Research

ABSTRACT

The purpose of this study was to compare female students' attitude towards mathematics achievement. The study employed a non-experimental comparative design using stratified sampling, simple random sampling, and purposive sampling. Questionnaire consisting of attitudinal and achievement tests were answered by 358 female students. Descriptive statistics: frequency, percentages, charts, mean and standard deviation and inferential statistics: independent samples t-test at a significant level of 0.05 were used to analyze the study. Perception, experience, expectation, interest, self-concept and motivation were investigated as constructs that affect the SHS female students' attitude and the result shows that (i) female students in single-sex schools have positive attitude towards mathematics compared to female students in mixed-sex schools, (ii) the mean scores of attitude and achievement of female students in single-sex schools are higher than that of female students in mixed-sex schools. Results from the t-test show that (iii) there is statistically significant difference between attitude towards mathematics and (iv) mathematics achievement of females in single-sex and mixed-sex SHSs. Even though single-sex environment favours female students' mathematics learning, female students should be explored and sent to the school where they will excel in mathematics and single-sex classes should be practiced in Ghana. Ghana Education Service can adopt single-sex classes in the mixed-sex schools. Teachers should have regular in-service training to be familiar with appropriate teaching strategies that suit each school type.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter discusses the background to the study, the statement of the problem, the purpose of the study, the objectives of the study, the research questions, the significant of the study, the delimitations and limitations of the study, definition of terms and the outline of the study.

1.1 The Background of the Study

Over the past two decades, the quest to find out the reasons for lack of women in higher level mathematics and careers for which mathematics is a basic requirement that heightened (Eisenkopf, Hessami, Fischbacher, & Ursprung, 2011). Fennema and Sherman (1977) stated that lack of mathematical background knowledge prevents women from entering a variety of occupations. Interest in this issue made the U.S. Department of Education in 2005 to experiment the school type by authorizing single-sex classes in public (missed-sex) schools (U. S. Department of Education, 2005) to find out whether female students do well in mathematics in females-only school or in mixed school. After several measures of intervention, the problem persist till date as fewer women are found offering mathematics related programmes at the universities and fewer are found at the mathematics and its related fields in Ghana and other parts of the world (Mutai, 2011; Sax et al., 2009).

There are three main school types that can be used to educate male and female students. These are single-sex education in separate male or female schools, mixed-sex of males and female students in the same classes in the same school, and mixed models. Mixed models can take various forms such as mixed-sex schools where males

and female students study several subjects in mixed classes but also have female-only or male-only classes for specific subjects like mathematics or science (UNESCO, 2007).

According to Robinson and Gillibrand (2004), proponents of single-sex schooling argued that female Schools do better in certain subject areas such as mathematics and science when males are not in the class. While proponents of mixed-sex education, argued that single-sex schools are in unnatural social settings which isolate females from males students and that a well-managed mixed-sex education makes male and female students learn to respect and value each other's ideas. They also listen and communicate with each other as well as develop effective interpersonal skills needed to perform respective adult roles in society as they mature (Schmuck, 2005). Bofah and Hannula (2016) posited that two decades ago single-sex schooling was preferred in Ghana to mixed-sex schooling due to the following reasons: (1) as a remedy to introduce change to the study area, (2) to make mathematics more favourable and adaptive to females students, (3) to close the gender gap, (4) and to improve school attendance and attitude towards mathematics most especially for female students. Bofah and Hannula also found that most female s in single-sex schools showed significantly higher self-confidence than females in mixed-sex schools but they argued that, it could be due to the high parental support received by the female schools in single-sex schools as compared to female schools in mixed-sex schools.

The works of Dale (1969, 1971, 1974) emphasize the need for mixed-sex education. Dale argued that females give males industrious support to boost their performance, develop good communication which arise in a healthy competition. Males and females educated in mixed-sex schools had more positive and friendly attitude towards one another, and as adults they believe in the equality of the sexes and have

happier marriages than graduates of single-sex schools. In Dale's point of view, mixed-sex schooling is the best 'natural' setting which provide protection against homosexuality. The debate continues as the findings of different researches were contradictory (Smithers & Robinson, 2006) and others could not even reach any conclusion. This incited a current research to compare the attitude of female students toward mathematics in single-sex and mixed-sex school which have a bearing on achievement (Mutodi & Ngirande 2014).

Education is necessity in building capacity of every country (Antwi, 2009). An attempt to make education accessible to all Ghanaians, has led to several educational reforms including the 1980's reform; Free Compulsory, Universal, Basic Education Program (FCUBE) establishes in 1995 which include 6 years of primary education and 3 years of junior secondary school education. The main objective of FCUBE is to encourage all children to access basic education facilities and to improve the quality of teaching and learning. Currently under the New Patriotic Party [NPP] Nana Akuffo Addo-led regime, there is free Senior High School Programme which began in 2017/2018 academic year. This is an extension of the 1980's reform to make education free and accessible to all senior high school students as well.

The basic objective of the Ghana education system is to give prominence to science and technology education as well as make education more accessible to females in order to obtain gender equity. As the focal point of all the sciences, Joensen and Nielsen (2010) opined that mathematics skills have a direct contributing effect on labour market outcomes and there is enough literature providing evidence that the individual returns on mathematics skills are higher than the returns on other skills (Buonanno & Pozzoli, 2009; Grogger & Eide 1995; Koedel & Tyhurst 2012; Paglin & Rufolo 1990).

Mathematics is widely used in all spheres of human life. It is of central importance to modern society, vital in ICT, finance and economic activities, including the industries and the individual achievement (Smith, 2004). Mathematics plays a key role in shaping how individuals deal with the various domains of private, social, and civil life (Anthony & Walshaw, 2009). It is in line with its significance, that mathematics is a compulsory subject at the basic and senior high school education level in most countries including Ghana. Mathematics as a subject studied in senior high schools (SHS) in Ghana is in two folds: elective mathematics and core mathematics. Core mathematics is studied by everyone who go through SHS education but elective mathematics is only studied by a section of students either by selection or as part of their elective courses. Since core mathematics is studied by all students, it is an entry requirement for every student entering SHS from junior high schools (JHS) to at least obtain a pass (minimum grade of 6) in mathematics.

Due to the relevance of mathematics in our nation, several contributions (Presidential Science and Mathematics initiative during President Kuffour-led NPP Government, National Science and Mathematics Quiz and a lot of sponsorship opportunities for mathematics students) have been made by government, researchers, educationists, non-governmental organization (NGO's) and other stakeholders as well as parents and teachers to improve the mathematics ability of students.

Despite the effort towards mathematics achievement, Mereku (2003) found that students continue to perform low in the subject, in West African Secondary Schools Certificate Examination (WASSCE). This low achievement in WASSCE makes the subject unattractive to majority of students especially females, hence the low representation of female students in mathematics programmes at the tertiary level and mathematics field in most countries including Ghana.

Tables 1.1 and 1.2 show the number of female schools who majored in mathematics and its related courses compared with their male counterparts in two public universities in Ghana; University of Cape Coast (UCC), Cape Coast and University of Education, Winneba (UEW) over the past five years. Bachelor of Science is the only Mathematics Education (BSC), is the only mathematics course offered on Winneba campus but UCC offers other mathematics programmes. Table 1.1 shows graduates from UEW with BSc. Mathematics Education and Table 1.2 shows graduates from UCC who offered mathematics and its related courses.

Table 1.1: UEW Bachelor of Science in Mathematics Education graduates from 2015 to 2019

PROGRAMME		MALE	FEMALE
2015	B. Sc. (Math Edu)	148	10
2016	B. Sc. (Math Edu)	204	18
2017	B. Sc. (Math Edu)	189	27
2018	B. Sc. (Math Edu)	161	17
2019	B. Sc. (Math Edu)	192	19

Source: UEW Libraries

Table 1.2: Male and female UCC mathematics and other mathematics-related graduates from 2015 to 2019

PROGRAMME (UCC)	2015		2016		2017		2018		2019	
	M	F	M	F	M	F	M	F	M	F
B.Ed. (Math)	114	8	89	16	103	20	158	22	140	12
BSc. (Math)	18	0	11	1	17	3	32	5	8	1
BSc. (Statistics)	10	1	5	0	15	2	70	14	22	3
BSc. (Math with Statistics)	28	1	21	3	23	5	56	13	27	7
BSc. (Math with Economics)	36	5	29	7	32	7	190	12	54	4
BSc. (Math with Business)	26	6	31	13	21	2	85	23	45	15
BSc. (Physics)	22	3	16	2	14	3	34	7	15	1
BSc. (Math with Physics)	27	4	44	1	24	2	82	8	25	2

Source: UCC Library **M: male** **F: female**

The information represented in the tables is in line with the assertion made by Park, Behrman and Choi (2012) that the STEM (Science, Technology, Engineering and Mathematics) subjects are male-dominated subjects, in which female students are underrepresented and the findings of Forgasz et al. (2010) corroborate these findings, i.e., only one percent of students graduating from Mathematics and Mathematics-related fields are females. Even though gender gap is widespread in STEM disciplines all over the world, such as mathematics is the only subject in which female students underperform as compared to males. According to Forgasz et al. (2010) and Salifu (2017), this continued low representation of female schools as compared to male schools in Mathematics at the tertiary level has become a source of worry and concern for many Ghanaians, educationists, analysts, parents and policy makers. In response to this situation, the government, philanthropists and NGOs have developed a number

of programmes to increase the enrolment and achievement rates of female students in Mathematics and its related programmes. Among these programmes are the Science, Mathematics and Technology (STMs) clinics for Senior High School students and the female Mentoring, Tutoring and Support Programmes (Campaign for Female Education [CAMFED], 2012).

In the face of all these enormous contributions, Adebule and Aborisade (2014) assert that females at senior high school level, ignorantly shy away from mathematics with the flimsy excuse that mathematics is difficult for them. Allotey (2012) also observed that most female students regard Mathematics as some "abstract black box" that comprises complex, strictly held concepts and procedural imaginative formulae for memorization. These opinions many females hold contribute to the negative attitude of female students towards the subject, thereby affecting their mathematics achievement (Mutodi & Ngirande, 2014). Negative attitude towards mathematics has a major impact on students' mathematics achievement and enrolment in higher education as well as future career decisions (Asante, 2010; Obomanu, 2011; Salifu, 2017; Zan & Martino 2007).

All over the world, people have agreed to the existence of gender gap in mathematics and most researchers are of the view that mathematics achievement is gender bias and favours male students than female students (Aedín, Donal, & Olive, 2012; Kiptum et al., 2013; Kyei, Apam, & Nokoe1, 2011; Mutai, 2011; Zan & Martino, 2007). Other researches indicated that, females and males were created differently and so they see, hear, and experience the world differently. They learn and behave differently because their brains are biologically wired differently (Gurian & Henley, 2001; Sax, 2005). It must be emphasized that ignoring these differences will not help to bring out the best from the students but rather the differences should be recognized and used to provide

a more effective and efficient senior high school education for the students especially the female schools.

1.2 Problem Statement

Attitude has direct implication on achievement (Mutodi & Ngirande, 2014). Poor attitude towards mathematics achievement at senior high school impede most students especially female students from furthering their education to the tertiary level (Mutodi & Ngirande). This brings about disparity between males and female schools studying mathematics at the tertiary level leading to low representation of female schools in mathematics and its related fields (Lee & Anderson 2015; Watt, 2004). Collis (1987) as cited in Norton and Rennie (1998), found that school; single-sex and mixed-sex schools have great influence on female students' attitude towards mathematics achievement.

Some feminists have advocated that single-sex schools increase students' achievement, help them to have positive attitude towards learning and minimize negative effects of gender stereotypes (Gill, 1996; Hildebrand, 1996). Single-sex schools increase the academic achievement of female students compared to their counterpart in mixed-sex school (Fryer & Levitt 2010; Gilson1999; Lee & Anderson, 2015; Smithers & Robinson 2006; Sullivan, Heather & Leonard, 2011), particularly in mathematics and science. Some strengths of single-sex education are: single-sex schools empower female students and enable them to create goals and values that differentiate them from female students in mixed-sex schools, they increase comfort levels and academic engagement due to no intimidation and harassment from male students SS females elevate teacher attention and concentration on students' needs during teaching and learning (Sax, 2005; Thompson & Ungerleider, 2004).

In contrast to these researchers, LePore and Warren (1997) reported that mixed-sex schools succeeded in reducing previous gender bias favouring male students in American classrooms since the 1980s making it favourable for female students to achieve in all subjects including mathematics. Pathan (2011) found out that female students from coeducational schools had a better and positive attitude towards their teachers, parents and opposite-sex, as compared to their counterpart from single-sex schools. Further, students from single-sex schools have an unfavourable attitude towards themselves as compared to female students from coeducational schools.

Numerous studies on single-sex and mixed-sex education have produced inconsistent results, which could be due to methodological issues or selection biases (Gilson, 1999). But, Pahlke and Carlie (2014) concluded that there was little evidence to conclude that school types i.e. single-sex or mixed-sex, have effect on female students' achievement in mathematics.

The literature is replete with rationale for being in favour of either single-sex or mixed-sex schools. However, an exhaustic and comprehensive study with respect to achievement in these schools has not been well documented in Ghana. It is to bridge this lacuna, that has given me the enthusiasm to investigate single-sex and mixed-sex education by comparing attitude of female students toward mathematics achievement in single-sex and mixed-sex public Senior High Schools in Ho Municipality.

1.3 Purpose of the Study

The purpose of this study was to compare female students' attitude towards mathematics achievement in single-sex and mixed-sex public senior high schools. This is to find out the school type (SS or MS) that promote positive attitude toward mathematics achievement and their mathematics achievement.

1.4 Objectives of the Study

i. To identify the attitude of female students in single-sex and mixed-sex public senior high schools towards mathematics.

ii. To identify the mathematics achievement of female students in single-sex and mixed-sex public senior high schools.

iii. To determine if differences in attitude towards mathematics achievement exist between female students in single-sex and mixed-sex public senior high schools.

iv. To determine if differences in mathematics achievement exist between female students in single-sex and mixed-sex public senior high schools.

1.5 Research Questions

1. What is the attitude of female students in single-sex and mixed-sex public senior high schools toward mathematics?
2. What is the mathematics achievement of female students in single-sex and mixed-sex public senior high schools?
3. Is there statistically significant difference in attitude between female students in single-sex and mixed-sex public senior high schools towards mathematics?
4. Is there statistically significant difference in mathematics achievement between female students in single-sex and mixed-sex public senior high schools?

1.6 The Research Hypotheses

- H_{01}: There is no difference in mathematics towards attitude between female students in single-sex and mixed-sex public senior high school towards mathematics.

- H_{02}: There is no difference in mathematics achievement between female students in single-sex and mixed-sex public senior high school.

1.7 Significance of the Study

1.7.1 Significance to the teachers

1. This study would enable teachers to evaluate their teaching approaches and adopt good teaching practices that would boost and improve students' interest in mathematics learning. This would help students to develop good attitude towards the study of mathematics.
2. Teachers would also become sensitive to gender issues during the teaching and learning of mathematics. This would help to avoid gender biases in setting questions and calling students to answer questions especially in mixed-sex classrooms.
3. When female students are placed in the right school, they would find mathematics more exciting and they would be willingly to cooperate with classroom activities. This would boost mathematics teacher's morale.

1.7.2 Significance to the students

1. The result of this study would assist female students and their parents to make the right choice of school that would promote female students' participation in mathematics and increase their achievement. This would boost the morale of female students to study mathematics and its related courses (engineering, economics and physics) at the tertiary level which would encourage female participation and competition in mathematics and its related fields/professions.
2. The study would help male and female students to co-exist within the same mixed-sex classes as well as single-sex classes. This would give female students the opportunity to learn mathematics and other science subjects only

with their female counterparts at their own pace whilst maintaining good co-existence with their male counterparts in studying other subjects.

3. Single-sex education is argued to favour female students (Eisenkopf, Hessami, Fischbacher & Ursprung, 2011). This implies that most female students in single-sex senior high schools would increase academic achievement in mathematics. This would lead to increase in the number of female students in mathematics and Science fields to compete with their male counterparts.

1.7.3 Significance to the administrators

1. The study would help senior high schools (mixed-sex and single-sex); to adopt female-friendly strategies that would enlighten female students to develop positive attitude towards the learning of mathematics and to create conducive school setting that support female to learn mathematics. For example, schools would liaise with old student associations especially those in mathematics related professions to help mentor female students.
2. This study would guide administrators to determine the best allocation of teachers and other teaching and learning aids.

1.7.4 Significance to the stakeholders and others

1. The study would inform the government, NGO's and other stakeholders on where to channel resources to empower growth in female student's mathematics achievement.
2. This study would expose single-sex schooling as a new job opportunity for more people to adventure to bring the best out of female students especially in mathematics achievement.

3. Some existing mixed-sex senior high schools would practice mixed-sex classes to enable female students to study mathematics with their co-female students in order to increase their mathematics achievement.
4. Finally, this study would add to existing knowledge on how school types can promote positive attitude of female students toward mathematics achievement.

1.8 Delimitation

The study was conducted only on female students in public senior high schools in Ho municipality in the Volta Region, Ghana; Mawuli, Sokode, Taviefe, Tanyigbe, Shia, OLA, and Mawuko senior high schools. Even though several factors accounted for the attitude of female students toward the study of mathematics which led to the low representation of female students in mathematics field, this study asserted that the school type (Single-Sex and Mixed-Sex) in which females' study, has major influence on their attitude toward mathematics achievement.

1.9 Limitations

In a few of the schools, the heads did not permit the questionnaires to be administered to the students during school contact hours. The questionnaires were shared to the students to answer in their various homes or dormitories with the claim by the school authorities that the schools do not have any free periods within the contact hours to allow students to answer questionnaires. The students therefore, returned the questionnaires after they had answered them in the comfort of their homes or dormitories.

In other schools, the questionnaires were administered to the students during their free periods. This was very tedious since the students, cut across all the programmes and classes. Meanwhile, all the classes do not have free periods on the same day, so the

researcher and her team had to visit the school several days to complete the administration of the questionnaires.

The instrument was planned and purposed to be administered to all the students in each school at a sitting in a hall which could accommodate all of them at the same time, so that they can answer the attitudinal test and the achievement test simultaneously. The reason was to measure students' own attitude and assess their own achievement without any influence. But this was not realized in all the schools due to the type of schools (i.e single track and double track) were ran on daily bases and the reluctant attitude shown by some persons in authority to support.

1.10 Definition of Terms

Single-Sex: Schools comprising same-sex students

Mixed-Sex: Schools comprising students of both sexes

Attitude: It is a generalized viewpoint or a settled way of feelings or thinking about a particular object, subject or situation.

Perception: It is a mental representation or mental organization constructed as the individual interacts with the environment and people.

Experience: It is the knowledge acquired as one is exposed to or involved in an activity.

Interest: It is the feeling of wanting to know or paying keen attention to something or to someone.

Self-concept: It is the personal beliefs that one holds about one's ability to reach goal.

Motivation: It is an inner or outer stimulus that produces a behaviour that can either be favourable, neutral or unfavourable towards the event, object or subject.

Achievement: It is an effort accomplished with great courage.

1.11 Organization of the Study

The study was organized into five (5) chapters. Chapter one dealt with the background of the study, the statement of problem, the purpose of the study, the objectives of the study, the research questions, the significance of the study, the definition of terms, delimitations and limitation of the study and the organization of the study. Chapter two dealt with the review of related literature relevant to the study. Area covered include: theoretical framework, the concept of attitude towards mathematics, the concept of mathematics achievement, the attitude of female students toward mathematics in single-sex and mixed-sex senior high school and mathematics achievement of female students in single-sex and mixed-sex senior high school. Chapter three described in details the key methods employed in conducting the research. It explained the research design, the population, sample size and sampling techniques as well as data collection procedures, instruments, the validity and reliability of the instruments, data analysis and limitations or challenges of the study. Chapter four presented the findings of the study. It discussed and analyzed the results of the findings in details and linked it to existing literature. Chapter five is summarized under the following sub-headings: summary of findings, conclusions, recommendations and suggestions.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This chapter presents the review of related literature relevant to the study under the following sub-heading: theoretical framework, the type school, the concept of attitude towards mathematics, the concept of mathematics achievement, the attitude of female students towards mathematics in mixed-sex and single-sex senior high school (SHS), mathematics achievement of female students in single-sex and mixed-sex SHS and a chapter summary.

2.1 Theoretical Framework

This study was guided by the Essential Difference Theory, Bandura's Social Cognitive Learning Theory and Expectancy –Value Theory.

2.1.1 Essential difference theory

The difference theory posits that males and females are created differently, they have different sexes, they act differently, their developmental stages require different level of attention and they have different views of life due to the intrinsic or essential differences between their biological make-ups (sexes). These differences are fundamental and cannot be altered (Tannen, 1990). This theory is very relevant for this study because understanding and appreciating the differences that exist between males and females may help initiate best practices that will bring out female students' mathematics competency, create supportive atmosphere to affect female students mathematics studies, develop strategies to enhance female students interest and understanding in mathematics, use methods that suit the nature, level and pace of female students in mathematics knowledge acquisition. The difference theory is used

to explain the concept that males are fundamentally different from females in all aspect of life such as expectation, developmental needs, communication and other interactions (Shulevitz, 2015).

Baron-Cohen (2003) posited that culture and socialization play a role in determining if a person develops a male brain (stronger interest in systems) or female brain (stronger interest in empathy). He emphasized that biological make-up of a person also contributes to how his/her brain works. According to Baron-Cohen female-type of brains are better at empathizing and communicating, while male brains are stronger at understanding and building systems not just computers and machinery, but abstract systems such as politics and music. Baron-Cohen further gave a clear indication that men in general are more independent, while women seek intimacy.

Differences can be seen in children right from infancy. Males are more interested in cars, trucks, planes, guns, swords, building blocks, and assembling toys. They seem to love putting things together, to build toy towers or vehicles. Females on the other hand seem to like baby toys such as dolls, play with friends and often cling to their parents (Kimura, 1997).

There is also a sex difference in how people react to aggression. Males tend to show far more direct aggression (pushing, hitting, punching) whilst females tend to show more indirect (relational, covert) aggression. Females show sympathy and are more sensitive to peoples need than male (Moore, 2003). For instance, females often release their own items to another person if it generates quarrel and they often avoid areas of violence or misunderstanding. Others claimed that, the gender difference theory could often be used to explain gender-based biases in society. For example, the justification that mathematics and its related fields/jobs are traditionally male dominated.

According to them, this perception is informed and reinforced by gender stereotype and causes females' underrepresentation in mathematics labour force (Awofala, 2011).

2.1.2 Bandura's social cognitive learning theory

The Bandura Social Cognitive Learning Theory (SCLT) states that in social context, people learn more rapidly by observing and modeling the behaviours of others (Bandura, 1986).

Bandura expanded the social learning theory in the mid-1980s to explain the way people learn by watching what others do, and that human thought processes are central to understanding personality (Bandura, 1999). The SCLT served as a bridge between behaviourist learning theories and cognitive learning theories due to it's inclusion of attention, memory, motivation, and focus on cognitive concepts.

Bandura explained four types of learning effects in the SCLT which are: Observational Learning Effect (Acquiring new behaviours from model) Response Facilitation Effect (Increased frequency of learned behaviours after model is reinforced for same behaviour). Response Inhibition Effect (Decreased frequency of learned behaviour after observing punished model) and Response Disinhibition Effect (Return of inhibited response after observing model behave that adverse consequences) (Green & Peil, 2009).

According to SCLT, certain part of an individual's knowledge acquisition are influenced by directly observing others within the context of social interactions, experiences, and outside media influences (Bandura, 1997). Hence, nurture has great influence on peoples' attitude and choices which are driven by believes and capabilities. This shows that the place in which an individual grows plays a key role

in the formation of his/her attitude. It is therefore important to create beneficial study areas for students (female students) and then exercise control over them. By carefully selecting the appropriate study area for female students, they may be influenced and guided toward the development of mathematics potentials.

An individual's behaviour is influenced by both internal (innate/nature) and external (nurture) factors. It is influenced greatly by the way students (females) observe and model the attitude of their colleagues and how it affects their own attitude and achievement in mathematics, either directly or indirectly without ignouring the cognitive aspect of the student. This justifies the placement of this study in the perspective of the SCLT. Since attitude formation and the survival of humanity is dependent upon the replication of the actions of others (Mccormick & Martinko, 2004), it is not negotiable to choose the right school setting (SS or MS) to mold female students to develop positive attitude towards mathematics learning and to contribute in bringing out female students' maximum mathematics potentials.

Self-efficacy and self-regulation are at the centre of SCLT (Mark, Donaldson & Campbell, 2011) in influencing beliefs about one's ability or capacity to execute a behaviour successfully. Self-efficacy originates from four sources: Performance accomplishments, vicarious experience, verbal persuasion, and physiological states (Bandura, 1977). It is an aspect of human behaviour, that detects expected outcomes of behaviour (Bandura, 1986, 2004, 2006b). Self-efficacy beliefs affect cognitive, motivational, emotional, and decisional processes. It determines whether a person thinks positively or negatively, in self-enhancing or self-incapacitating ways.

Mccormick and Martinko (2004) found that people with high efficacy see difficult tasks as something to be mastered rather than something to be avoided whilst people

with weak efficacy dodge challenging tasks and focus on personal failings and negative outcomes. According to Betz (2007), self-efficacy forms an integral part of SCLT. It plays a dominant role in the self-regulation of motivation through task challenges and outcome expectations.

Though self-regulation is more associated with social learning theory, it is considered in SCLT as an essential element that directs an individual to decide and implement his/her own ideas about what is appropriate or inappropriate behaviour and to choose actions accordingly (Williams, 2010). Self-regulation therefore refers to the process in which a person regulates and direct his/her own actions. It posited that the individual is a goal director who is actively involved in developing practical thinking patterns in response to his/her setting conditions/experiences in order to attain personal goals/satisfaction.

Bandura (1978) opined for promoting self-efficacy and self-regulation as an important technique in education due to the strong effect they have on teaching the individual to attain self-reward or self-satisfaction after performing a task. In this case, SHS females with high self-efficacy will no matter the challenges (whether in SS or MS), study assiduously toward achieving success in mathematics and females with good sentiment of self-regulation will persevere to gain the inward satisfaction from getting the solution to a challenging or difficult mathematics problem. Schematization is another essential element associated with SCLT. Bandura (2001) explained the theory through schematization of triadic reciprocal causation. According to the theory, a schema shows how the reproduction of an observed behaviour is influenced by the interaction of the following three determinants:

Personal: Whether the individual has high or low self-efficacy toward the behaviour (e.g. Make the learner (a females) to believe in her personal abilities to correctly complete a behaviour i.e. to complete a mathematics task).

Behavioural: The response an individual receives after they perform a behaviour (e. g. Provide chances for the learner (a female student) to experience successful learning as a result of performing the behaviour correctly).

Type of School: Aspects of the school setting, Single-Sex [SS] and Mixed-Sex [MS] also influence the individual's ability to successfully complete a behaviour (i.e. Make the study area conditions conducive for improved self-efficacy by providing appropriate support and materials) (Stajkovic, & Luthans, 2003).

Through Bandura's bobo doll experiment, it is evidenced in the SCLT that the process of knowledge acquisition revolves around models (Bandura, Ross, & Ross, 1963). A model is someone whose behaviour or attitude is being observed and imitated by another individual. Observations in this case, must go through the following stages of observational learning for a behaviour to be replicated;

Attention: learners selectively give attention to specific social behaviour depending on accessibility, relevance, complexity, functional value of the behaviour or some observer's personal attributes such as cognitive capability, value preference, preconceptions.

Retention: learners observe a behavior and its' subsequent consequences, then convert that observation to a symbol that can be accessed for future reenactments of that behavior. For instance, when a positive behavior is shown a positive reinforcement should follow, this same measure should be applied to negative behavior.

Production: this refers to the symbolic representation of the original behavior being translated into action through reproduction of the observed behavior in seemingly appropriate contexts. During reproduction of the behavior, the learner receives feedback from others and can adjust her representation for future references.

Motivational process: this allows the learner to reenacts a behaviour depending on responses and consequences the observer receives when reenacting that behavior (Bandura, 2001).

2.1.3 Expectancy –value theory

In an attempt to understand how motivation affects individuals' achievement, John William Atkinson developed the Expectancy-Value Theory (EVT) in the 1950s and 1960s (Eccles, 1983). But the theory was later said to have been developed by Dr. Martin Fishbein in the early to mid-1970s and is credited to him that is why it is sometimes referred to as Fishbein's expectancy-value theory or simply expectancy-value model (Eccles). It was then expanded and extended to education in the 1980s, by professor Jacquelynne Eccles. The Expectancy Value Theory predicts the means by which individuals make behavioural decisions based upon their attitudes and beliefs: that is people are most likely to do things they have high value for and also think they can succeed (Wigfield, 1994).

According to EVT, people are goal-driven creatures; they behave based upon their pre-existing values and beliefs; a person's attitude towards an object is consistent solely with that individual's association with his/her beliefs about the object (Fishbein 1967).The application of the expectancy-value theory posits that students' achievement and their career choices are mostly determined by two factors; expectancies for success, and subjective task values (Sax, 2005). Expectancies refer to

how confident an individual is in his or her ability to succeed in a task whereas subjective task values refer to how significant, valuable, or pleasurable the individual perceives the task. In other words, the usefulness or the importance one attaches to a task or the value an individual place on a task is referred to as subjective task value (Wigfield & Cambria, 2010). According to Eccles (1983), subjective task values can be put into four sub-categories: Attainment Value (Importance for identity or self), Intrinsic Value (Enjoyment or Interest), Utility Value (Usefulness or Relevance), and Cost (loss of time, overly-high effort demands, loss of valued alternatives, or negative psychological experiences such as stress). All the four values are inter-correlated.

The work of some researchers (Nagengast, et al. 2011; Trautwein, et al., 2012) showed that expectancies and values interact to predict important outcomes such as engagement, sustainable interest, and academic achievement. For instance, factors such as, earlier experiences with others in mathematics, perceptions of the subject, myths and beliefs about the subject can affect achievement outcomes indirectly through ones' expectancies and values. This EVT has widely been applied and used in educational research because it placed values on the expectancies of the learner, play an essential role in determining the level of effort and eventually lead to the level of achievement of a particular task (Hannula, 2002).

The expectancy-value theory, was purposed to explain and predict an individual's attitude toward objects and actions (Kahle & Valette-Florence, 2012). The concept of expectancy vividly explains the idea that most learners will not choose to do a task or continue to engage in a task when they expect to fail. For example, a female student who continually have low marks in Mathematics will simply not think of mathematics being an option to pursue in further studies. Value can refer to the different beliefs' students have about the reasons they might engage in a task.

The expectancy-value theory has three basic components: belief, value and expectancies (Wigfield & Cambria 2010). The learners' response to an information about a given task is based on the belief they have about it. If the belief already exists, it may be modified by new information. In addition, the learner assigns a value to each attribute that a belief is based on. Finally, an expectation is created or modified based on the analysis of beliefs and values. For instance, a female students in single-sex school who witnessed her fellow female students participate in the National science and Math Quiz (NSMQ) will not hesitate when called to represent the school in any of such competitions and will readily avail herself to take up courses in mathematics without the feeling of intimidation as compared to a female students in the mixed-sex school where often male students are featured in NSMQ despite the presence of female students in the school. She may feel competitions generally are for male students or competition in mathematics and science fields are in the domain of male. Expectancies can also influence an individuals' self-concept and self-efficacy. self-concept is the belief in one's ability to achieve his or her goal whilst self-efficacy is a concept that deals with the individual's competence with regard to his/her ability in realizing goals in life (Wigfield & Cambria, 2010).

The expectancy-value theory posits that, attitude, behaviour, and the choice of the individual are determined by the expectations he/she has towards a particular object (Ajzen,1988; Minton & Khale, 2014). For example, a senior high school female student whose future expectation is to become an engineer would devout all her energy/effort to learning Mathematics to obtain good grade in mathematics. But a female student whose expectation is to become a house wife or a female students who does not have any aim, direction, or reason for even being in school let alone to pursue mathematics might not see the need to be serious in school or to be a good

student in mathematics. Wigfield, Tonks, and Eccles (2004) enumerated a wide range of different factors that determine the individual's expectancies and values. These factors they listed as: cultural milieu, socializer's beliefs and behaviors, differential aptitudes of the individual, previous achievement-related experiences, individual perceptions of social beliefs, individual's interpretations of experiences, affective memories, general goals and self-concepts.

The expectancy-value theory is to be applied as an intervention to boost classroom activities. According to Hulleman and Harackiewicz (2009), value- focused interventions are developed to help education policy makers and teachers to design the curriculum in ways that allow students to see connections between the material they learn in the classroom and their own lives. It is also to help teachers to teach topics within the syllabus in an order that shows the beauty of scaffolding in mathematics where students learn from known to unknown in a super connected manner. This is to ensure the promotion of interest and performance in senior high school mathematics classes. Hulleman and Harackiewicz argued that the intervention is to boost student's performance and interest; mostly for students who have low entry expectancy. According to the expectancy-value theory as explained by Hulleman and Harackiewicz, the interventions are very effective when applied in the mathematics classroom because they stimulate, increase and sustain students' interest in the presentation of the material.

A female student might be wondering why the need to study mathematics which is full of abstract calculations which make no meaningful relation to life outside the classroom. This thinking will only have answers which will guide the female to put in their maximum best to achieve in mathematics if only the content of the subject is structured in such a way that they can appreciate its relations to life. If students for

instance, are aware that basic mathematics computations such as addition, subtraction, multiplications and division help them to master buying and selling of items either in the market or in the shops, it will boost their interest in computations than when they merely engage in the raw computation of numbers without construction of meanings and relations.

The Essential difference Theory lays emphasis on the fact that males and females have different and unique features of which attention must be paid, to bring out the best out of them. This support its choice that if females' characteristics are factored into educating them, then there will be no hindrance in the development of their mathematical concept. The nurturing of the concept is to be supported in an adaptive place/setting free from all forms of prejudices (Bandura Cognitive Learning Theory). Hence these will lead to positive feelings about ones' self-concept, believing in ones' capabilities and setting attainment goals (Expectancy Value Theory) for oneself to which one cannot decline in all fields of work, especially in mathematics fields. This then, will bring about a rapid decline in the negative attitude of senior high female students toward mathematics achievement.

These theories are relevant because they contribute to putting the female student in the right state of mind to know her identity and potentials. The right decision is taken to put the student in the right place for learning to affect her behaviour positively (Hannula, 2002). The female student will then have positive mindset about learning and achieving in mathematics. These theories are represented in figure 2.1.

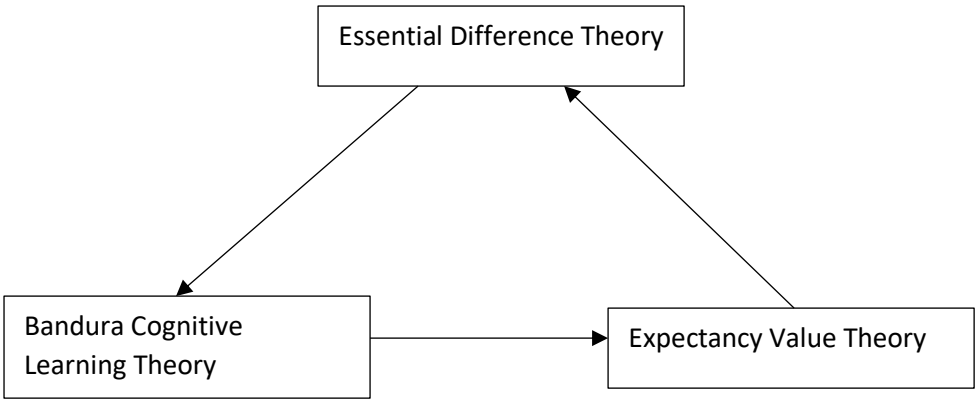


Figure 2.1: Theoretical framework for positive attitude towards mathematics

In conclusion, the three theoretical frameworks guiding this study are interwoven in the sense that if critical attention is paid to females uniqueness through the differential theory (Essential Difference Theory), teaching and learning styles will be developed to enhance the mathematical inclination of the female in an unbiased setting (Bandura Cognitive Learning Theory) where females will develop the sense of positive thinking of their engagement in every activity (including mathematics) within their setting with a strong expectation (Expectancy Value Theory) of exceeding without limitation. This will turn back the whole clock of females' attitude and assertion about mathematics all over the world.

2.2 The School Setting

The school setting (mixed-sex or single-sex) is identified in this study as a major factor that influences female students' attitude towards the study of Mathematics. The nature and type of setting learners find themselves does affect the type of attitude being developed. Students who find themselves in an intimidating school setting are more likely to develop negative attitudes than those in a friendly setting (Gallagher & Kaufman, 2006).

According to UNESCO (2007) and Riordan (2008), policymakers in many education ministries are debating the value of coeducational classes and single-sex education. In

single sex education, all learners are either males or females. The heart of most debate is whether female students will be safer and get a better education if they learn only with other female students or in mixed-sex classes with male students. Educators have three main choices of educating females. There can be single-sex education in separate males' or females' schools, co-education of females and males' students in the same classes in the same school, or mixed models. Separate males' schools and females' schools may also bring their students together for some joint education for sport or extra-curricular activities.

The study of female students, plays an important role in explaining why she chooses not to compete (Booth & Nolan, 2009). Female students from single-sex schools behave more competitively than do female students in coeducational schools. A study by Malcove (2007) found that female students frequently expressed having more confidence in the single-gender setting. This study also found out that it is easier for females to contribute to oral discussions and to ask questions without being ridiculed in a single gender setting.

Eisenkopf, Hessami, Fischbacher, and Ursprung (2011) analysis on the impact of female-only classes on mathematic achievement, exploiting random assignment of females into single-sex and coeducational classes in Switzerland secondary schools, found that single sex classes improve the performance of female students in mathematics. In a study by Kessels and Hannover (2008) they found out that females from single-sex classes are reported to possess a better self-concept of ability than female students from coeducational classes. Single sex schooling was found to help adolescents to gain a better self-concept of ability in school subjects that are considered inappropriate for their own sex. A study by Australian Council for

Education Research [ACER] (2008) found out that females attending single sex schools produced higher tertiary entrance scores than those in coeducational schools.

In a study on students and teachers' perceptions of the causes of poor academic performance in Nigeria, Asikhia (2010) stated that inconducive school conditions such as large class size has not only lead to the negative attitudes of learners but also, it has contributed to the poor academic performance of students. Classroom size, social interaction within the school (between students and school authorities, or among students themselves), methods of assessment in the school and the content of the curriculum are some features of the school that influences learners' attitude and interests in Mathematics (Gallagher & Kaufman, 2006). Several different and opposing ideological and social contexts have inspired single-sex learning (Haag, 1998). Single-sex types of schools are advocated by some feminists to minimize the negative effects of gender stereotypes, for example, that mathematics is a masculine subject (Gill, 1996; Hildebrand, 1996; Granleese & Joseph, 1993; Mallam, 1993).

According to Sugden (2009), the greatest benefit of single-sex (female-only) education is the findings that many female students score higher on their final academic scores and have greater educational opportunities from an all-female school as compared to a female student who attended traditional high school (coeducational school). Sax (2010) in his book "Female on the Edge: The four factors driving the new crisis for female" argues that at every age, female in female-only classrooms are more likely to explore "non-traditional" subjects such as Mathematics, Computer Science, Physics (or the primary school precursors to the Physical Sciences), Woodworking, among others.

In female-only, female students are exposed to more successful female role models. The top students in all academic subjects and the leaders in sport and extra-curricular activities are female. In general, they feel better about their bodies and their body image as well as about their academic abilities. By promoting self-esteem, single-sex schools may better equip female to fight for their human rights in gender-biased male-dominated societies (Sullivan, Joshi & Leonard, 2010)

Some researchers hold the view that single-sex classes instead of single-sex schooling should be offered because they are seen to reinforce students in traditional gender roles (Ascher, 1992; Carpenter & Hayden, 1987; Yates, 1993). Single-sex classes provide appropriate role models of the same sex and include male and female initiation rites (Ascher). Some parents and students prefer single-sex private schools for female because they offer a more traditional mission (Carpenter & Hayden). Yates (1993) also states that the structure of single-sex education does not in itself guarantee any particular outcome.

Proponents of single-sex schools argue that these schools allow female to flourish in a way that coeducational schools may not. Some studies indicated that female in schools with single-sex programs achieve higher learning, display more self-confidence and leadership skills, and enter male-dominated fields at a higher rate (Ferrara, 2005; Smyth, 2010). Studies have also shown that female in single-sex classes are actually more likely to act outside of traditional gender roles. When female students are around, they are the ones expected to take part in such, non-macho pursuits. But when the female students are not in the school, males may perceive that it is acceptable to fill those feminine roles. Single-sex schools would therefore allow some male students to transcend the gender roles that are typically assigned to them.

According to Schmuck (2005) and Smyth (2010) critics of single-sex education argue that females-only schools are unnatural social settings which isolate females from males. In well-managed co-educational schools, male and female students learn to respect and value each other's ideas. They learn to listen and communicate with each other. Isolating females and males in single-sex schools is considered a barrier to them developing the effective interpersonal skills they will need to function as grown-ups in their society.

On the other hand, Eliot (2009) argues that single sex schools automatically expand the leadership opportunities available to both males and females, and they increase the odds that each sex will enter non-traditional disciplines. Female students were also found to do better in certain subject areas such as Mathematics and Science when males are not in the class. A study by Sullivan, Joshi and Leonard (2010) in British schools examining the impact of single-sex schooling found out that single sex schooling is linked to the attainment of gender stereotyped subject areas for both sexes, not just during the school years, but also later in life. Sax (2009) in a research commissioned by the US department of Education found out that in single-sex high schools, students exhibited high levels of engagement in academic activities and homework completion than students in coeducational schools.

2.3 The Concept of Attitude towards Mathematics

Attitude towards Mathematics is seen as a like or dislike for Mathematics, the tendency to engage in or avoid Mathematical activities or beliefs that one is good or bad at Mathematics and the usefulness an individual hold towards Mathematics (Neale, 1969). Zan and Martino (2007) defined attitude towards Mathematics as a positive or negative emotional disposition towards Mathematics

Similarly, Hart (1989) considers attitude towards Mathematics from multidimensional perspectives and defined an individual's attitude towards Mathematics as a more complex phenomenon characterized by the emotions that he associates with Mathematics, his beliefs about Mathematics and how he behaves towards Mathematics. Attitude towards Mathematics includes the tendency to be fearful of and anxious about Mathematics.

There is no doubt that attitude plays a vital role in students' Mathematics achievement, Mathematics specialization and the choice of Mathematics related careers (Gunderson, Ramirez, Levine & Beilock, 2012). A positive attitude can motivate students to develop critical thinking skills, be active in the classroom, work together in groups, improve interaction and communication skills.

The study identified expectancy, experience, perception, interest, self – concept and motivation as constructs of attitude that influence student's achievement in mathematics. Students' achievement in a particular subject depends on their attitude towards the subject. Positive attitude towards a subject (Mathematics) will encourage better achievement in the subject (Mathematics). Linero and Hinojosa (2012) said people become more likely to have positive attitude towards the attitude they are frequently exposed to than one they are not exposed to. The explanation of the attitudinal constructs: Experience, Perception, Interest, Self-Concept, and Motivation identified in this study to have influence on students' attitude which in turn leads to the influence of students' achievement or they may have influence on achievement directly.

2.3.1 Experience

Most students who obtain low marks in Mathematics struggle through the subject because they think the amount of materials in Mathematics to be studied is so voluminous making it difficult to be absorbed. Difficulties in learning mathematics which result from difficulty in applying formulae, using measurements, were found as obstacles that affects some sections of students. Students who were thought through the use of teacher-centred approaches think mathematics is a huddle one has to cross in order to progress to the next grade level. Students also indicated their academic progress is hampered by low scores in Mathematics even if they are performing well in other subjects (Mutodi, & Ngirande, 2014).

A female students' experience in Mathematics in the MS school, for instance, when she frequently gets poor marks while males in the same class gets good marks, she may be force to see mathematics as a subject she is incapable of doing or a subject that is masculine. This will make her not to like Mathematics and so she will not believe in her ability that she can ever achieve in mathematics. If these female students happen to do well one day in Mathematics and is being appreciated by anyone, she may think she is being mocked due to lack of belief in her own capability. It is also argued that ones' expectation can influence his/her attitude, which will in turn, influence the Mathematics achievement. An example is a female whose expectation is to become an engineer and knows that she must excel in both core and elective Mathematics, will not be discouraged from learning Mathematics even if she performs poorly in Mathematics, but she will seek the necessary help to excel. She will also form positive images about mathematics and pay more attention to the subject by allocating more time on her personal time table for Mathematics than other

subject. She will also believe in her ability to achieve in the subject and will always gain internal satisfaction from achievements that proceed from her effort.

2.3.2 Perception

Many students view mathematics as a difficult, cold and abstract subject. It is perceived by many students as an exclusive discipline (Buhagiar, 2013). Such perceptions may prevent students from learning alternative strategies and approaches to Mathematical problems. This may influence students to approach Mathematical tasks in class with a very narrow frame of mind that prevent them from developing personal methods to build confidence in dealing with Mathematical ideas. The subject is also seen as an obstacle, often feared and required hard work. Many viewed the subject as static and objective discipline, which can only be discovered by Mathematicians, and then transmitted by teachers and received by the students. For this reason, most students do not make any effort on their own to study Mathematics but they only wait/depend on the teacher, leading majority of them to solely depend on the teachers' note/explanation. Many believed that Mathematical activities involve procedures that are detached from real life, discovery and problem solving. There is also a claim that Mathematics is only for the clever ones, or only for those who have inherited Mathematical ability (Kimball & Smith, 2013).

A study conducted by Mutodi (2014) on student's perception concluded that there existed strong positive relationships between performance and perception constructs such as self-confidence, interests in mathematics, teacher and learning support material as well as myths and beliefs. Some students perceived lack of proficiency in Mathematics as a challenge, and attributed achievement in Mathematics to effort and perseverance while others also perceived difficulty in mathematics as an obstacle, and attributed failure to their own lack of inherited Mathematical ability. The previous-

mentioned perception constructs Mutodi stated lead to differences in students' perceptions about mathematics. These in turn may lead to differences in attitudes towards mathematics and learning mathematics which have a bearing on achievement.

These views cause many people to believe that learning mathematics is an issue of ability rather than effort and that there is an inherent natural ability for mathematics. These perceptions lead students to accept their lack of accomplishment in mathematics as a permanent state over which they have little control (Mutodi, & Ngirande, 2014).

2.3.3 Expectation

The expectations of students regarding Mathematics and Mathematics teaching have been considered to be very significant factor underlying their school experience and achievement (Borasi, 1990). This conception determined the way students approach Mathematics tasks, in many cases leading them into non-productive paths.

Students have been found to hold a strong procedural and rule-oriented view of Mathematics and assumed that mathematics questions should be quickly solvable in just a few steps, per their conviction, the goal just being to get "right answers". They think, the role of a student is to receive mathematical knowledge and to be able to demonstrate so.

2.3.4 Interest

According to Oxford Advance Dictionary (2016), interest is the feeling or wanting to know or learn someone or something. Interest can be positive or negative. A positive interest towards mathematics is the likeness for the subject while a negative interest is the dislike for the subject. A high interest in a particular subject can influence the level of student achievement and will encourage students to study in depth. Interest

can be said to have direct link with attitude, a student who has a positive attitude towards mathematics will not have any problem doing mathematics (Orora, 1986). Most Ghanaian students exhibit negative attitude towards mathematics because of the belief they hold. Philipp (2006) explain that the beliefs and feelings of people (students) are carried throughout their life time. Most students are said to hold the belief or myth that being good in mathematics is mainly due to ability than effort (McLeod, 1992). The irony is that sometimes people develop interest for what is within their capability. That is what they find themselves achieving in is what they develop interest for. In this case, a female student who does not do well in Mathematics will never develop interest for mathematics.

2.3.5 Self – concept

Ignacio, Nieto and Barona (2006) used the term Mathematics self-concept to refer to personal beliefs relating to the world of Mathematics. It is also defined as set of ideas, judgements, beliefs, and attributions that a person has gradually built up during his or her process of learning in the school. Personal beliefs affect a person's interest in Mathematics, efficiency in performing Mathematics tasks, motivation and pleasure of doing Mathematics. It can be attributed to the causes of academic success or failure, and the impression of belonging to a certain social group.

Hannula (2007) pointed out that a Mathematics learner's liking or disliking of the subject is derived from his/her belief structure. People's beliefs towards Mathematics are shaped by their personal characteristics and experiences related to their academic self-image. For example, if a female has positive self-concept about achieving in Mathematics, she will surely do well in Mathematics despite the school in which she finds herself.

2.3.6 Motivation

Motivation is the inner striving conditions such as wishes, desires and urges that lead a person's concentration towards a particular activity (Ofoegbu, 2004). It is also defined as the readiness of individuals to exert high levels of efforts towards the realization of an organizational goals (Baba, 2012). Motivation can be influenced by internal (intrinsic) or external (extrinsic) desires that push and sustain one's interest toward the achievement of a goal (Akuamoah et al, 2004; Akuguru, 2010).

Intrinsic motivation is the arousal of a satisfaction from within that one gets from performing an activity which leaves the traces of joy and encouragement for the person to willingly engage in such activities many times possible. Intrinsic motivation is self-rewarding and it makes learning an enjoyable process which results in long lasting positive effects among students even after they have left school (Akuamoah et al, 2004; Akurugu, 2010). Intrinsic motivation helps students in the development of positive attitudes towards Mathematics and sustained their interest throughout life time. For example, Students are motivated towards the study of Mathematics in school if they expect that it will lead them to a desired goal (Salifu, 2017).

Extrinsic motivation in education is learning that is determined by outside influence or incentives such as rewards, praises, high grades and self-esteem (Akuamoah et al., 2004). Extrinsic motivation plays an important role in getting students to involve in serious studies with hard work but it may not last for long (Armstrong, 2007). For example, when female students are giving awards to entice them to do well in Mathematics or further their studies in Mathematics, it may motivate several of them to be doing well in the subject with the view of receiving the award or the support but as soon as the support is taken-off, the hard work put in may extinct leading them to the formal state of non-performance.

Motivation towards Mathematics has to do with the factors that inform and influence students to pursue the subject. It determines the kind of attitude students have towards Mathematics and their efforts in studying the subject. Motivation is the motive behind the performance of a given activity and helps to determine the kind of efforts being put into the activity and the time frame within which the activity is accomplished (Dornyei, 2001). According to Saeman (2009), motivation involves attitudes and affective states of a person which in turns influence the degree of effort a person exerts on the attainment of a desired goal. The Mathematics Motivation for female students may be seen as the internal drives, desires and expectations which urge female students to pursue Mathematics.

There are three components of motivation; effort, desire and affect (Salifu, 2017). Effort is the energy exerted towards some activity. Students who are highly motivated will exert more effort such as attending extra classes and doing personal studies in Mathematics. When a female has the desire for achievement in Mathematics it will surely influence her seriousness towards her studies. The affect component of motivation deals with the enjoyment, excitement and the fun associated with doing a task such as studying Mathematics. Salifu explained that it is necessary to note that the three components of motivation are interrelated and interconnected. SHS females must be encouraged to possess the three components of motivation so as to be fully motivated to study Mathematics and its related courses from early stages of their lives. This will prevent difficulties in learning and achieving in the subject which may subsequently result in the development of negative attitude towards Mathematics (Saeman, 2009; Baba, 2012).

2.4 The Concept of Mathematics Achievement

Mathematics achievement is the attainment, accomplishment or successful performance in a mathematics examination, measured in scores obtained by candidates in an examination (Makau, 1997). Students' mathematical achievements in senior high school have an influential effect on their performance in college and their future careers. Having a solid background in mathematics aids students to develop sophisticated perspectives and offers more career options (Wilkins & Ma, 2002). The relevance of the subject had led most educators to rely on many sources of information which focused on various factors that affect students' mathematical achievements, including students' own backgrounds, influence, and parental involvement (Young, Reynolds & Walberg, 1996).

According to Ma (1999), school factors have major influence on students' mathematics progress, for that matter cannot be overlooked. School factors were classified into two sets of variables. Set one described the context of a school: school enrolment size, school location, and percentage of free lunch students. Set two described school level variables, referred to as evaluative variables: associated with school climate, attempting to describe the inner working of school life, for example, school organization and expectations of students, parents, and teachers. (Wilkins & Ma, 2002). The work of Wilkins and Ma continued to reveal that students' initial mathematics achievement, annual progress and their relationships in the senior high schools affect their mathematics progress. They concluded that students with higher initial status tend to grow mathematical skills faster than those from a lower starting point.

This made Muller, Stage, and Kinzie (2001) to opined that a more dynamic approach to experiences in academic achievement is needed to unearth the initial problem.

When teachers and parents recognize the factors that influence female students' mathematics achievement and improvement, there would be positive attitude towards mathematics achievement leading to substantial academic progress in the senior high schools.

2.5 The Attitude of Female Students towards Mathematics in Mixed-Sex and Single-Sex Senior High School

The results of the investigation by Eshun (2006) on the attitude of students towards mathematics in 12 senior high schools in Central and Western Regions of Ghana which involved 1,419 students showed differences in attitude of females in single-sex and mixed schools. Female students in mixed schools showed the lowest confidence, likeness and success in doing mathematics and had higher mathematics anxiety. He also found that female students in the single-sex schools had the most positive self-concept while female students in mixed-sex schools had the least positive self-concept.

As a response to the continuous decline in the attitude of senior secondary students (Watt, 2004), Lee and Anderson (2015) presented a paper on the topic, gender differences in mathematics attitudes in coeducational and single-sex secondary education at an annual meeting of the Mathematics Education Research Group of Australasia. The paper revealed differences in attitude towards mathematics with females in the single-sex school having the most positive attitudes and female students in the coeducation setting having the least positive attitude. They explained that female students in single-sex settings have more favourable attitudes towards mathematics than those in coeducational settings. Sullivan, Joshi, & Leonard (2011) also confirmed the fact that female students in single-sex schools showed more positive attitude towards mathematics than female students in mixed-sex schools.

Gilson (1999) found no difference in the attitude of females in the independent single-gender and coeducational schools in San Francisco [CA], among 467 high school females. She explained that, the result could be influenced by large number of female mathematics teachers whose students participated in the study, the relatively small-size classes, and the attention to issues of gender equity by the participating schools. Also, a research conducted by Adebule and Aborisade (2014) in Ekiti-Nigeria, found no significant difference in the attitude of females in single-sex and mixed-sex schools toward mathematics.

In contrast, the study conducted by Pathan (2011) on a comparative study of students' attitude towards co-education from single-sex and co-educational college in Pune City, showed that females from single-sex institutions had an unfavorable attitude towards themselves as compared to the students from co-educational institutions and students from co-educational institutions had a positive attitude towards opposite-sex as compared to the students from single-sex institutions. she continues that students from co-educational institutions had positive attitude towards teachers and their parents as compared to the students from single-sex institutions.

Using a multivariate analysis of variance to guide an exploration of how students' attitudes varied according to grade, sex and educational setting, the findings of Norton and Rennie (1998) concluded that, students in general do not see mathematics as problem or a hurdle they cannot overcome at the early stages of life but as they proceed through education to higher grades, they develop negative attitude towards the subject. Salifu (2017) identified major factors causing negative attitude of female students towards Mathematics as: teachers' beliefs, attitudes, knowledge, professionalism, demeanor and personality. In addition, Salifu agreed to the fact that the school conditions (both in and outside the classroom) is also a contributing factor

as well as peer influence, the home and the family of the female student, socio-cultural beliefs such as gender stereotyping and gender roles as other major contributory factors.

2.6 Mathematics Achievement of Females in Single-Sex and Mixed-Sex SHS

Jiminez and Lockheed (1989) investigated mathematics performance in Thailand and concluded that peer quality seemed to account for most of the differences between achievement levels in single-sex schools and coeducational schools. Carpenter and Hayden (1987) supported the importance of peer influence on achievement in their study of single-sex high schools in Queensland and Victoria, Australia. Their study suggested that social context (i.e., socio-economic status) and the variety of schooling available may maximize or minimize school type effects.

Similar findings were reported by researchers at Cambridge University. They studied single-sex high school classrooms in four different neighborhoods, including rural, suburban, and inner-city schools. All the schools studied raised educational achievement (Salomone, 2003). In the same way, research conducted by Eisenkopf, Hessami, Fischbacher and Ursprung (2011) on “Academic Performance and Single-Sex Schooling: Evidence from a Natural Experiment in Switzerland" came up with the result that single-sex schooling improves the performance of female students in mathematics.

After Comparing the Effect of Single-Sex and Mixed-Sex Classes on Middle School Students’ Achievement, Thom (2006) revealed that, the use of single-sex classes to deliver instruction at Stonewall Jackson Middle School significantly improved student achievement in mathematics. In addition, female students who attended single-sex

schools fared well in examinations and perform better compared to female students who had attended co-educational schools (Sullivan, Joshi, & Leonard, 2011).

An ex post facto causal-comparative research design conducted in Georgia between 2007-2010 by Ogden (2011) to investigate if differences exist in academic performance in mathematics among urban middle school students who attend coeducational classes, single-sex classes within a coeducational school, or a single-sex school came out with the following findings; students' performance in mathematics showed that female students in the coed single-sex classes and single-sex schools proved to be more consistent in maintaining their standards in mathematics as compared to the students from coed schools. Ogden further explained that the increase in performance may be due to the attention paid to it by everyone including both teachers and students and the fact that many of the teachers were female mathematics teachers who created the right learning pace nurturing to female students. Traditionally, it is said that female teachers make classroom and methodologies more conducive to suit females learning than male teachers (Gurian, 2001). Eisenkopf, Hessami, Fischbacher, and Ursprung (2011) supported Ogden that single-sex schooling improves the performance of female students in mathematics but unlike Ogden, and Gurian, they said the positive effect increases if the single-sex class is taught by male teachers.

The analysis of Kyei1, Apam and Nokoel (2011) on some gender differences in performance in senior high mathematics examinations in mixed high schools concluded that the class size of students affects their performance. They also found that the number of educated people in the students' house and the sex of the students also have effect on the student's performance.

In the quest to find out the effects of single-sex and coeducational secondary schooling on children's academic achievement in New Zealand, Woodward, Fergusson, and Horwood (1999) collected data over the course of an 18-year longitudinal study of a birth cohort of 668 New Zealand children. Their analysis showed tremendous gain in academic success in favour of female students from single-sex schools. A paper presented by Gilson (2002) at the Annual meeting of the American Educational Research Association, Montreal, Canada, on the topic Single – gender education verses coeducation for female students: a study of mathematics achievement and attitudes toward mathematics of middle school students, she concluded that there were statistically significant differences in mathematics achievement on Level F of the Comprehensive Testing Program (CTP 11I) at the eight-grade level.

Lee and Lockheed (1990) measured mathematics achievement for 1,012 ninth grade Nigerian students. They found that females in single-sex schools outperformed females in coeducational schools. Lee (1997) has indicated that what she defines as "good" school practices that exist in most single-sex schools, for example, smaller school size, focused academic curriculum, and teachers' high expectations for student success, could be incorporated into coeducational schools. Ian (1998) concluded in his study that, there is no clear winner in the academic performance of single-sex schools and coeducational schools, there is no relationship between type of schooling in terms of academic achievement. But he found some social advantages in students who attended coeducational secondary schools to possess an increased self-concept as compared to students from single-sex schools.

2.7 Chapter Summary

The works of earlier researchers are mostly on the attitude of SHS females toward mathematics, mathematics achievement of students in single-sex and co-educational high schools. Very few did the comparison of the effect of single-sex versus mixed-sex classes on middle school students' achievement. Also, numerous researches reviewed in this study, showed clearly that there is no straight forward answer to the research questions posed in this study. Moreover, since all the reviewed studies are conducted in different settings using varied samples, methods, and tools, it is relevant to compare attitude towards mathematics achievement of females in all females single-sex and mixed-sex public senior high schools in Ho Municipal, in the Volta Region of Ghana.

CHAPTER THREE

RESEARCH METHODOLOGY

3.0 Overview

This chapter describes the methodology and procedures employed for the study. It includes: the research design, the study area, the population, sampling procedures and sample size, research instruments, pilot study, data collection procedure and data analysis.

3.1 Research Design

A comparative design was used for this study. A comparative design was chosen because it enabled the researcher to describe and compare the attitude of female students in single-sex (SS) and mixed-sex (MS) senior high schools towards mathematics achievement. The comparative design is a non-experimental design which goes beyond description to compare two phenomena without manipulating the factors that influence them (Mcmillan & Schumacher, 2014). The descriptive aspect of the design collects data from a wide range of people and provide a large amounts of quality responses. This design helped to describe the attitude and the achievement of female students in single-sex and mixed-sex public senior high schools in the Ho municipality.

3.2 The Study Area

The study was carried out in the Ho municipality. Ho is the Capital Town and the Administrative Centre of Ho Municipality in the Volta Region. Ho Municipality is one of the twenty-five (25) districts in the Volta Region. The Municipality lies between Mountain Adaklu and Mountain Galenukui with an area of 2,361km^2. It has a population of 177,281 as at 2010 Population and Housing Census, representing 8.4

of the Regions total population. The traditional occupation of the natives is farming. Ho is the central business town for most traders in the near-by surroundings. Most of the residents in the main town are workers at the government sector. Though the natives are mainly Ewes, most people at the government sectors are from other tribes. There are ten (10) senior high schools in Ho municipality: comprising three (3) mixed-sex private schools, five (5) mixed-sex public schools and two single-sex (all females) public schools. In all, there are three (3) private senior high schools and seven (7) public senior high schools in the Ho Municipality. The map below gives a visual view of Ho municipality. The area of Ho Municipality is bounded by the blue line.

Source: Ho Municipal District Assembly

Figure 3. 1: Area Map of Ho Municipal District Assembly

3.3 Population

The study was conducted within Ho Municipality in the Volta Region. It includes all the public senior high schools in the Ho Municipality, comprising two (2) female single-sex senior high schools and five (5) mixed-sex senior high schools.

Table 3.1: Distribution of Public SHSs in Ho Municipality by School Type

School Type	Number of School
Single-Sex (all females)	2
Mixed-Sex	5
Totals	7

Source: Researcher

The population for this study was 6,586 female students in all the public senior high schools in Ho Municipality. Out of the seven (7) public senior high schools in the Ho Municipality, five (5) are mixed-sex and two (2) are all female students single-sex schools. In order to conceal the true identity of the schools, pseudonyms are used. The names of the schools were labelled as follows: school A, school B, school C, school D, school E, school F and school G. Schools A, B, C, D and E are mixed-sex schools whereas schools F and G are single-sex (all- females) schools. Schools A, F and G were running double-track system while the rest of the schools: B, C, D and E were running single-track system of education.

Table 3.2 shows the names and types of public schools in the municipality with the estimated population of female students.

Table 3.2: Distribution of female studens' population in the public schools

Name of School	School Type	Female Population
A	Mixed-Sex	1,925
B	Mixed-Sex	565
C	Mixed-Sex	486
D	Mixed-Sex	281
E	Mixed-Sex	178
F	Single-Sex	2,119
G	Single-Sex	1,032
Total		6,586

Source: School Management

3.4 Sampling Procedure and Sample Size

Purposive sampling was used to select female students only for the study. The main goal of using purposive sampling in this study was to focus on female students' attitude toward mathematics achievement in single-sex and mixed-sex public senior high schools in the Ho Municipality. It also helped the researcher to answer the research questions in the study.

Form two "green track" classes were preferred among the schools running double-track system because the time the data was collected was the beginning of a new academic year (2019/2020). This academic year was opened with the "green track" second-year students and the admission of the first-year students. The first-year students were reporting for their prospectus but the "gold track" second-year students were on vacation. The third-year students were already in school in their third term and were close to writing mock examination. This is because all third-year classes were running single-track system. So, they had been in school long ago before the green track students resumed. Again, school was in section for the schools running the single-track system. From the explanations above, it is only the form two green

classes from the “double track” and form two classes from the “single-track” readily available to respond to the questionnaires.

The selection of the students was done through stratified sampling. This technique was preferred due to its assurance of desired representation of relevant sub-groups to increase the efficiency of the population estimates (Gay, 1992). The students were divided into two strata: 1. students from single-sex schools and 2. students from mixed-sex senior high schools. The stratified random sampling was based on proportion. That is, in each school students were selected from all programs of study to get a good representation of ideas.

Simple random sampling was used to draw the sample size for the study through the use of random number generator (calculator). The sample size of 364 was sampled from a population of 6,586. The sample size was determined by using Krejcie and Morgan (1970) table. The table calculator assumes a population size of 7000 to a sample size of 364 (Krejcie & Morgan, 1970). Because the targeted population was 6586 as shown in Table 3.2, was close to 7000, 364 was used as the sample size. Table 3.3 shows the sampling grid for females in the sampled schools.

Table 3.3: Sampling Grid for Female Students

Name of School	Enrolment of form Two Female Students	Sampled Students(B)	Sampled Students(A)
A	663	106	104
B	205	33	32
C	104	17	16
D	49	8	8
E	67	11	10
F	744	119	119
G	436	70	69
Total	2,268	364	358

Source: Researcher Before (B) After (A)

The students were sampled by finding the proportion (enrolment of form two females divided by their total enrolment, multiplied by the sample size) of form two female students using the formulae $(n \div N) \times 364$. This produced the result labeled sample students B in Table 3.3. After the instruments were answered and returned, the response rate was 95.6%.

3.5 Data Collection Instruments

A closed ended questionnaire was developed by the researcher under the supervision of the supervisor for data collection. It was made up of attitudinal test and mathematics achievement tests. The questionnaire helped the researcher to collect data from a wide range of participants at the same time. This made it possible for the researcher to compare responses from different students on the same questions. The challenge of this instrument is the possibility of some of the participants not being truthful with the responses due to their personal conviction or misunderstanding of the questions (Linn & Grolund, 1995).

The questionnaire consisted of three sections (A, B & C). Section A was on personal or background data of the students and it was made up of 4 items (1-4). It solicited name of school, school type, programme of study and age of students. The section B part of the questionnaire was attitudinal test. This helped to collect data on female students' attitude towards mathematics. The section consisted of items that solicited responses to the following attitudinal constructs: perception, experience, expectation, interest, self-concept and motivation. Section A was made up of 25 items (5–29), on a five-point Likert scale (Strongly Agree, Agree, Unsure, Disagree and Strongly Disagree). Table 3.4 shows the distribution of questions to the attitudinal constructs.

Table 3.4: Distribution of items to the attitudinal constructs

Attitudinal constructs	Number of items
Perception	4 (5-8)
Experience	3 (9-11)
Expectation	3 (12-14)
Interest	4 (15-18)
Self-concept	5 (19-23)
Motivation	6 (24-29)

Section C was on an achievement test in mathematics. Self-designed (teacher-made) test was used to collect data on students' mathematics achievement. An achievement test was developed by the researcher based on the content of the SHS syllabus. The test items were set on topics to be covered in form one because the data was collected at the beginning of the 2019/2020 academic year when the form one students had just been promoted to form two. The test comprised of twenty (20) items. It was ensured that all the sampled schools were taught all the topics covered in the test. The test enabled the researcher to compare the achievement of form two female students in the selected schools. Proportion was found for the form two female students in all the selected schools and random numbers were generated for all the participants.

Table 3.5 shows the proportion of form two female students sampled for the study before and after the collection of data, editing and coding.

Table 3.5: Proportion of respondents, before and after data collection

	Before	After
Mixed-sex	175	170
Single-sex	189	188
Total	364 (100%)	358(95.6%)

Source: Researcher

3.6 Pilot study

The attitudinal test and mathematics achievement test were administered in aschool H in Ho-West District after permission was sought from the headmaster of the school. The researcher visited the headmaster of the school in his office. She explained her intention to test her instrument in the school and agreement was reached. The purpose of the study was explained to both teachers and students. Two mathematics teachers agreed to help in the data collection after which seventy (70) form one female

students were proportionately sampled according to their programmes of study. The sampled students were informed to report at the dining hall the next morning to answer the questionnaires. The students were seated and the questionnaires were distributed to them. The instructions were read and explained to the students and they were given forty (40) minutes to complete the questionnaire. The students were monitored by a mathematics tutor and the researcher. The data collected were edited, coded and entered into Statistical Package for Social Sciences. It was analyzed purposely to check the time allocation, make necessary corrections, check reliability and validity of the study. Five (5) items were set on personal data, twenty-five (25) items were set for the attitudinal test, and twenty (20) items for the mathematics achievement test. Fifty-eight (58) results were processed and twelve (12) were uncompleted. Modification was made on the test instrument. The items were thirty (30) on the attitudinal test but they finally reduced to twenty-nine (29) and item 12 on the test item was changed. The piloted school was not part of the main study. The Cronbach's Alpha for the pilot study was 0.758. This is a confirmation that the items were reliable.

3.7 Validity of the Instruments

Validity is the extent to which a measuring instrument provides adequate coverage of the topic under study. A content validity is good if the measurements has a representative sample (Kothari, 2004). To ensure content validity of the instruments, the researcher prepared the instruments and gave copies to experts in the mathematics department to seek their views and their suggestions and inputs were considered to revise the instrument. A copy was sent to the supervisor to go through for his approval. His suggestions were used to correct the instrument before the collection of data.

3.8 Reliability of the Instruments

To obtain the reliability of the instruments, Cronbach's alpha coefficient was calculated for all the items on the instruments that was piloted. The calculated Cronbach's Alpha for the instrument was 0.758. This confirmed that the items were reliable since the result is above 0.5. Cronbach's Alpha was also calculated after collecting the main data and it was 0.786. this implies that the instrument could be relied upon to draw conclusion on the comparison of female students' attitude towards mathematics between single-sex and mixed-sex senior high schools.

3.9 Data Collection Procedure

In order to ensure smooth administration of the instruments, the researcher collected an introductory letter from the Department of Mathematics Education, UEW. The researcher sought permission from heads of the sampled schools for the study by giving them both introductory letter and consent letter. Samples of questionnaire were given to the assistant heads (academic) as well as the mathematics unit heads to read through and know the content of what their students would be assessed on. Due notice was given to the students to prepare for the test. On the approved day of each of the schools, the researcher distributed copies of the questionnaires to the students to respond to it under the supervision of the researcher and some mathematics tutors in some of the sampled schools. But in one of the schools, the school authorities asked the students to take the questionnaire home to answer on the claim that their timetable was choked with activities to the extent that no time could be allocated to the researcher to engage the students in answering the questionnaires, not even Saturday.

3.10 Data Processing and Analysis

After the collection of the questionnaires, the data were edited, scored and properly coded. The attitudinal tests were scored. In order to describe the attitude of females,

Strongly Agree and Agree were combined as agree whereas Strongly disagree and Disagree were also combined as disagree. Also, to be able to find the mean and standard deviation of the attitudinal test, numerical scores were assigned to the 5-point Likert scale. For positively stated items, the score values were assigned as follows: Strongly Agree (SA)–5; Agree (A)–4; Unsure (U)– 3; Disagree (D) – 2; Strongly Disagree (SD)–1 and for negatively stated items, scores were reversed as Strongly Agree (SA)–1; Agree (A)–2; Unsure (U)–3; Disagree (D)–4; and Strongly Disagree (SD)–5.

The achievement test items consisting of 20 items were marked and scored out of twenty and then multiplied by 5 in order to convert it into percentage. The data were analyzed statistically. Research questions 1 and 2 were analysed using frequencies, percentages, mean, and standard deviation. This enabled the researcher to describe how the choice of school (mixed & single-sex) influenced female students' attitude towards mathematics and their mathematics achievement. Research questions 3 and 4 were analysed using independent sample t – test at 0.5 alpha level as recommended by Johnson and Christenson (2000). This helped the researcher to compare the attitude of female students towards mathematics achievement between single-sex and mixed-sex senior high schools.

3.11 Ethical Issues

The researcher collected an introductory letter from the department of mathematics, UEW which introduced her and the research topic to all the heads of the sampled schools and requesting them to allow their students to participate in the research (see APPENDIX B). In addition, the researcher wrote a consent letter (see APPENDIX C) which she distributed to all the heads of schools which were sampled for the study explaining the purpose of the research to seek their approval for the research to be

conducted in their schools. The consent of the teachers was sought before they were engaged in the study and the students were also assured of the confidentiality of the research results.

CHAPTER FOUR

RESULT/FINDINGS AND DISCUSSIONS

4.0 Overview

This chapter presents the result or finding and discussions from the data collected in the research. Out of the 364 instruments administered, 358 were correctly filled and returned giving a response rate of (95.6%) while 6 questionnaires were incorrectly filled. The data were analyzed using descriptive and inferential statistics to include: charts, frequencies, percentages, mean, standard deviation and independent t-test. The result are presented in two parts. The first part dealt with the demographic data of the students in public senior high schools in the Ho Municipality. It included: the names of schools, programme of study, school type and age distribution of the students. The second part dealt with the analyses and discussions of the research questions:

1. What is the attitude of female students in single-sex and mixed-sex public senior high school towards mathematics?
2. What is the mathematics achievement of female students in single-sex and mixed-sex public senior high school?
3. Is there a statistically significance difference in attitude between female students in single-sex and mixed-sex public senior high school towards mathematics?
4. Is there a statistically significance difference in mathematics achievement between female students in single-sex and mixed-sex public senior high school?

The demographic data were analyzed using charts, frequencies and percentages.

4.1 Demographic Data of the Students

This section shows the demographic data of the students. It includes: names of school, programme of study, school type and the age distribution of the students.

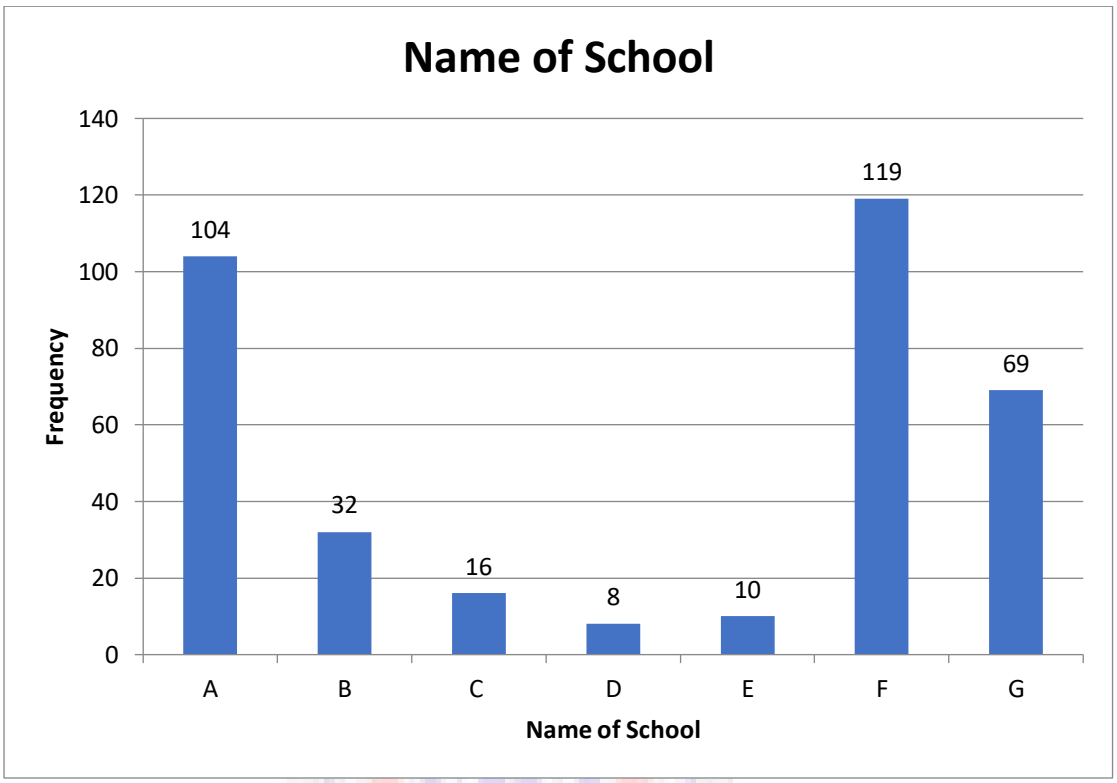
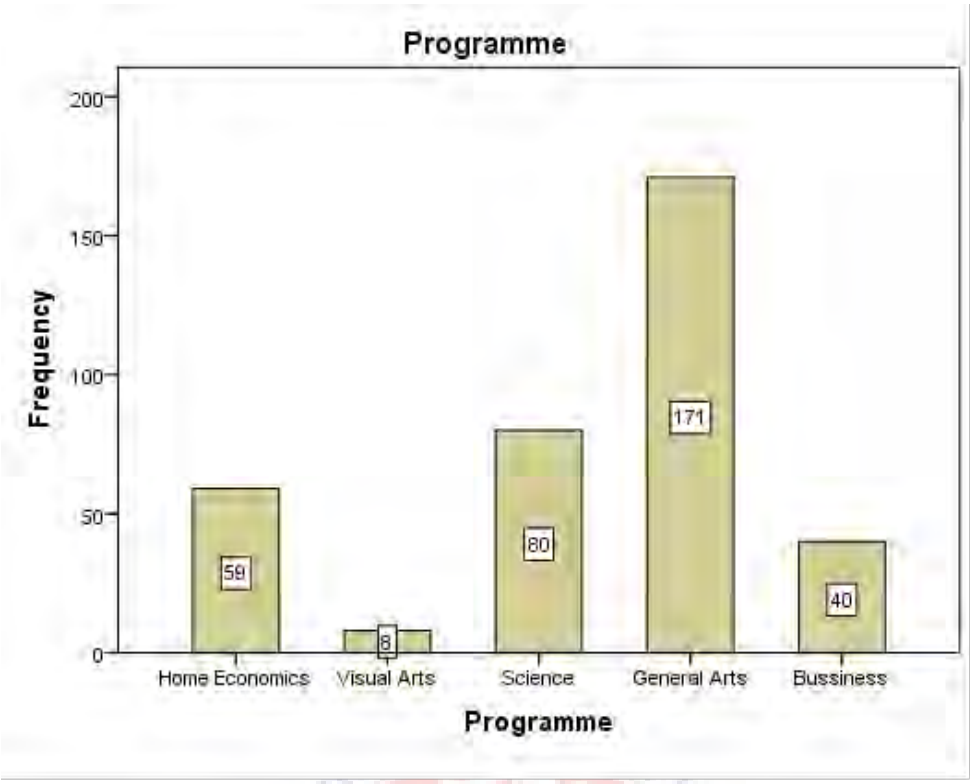


Figure 4.1: Distribution of Names of Schools of Students

Source: Researcher

Figure 4.1 shows the frequency distribution of the sampled students from the various schools. It is necessary to ensure participation of students based on proportion of the total population of each school.

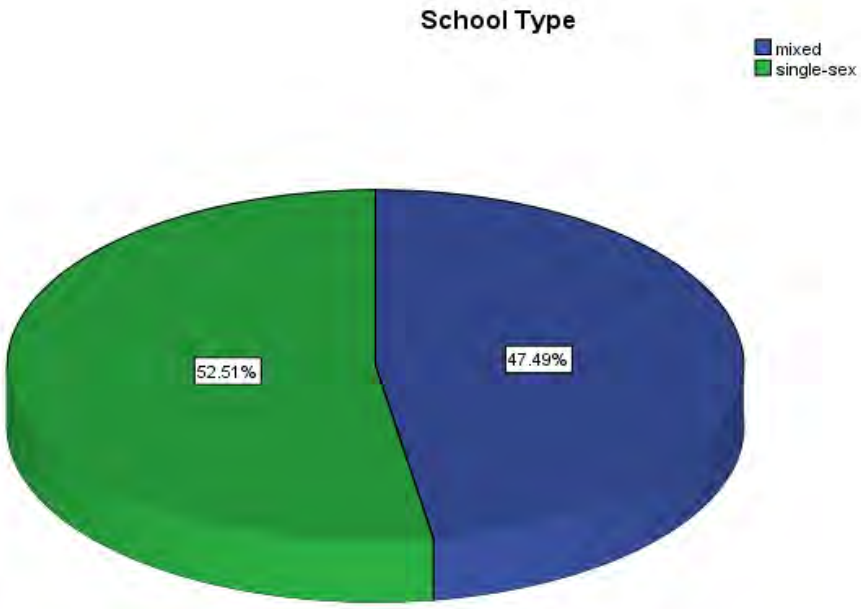
The programmes of study of the students were considered to ensure proportionate distribution of students across the various programmes in the participating schools. The programme of study of the students is represented in Figure 4.2.



Source: Researcher

Figure 4.2: Percentage of programmes of study of Students

The school types of the students were considered to know the percentage of students from each school type (mixed-sex and single-sex).

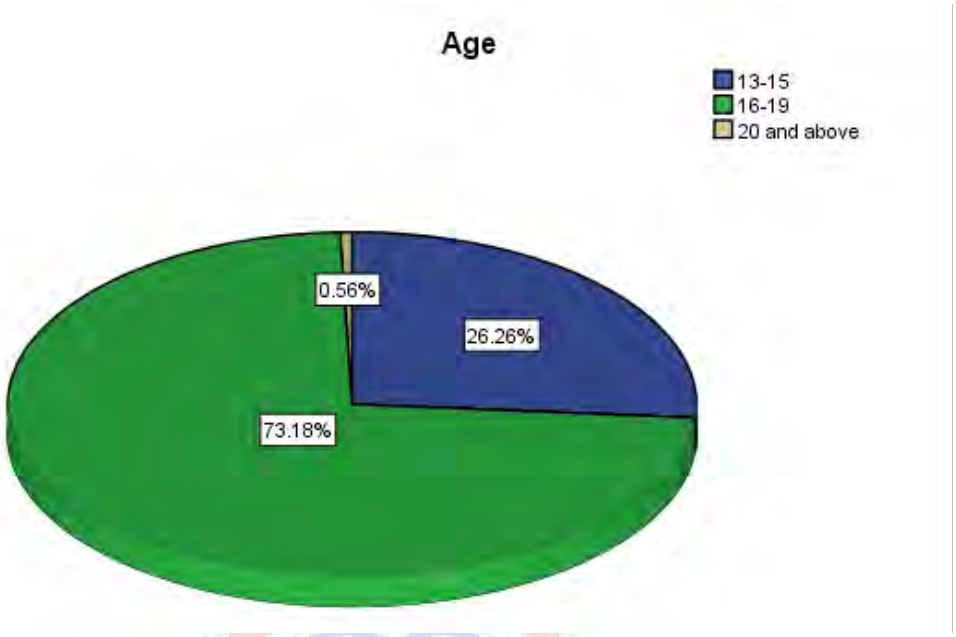


Source: Researcher

Figure 4.3: Percentage of Students from each School Type

Figure 4.3 shows the percentage of the students from each school type. 170 students are from mixed-sex school and 188 are from single-sex (all- females) schools.

The age of the students was considered to identify the age classification of those who participated in the study.



Source: Researcher

Figure 4.4: Age Distribution of the Students

Figure 4.4 shows the age distribution of the students. From figure 4.4 it is observed that majority of the students fall within the age range of 16-19.

It is presumed that this demographic data can help us to make an informed decision when taking the analysis of this study into consideration.

4.2 Analyses and Discussions of Research Questions and Hypotheses

Research question one: *What is the attitude of female students in single-sex and mixed-sex senior high schools towards mathematics?*

The question sought to describe the attitude of female students in mixed-sex and single-sex public senior high schools and to inquire which school type have greater influence in developing positive attitude of female students toward mathematics learning. To answer this research question, 25(5-29) items were used in the questionnaire to assess female students' attitude towards mathematics. The study combined Strongly Agree and Agree, as "agree" and Strongly Disagree and Disagree were also combined as "disagree". The attitudinal items were classified under the following constructs: perception, experience, expectation, interest, self-concept and motivation.

Result of research question one

Table 4.1 presents the perception of students in mixed-sex school.

Table 4.1: Perception of Female Students in Mixed-Sex (MS) Schools (n=170)

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
Math is fun	118	69.4	22	12.9	30	17.7
Math is stressful	63	37.1	31	18.2	76	44.7
Math is exciting	136	80.0	19	11.2	15	8.8
Math is boring	101	59.4	29	17.1	40	23.5

Source: Researcher Frequency (F) Percentage (%)

From table 4.1, 118(69.4%) of the accepted mathematics to be fun, with 22(12.9%) not certain on whether mathematics is fun to them whereas, 30(17.7%) disagree with the statement. 76(44.7%) of the students considered mathematics to be stressful.

While 31(18.2%) is uncertain, 63(37.1%) disagree with the statement. 136(80.0%) referred to mathematics as exciting. 19(11.2%) were not sure of the decision to make whereas 15(8.8%) were in disagreement. 40(23.5%) accept that mathematics is boring with 29(17.1%) unsure of what to say and more than half do not accept that mathematics is boring.

Table 4.2 summarizes the data collected on the responses of students on their perception in mathematics in the single-sex *Schools*.

Table 4.2: Perception of Female Student in Single-Sex (SS) Schools (n = 188)

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
Math is fun	155	82.4	17	9.0	16	8.5
Math is stressful	85	45.2	44	23.4	59	31.4
Math is exciting	158	84.0	17	9.0	13	6.9
Math is boring	130	69.1	34	18.1	24	12.8

Source: Researcher Frequency (F) Percentage (%)

From table 4.2, more than three quarter 155(82.4%) of the students accepted that mathematics is fun, with very few 17(9.0%) not sure on their decision and with a hand full 16(8.5%) in disagreement. 59(31.4%) disagree that mathematics was stressful with 34(18.1%) unsure and 85(45.2%) disagree to the statement. A very large 158(84.0%) regarded mathematics to be exciting whereas a few 17(9.0%) were indecisive and 13(6.9%) disagreed. Very few 24(12.8%) of the students agreed that mathematics was boring, with 34(18.1%) unsure while most of the students were in disagreement to the statement.

Table 4.3 shows the experience of students in the mixed-sex Schools with respect to mathematics.

Table 4.3: Experience of Female Students in MS Schools

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
I feel extremely anxious and fearful when math exams are mentioned	72	42.4	14	8.2	84	49.4
I am given a lot of unnecessary math assignments	136	80.0	13	7.6	21	12.3
I do not perform well in math	48	28.2	18	10.5	104	61.2

Source: Researcher Frequency (F) Percentage (%)

Almost half of the students 84(49.4%) agreed to it that they feel anxious and fearful at the mention of examination. Very few 14(8.2%) were unsure and more than half disagreed with the statement. While a handful agreed they were given a lot of unnecessary assignments, very few 13(7.6%) were unsure while majority of the students disagreed to it that they were giving a lot of unnecessary mathematics assignment. More than half of the students accepted they do not perform well in mathematics, few 18(10.5%) were undecided and less than half disagreed with the statement.

Table 4.4 shows the responses of experience of female students in the single-sex Schools with regards to mathematics.

Table 4.4: Experience of Female Students in SS schools

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
I feel extremely anxious and fearful when math exams are mentioned	78	41.4	19	10.1	91	48.4
I am given a lot of unnecessary math assignments	151	80.4	21	11.2	16	8.5
I do not perform well in math	78	41.5	13	6.9	97	51.6

Source: Researcher Frequency (F) Percentage (%)

Form table 4.4, a little below half 91(48.4%) of the students feel anxious and fearful when they about mathematics examinations, with very few 19(10.1%) being indecisive and less than half 78(41.4%) were in disagreement with the statement. Very few 16(8.5%) of the respondents were in agreement that they are given a lot of unnecessary mathematics assignments with 21(11.2%) not sure while majority disagreed to the statement. A little above half agreed that they do not perform well in mathematics with a very few not sure on the decision to make while 78(41.5%) disagreed to the statement.

Table 4.5 shows the expectation of students in mixed-sex school schools with regards to mathematics.

Table 4.5: Expectation of Female Students in MS Schools

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
I will further my studies in math after completing SHS	76	44.7	46	27.1	48	28.2
Math will help me to make good decisions in life	144	94.7	12	7.1	14	8.3
Math is not useful to me	142	83.6	8	4.7	20	11.8

Source: Researcher Frequency (F) Percentage (%)

From table 4.5, close to half 76(44.7%) of students in the mixed-sex school environment agreed to further their education in mathematics with 46(27.1%) not sure of what to decide and a few 48(28.2%) of the students will not further their education in mathematics. A very high 144(94.5%) percentage of the students agreed that mathematics will help them to make future decision but yet a very few 12(7.1%) were unsure and 14(8.3%) in disagreement to the statement. Few 20(11.8%) of the students accepted that mathematics is not useful to them with 8(4.7%) been indecisive and majority disagreeing to the statement.

Table 4.6 shows students' responses on students' expectation in mathematics in single-sex school.

Table 4.6: Expectation of Female Students in SS Schools

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
I will further my studies in math after completing SHS	91	48.4	58	30.9	39	20.7
Math will help me to make good decisions in life	160	85.1	20	10.6	8	4.2
Math is not useful to me	164	87.3	12	6.4	12	6.4

Source: Researcher Frequency (F) Percentage (%)

From table 4.6, almost half 91(48.4%) of the students agreed to further their education in mathematics after completion, a lot of them were indecisive and 39(20.7%) of them disagreed with the statement. More than three-third of the respondents accepted that mathematics will help them to make good decisions in life, while a few 20(10.6%) were unsure 8(4.2%) were in disagreement with the statement. While few 12(6.4%) of the respondents agreed that mathematics is not useful to them, the same percentage

were not sure on the decision to make whereas a high percentage disagreed to the statement.

Table 4.7 shows the interest of students in mathematics in the mixed-sex schools.

Table 4.7: Interest of Female Students in MS Schools

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
I like solving Math questions	113	66.5	27	15.9	30	17.6
Math is impossible to learn	119	71.2	19	11.2	32	17.6
Among the subjects taught, math is my favourite	78	45.9	40	23.5	52	30.6
Math should not be a compulsory subject	101	59.5	12	7.1	57	33.6

Source: Researcher Frequency (F) Percentage (%)

From table 4.6, more than half 113(66.3%) of the students from mixed-sex school environment agreed that they like solving mathematics questions, 27(15.9%) were indecisive and 30(17.6%) were in disagreement. 30(17.6%) students agreed that mathematics is impossible to learn, 19(11.2%) were not sure but more than half 119(71.2%) of the respondents disagreed to the statement. 78(45.9) students agreed that mathematics is their favourite subject whereas 40(23.5%) were indecisive and 52(30.6%) disagreed.

Table 4.8 shows the students interest in mathematics in all female students single-sex school.

Table 4.8: Interest of Female Students in SS Schools

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
I like solving Math questions	136	72.3	24	12.8	28	14.9
Math is impossible to learn	152	80.8	17	9.0	19	10.2
Among the subjects taught, math is my favourite	97	51.6	43	22.2	48	25.6
Math should not be a compulsory subject	126	67.0	13	6.9	49	26.1

Source: Researcher Frequency (F) Percentage (%)

From table 4.8, almost three-third 136(72.6%) like solving mathematics questions with only 24(12.8%) unsure and 28(14.9%) in disagreement. Whilst 19(14.9%) responded positive to the statement that mathematics is impossible to learn, 17(9.0%) are unsure with majority 152(80.8%) of the students in disagreement with the statement. More than half 97(51.6%) of the students agreed that mathematics is their favourate with 43(22.2%) indecisive and 48(25.6%) not in favour with the statement. Few 49(26.1%) of the students agreed that mathematics should not be compulsory, with 13(6.9%) unsure whereas 126(67.0%) disagreed to the statement.

Table 4.9 shows responses of students on self-confidence in mathematics in mixed-sex school.

Table 4.9: Self-Concept of Students in MS Schools

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
I do a lot of math exercises on my own	105	61.7	28	16.5	37	21.8
When I study math, I get better grades	117	68.8	21	12.4	32	18.8
Everyone can learn math	150	88.2	9	5.3	11	6.4
I like problem solving in math	83	48.2	45	26.5	43	25.3
Different approaches to math solution make it more interesting	142	83.5	13	7.6	15	8.8

Source: Researcher Frequency (F) Percentage (%)

From table 4.9, more than half of the students agreed to the following statement that they do a lot of mathematics exercises on their own and they get better grade when they Study Mathematics. Whilst more than 80% of the students agreed that everyone can learn mathematics and different approaches to solving mathematics questions make the subject more interesting, less than 10% disagreed with the rest being indecisive. A little below half 83(48.2%) of the students agreed that they like problem solving in mathematics with 45(26.5%) unsure and 43(25.3%) in disagreement.

Table 4.10 shows the responses of students on their self-concept towards mathematics in single-sex school.

Table 4.10: Self-Concept of Female Students in SS schools

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
I do a lot of math exercises on my own	133	70.8	19	10.1	36	26.1
When I study math, I get better grades	144	76.6	21	11.2	23	12.3
Everyone can learn math	174	92.5	8	4.3	6	3.2
I like problem solving in math	105	55.9	33	17.6	50	26.6
Different approaches to math solution make it more interesting	170	90.4	8	4.3	10	5.3

Source: Researcher Frequency (F) Percentage (%)

More than 70% of the students agreed that they do a lot of mathematics exercises on their own and they get good grades when they study. More than 90% also believed that everyone can learn mathematics and different approaches to solving mathematics problems make it more interesting. A little above half 105(55.9%) of the students agreed they like problem solving in mathematics whereas 33(17.6%) were not sure whether they like problem solving in mathematics or not, 50(26.6%) were in disagreement with the statement.

Table 4.11 shows students' responses on motivation of participants towards the learning of mathematics in Mixed-sex school.

Table 4.11: Motivation of Female Student in MS school

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
I am well provided with math textbooks	99	58.2	14	8.2	57	34.6
Math is just collection of formulae	22	13.0	17	10.0	131	77.1
I am happy when I get good grades in math	162	95.3	1	0.6	7	4.1
Math help me to think critically	155	91.2	5	2.9	10	5.9
Math is self-rewarding	141	82.9	15	8.8	14	8.2
I am angry when it is time for math	116	68.3	18	10.6	36	21.2

Source: Researcher Frequency (F) Percentage (%)

From Table 4.7, 99(58.2%) students agreed they were well provided with textbooks, 14(8.2%) were indecisive and 57(34.6%) disagreed. Whereas more than three-third 131(77.1%) agreed that mathematics is just a collection of formulae, 17(10.0%) could not take side and only 22(13.0%) disagreed with the statement. Whilst majority 162(95.3%) of the students agreed that they are happy when they get good grades in mathematics, one person was indecisive with 7(4.1%) in disagreement. More than 90% agreed that mathematics help them to think critically but very few 10(5.9%) of them disagreed. Whilst 142(82.9%) considered mathematics to be self-rewarding, 15(8.8%) were unsure and 14(8.2%) were in disagreement. A few 36(21.2%) of the respondents expressed that they get angry when it is time for mathematics but 18(10.8%) were indecisive with a lot more than half 116(68.3%) disagreed with the statement.

Table 4.12 shows students' responses on motivation of mathematics in single-sex school.

Table 4.12: Motivation of Female Student in SS school

	Agree		Unsure		Disagree	
	F	%	F	%	F	%
I am well provided with math textbooks	126	67.0	14	7.4	48	25.6
Math is just collection of formulae	27	14.4	21	11.2	140	74.4
I am happy when I get good grades in math	187	99.4	1	0.5	__	__
Math help me to think critically	175	93.1	4	2.1	9	4.8
Math is self-rewarding	151	80.3	29	15.4	8	4.2
I am angry when it is time for math	122	64.9	22	11.7	44	23.4

Source: Researcher Frequency (F) Percentage (%)

Quite a large number 126(67.0%) of students agreed that that they are provided with a lot of mathematics textbooks whilst few 14(7.4%) were unsure and 48(25.6%) were in disagreement. Almost three-third 140(74.4%) of the students agreed that mathematics is just a collection of formulae but 27(14.4%) agreed with the statement and 21(11.2%) undecided. All the students except one who was indecisive agreed that they become happy when they get good grade in mathematics. Almost all 175(93.1%) the students agreed that mathematics help them to think critically but 4(2.1%) responded not sure and 8(4.2%) responded negatively. Most 151(80.3%) students agreed that mathematics was self-rewarding but 29(15.4%) were unsure and 44(23.4%) were in disagreement. While few 44(23.4%) students are in affirmation that they get angry when it is time for mathematics and 22(11.7%) unsure, more than half 122(64.9%) of the students objected to the statement.

Table 4.13: Mean and Standard Deviation of Students in MS schools

Attitudinal Constructs	Mean	Constructs' Positions	Standard Deviation
Perception	14.31	3	3.28
Experience	9.55	6	2.85
Expectation	11.75	5	2.52
Interest	14.28	4	3.75
Self-concept	19.55	2	5.55
Motivation	22.82	1	5.24

Source: Researcher

Table 4.13 shows that students in mixed-sex school have motivation as the highest attitudinal construct with a mean of 22.82 followed by self-concept with a mean of 19.55 and the construct with the least mean in the mixed-sex school environment is experience of the students. It can be concluded that in the mixed-sex school environment, females are motivated to study mathematics but they do not have good experience in mathematics.

Table 4.14: Mean and Standard Deviation of Students in SS school

Attitudinal Constructs	Mean	Constructs' Positions	Standard Deviation
Perception	15.26	4	2.88
Experience	9.87	6	2.94
Expectation	12.30	5	3.27
Interest	15.51	3	4.79
Self-concept	20.26	2	3.46
Motivation	22.99	1	3.29

Source: Researcher

Table 4.14 shows that motivation has the highest mean of (M=22.99) and a standard deviation of (SD=3.29) among the attitudinal construct. It is followed by self-concept with a mean of (M=20.26) and a standard deviation of (SD=3.46) and experience ranked last with a mean of (M=9.87) and a standard deviation of (2.98). It can be concluded from table 4.14 that females in single-sex schools are highly motivated, have high self-concept but they also have low experience in mathematics.

Discussion of research question one

The study found that, in the mixed-sex schools motivation had the highest mean of (M=22.82) and a standard deviation of (SD=5.24). It is directly followed by self-concept with a mean of (M=9.55) and a standard deviation of (SD=5.53). This same trend is found in the single-sex schools as motivation has the highest mean of (M=22.99) and a standard deviation of (SD=3.29) and self-concept followed by a mean of (M=20.26) and a standard deviation of (SD=3.46). It is observed that even though both schools expressed positive motivation followed by self-concept, females

in single-sex school are highly motivated to learn mathematics than female students in mixed-sex school. If this motivation is intrinsic, then it is self-rewarding, and it will make learning more enjoyable to the female students which will results in long lasting positive effects even after they have left school (Akuamoah et al, 2004; Akurugu, 2010). But if the motivation is extrinsic, there is a high possibility that the zeal to do mathematics may extinct on the way as these female students continue to climb the academic ladder (Armstrong, 2007). In addition, female students in single-sex school have higher self-concept of doing mathematics than female students in mixed-sex schools. This finding agrees with the research conducted by Eshun (2006), who found that female students in the single-sex schools had the most positive self-concept while female students in the mixed-sex schools had the least positive self-concept.

In the mixed-sex schools, perception comes third followed by interest while in the single-sex schools, interest comes third followed by perception. This showed that in the Ho Municipality, female students who schooled in mixed-sex schools have better perception about mathematics than female students in single-sex schools. It also revealed that female students in single-sex schools have higher interest in doing mathematics than female students in mixed-sex schools. In this study, though the way female students in mixed-sex school perceive mathematics is better than the way female students in single-sex school perceive it, female students in single-sex school have high achievement scores in mathematics compared to female students in mixed-sex school. This finding is inconsistent with the findings of Mutodi (2014) on student's perception who revealed that there existed strong positive relationships between performance and perception of female students.

This study also revealed that the rest of the constructs under study: expectation and experience have their means placing the same position for both mixed-sex and single-

sex schools. But the means of expectation and experience of female students in single-sex public schools are higher than that of female students in mixed-sex public schools. This shows that females in single-sex schools have higher expectation and experience in mathematics than those in mixed-sex schools. This finding also showed that females do not expect more in mathematics and they do not have good mathematics experience leading to their low performance and hence, low representation in mathematics fields (Mutai, 2011). Majority of the female students agreed to the following statements: "I do not perform well in mathematics" and "I feel extremely fearful and anxious when mathematics exams are mentioned". This is pathetic knowing very well that mathematics skills have direct contributing effect on the country's labour market (Joensen & Nielsen, 2010). This then is the reason for having few female students furthering their education in the country. This is consistent with the findings of Mutodi and Ngirande (2014) who concluded that students indicated their academic progress is hampered by low scores in Mathematics even if they perform well in other subjects.

Research question two: *What is the mathematics achievement of female students in single-sex and mixed-sex public senior high schools?*

The research question sought to describe the mathematics achievement of female students in single-sex and mixed-sex public senior high schools. The third (Section C) part of the questionnaire which consists of achievement test made up of 20 items is purposed to answer this question. The questions were marked out of twenty and later converted to out of hundred (%) by multiplying the result by five (*5). Mean and standard deviation was used to analyse the data.

Results of research question two

Table 4.15 shows the mathematics achievement scores of female students in single-sex schools.

Table 4.15: Achievement Scores of Students in Mixed-sex schools

Scores	Frequency	Percent (%)
0-20	4	2.4
21-40	22	13.0
41-60	51	30.0
61-80	57	33.5
81-100	36	21.2
Mean	64.29	
Standard Deviation	19.85	

Source: Researcher

The achievement scores in table 4.15 shows that, majority 57(33.5%) of the students scored between 41-60 followed by 51(30.0%) students who scored between 41-60. It is followed by 36(21.2%) students who obtained the highest scores (81-100). The least scores 0-20 is obtained by 4(2.4%) students. It can be concluded that more than half of the students scored between 41-80.

Table 4.16: Achievement Scores of Students in Single-Sex schools

Scores	Frequency	Percent (%)
0-20	2	1.0
21-40	14	7.5
41-60	51	27.1
61-80	55	29.3
81-100	66	35.1
Mean	71.22	
Standard Deviation	20.33	

Source: Researcher

Majority of the students 66(35.1%) obtained the highest scores 81-100 followed by 55(29.3%) and 51(27.1%) students who scored between 61-80 and 41-60respectively. The least number of students 2(1.0%) obtained the least mark 0-20. It can be concluded that more than 60% of the respondents scored above 60.

Discussion of research question two

From the analysis of the study, female students from single-sex school had higher achievement scores as compared to female students in mixed-sex senior high school. This is in line with the analysis of Woodward, Fergusson and Horwood (1999) whose analysis showed a persistent tendency for children attending single-sex schools to have greater successes in the schools' certificate examination than children attending coeducational schools.

The result of the study also revealed that females from single-sex schools had higher mean scores than those from mixed-sex schools, this agreed with the findings of Adebule and Aborisade (2014).

Research question three: *Is there a difference in attitude between female students in single-sex and mixed-sex public senior high schools towards mathematics?*

The research question was developed to determine if SHS females' attitudes toward mathematics are influenced by the school settings (MS or SS) in which they are educated. The number of items on the attitude test were 25 on a scale of 1-5. Based on this, a scale of 25 to 125 was used to determine the direction of the attitude. Between 25 and 125 is a mid-point of 75, so if the overall mean is below this mid-point it means that attitude is negative but if it is above the mid-point, then attitude is positive.

Means and standard deviation were used to compare the attitude of female students who attend single-sex [SS] schools and the attitude of female students who attend mixed-sex [MS] schools. The results are presented in Table 4.17.

Results of research question three

Table 4.17 presents the mean and standard deviation of the attitude of female students in SS and MS public senior high schools.

Table 4.17: Mean and Standard Deviation of Female Students' Attitude

School type	N	Mean	Std. Deviation	Std. Error of Mean
Mixed-sex	170	92.26	16.77	1.286
Single-Sex	188	96.19	14.29	1.042
Total	358	94.32	15.62	.821

Source: Researcher

From Table 4.17 the result shows that female students in mixed-sex schools have a mean of 92.26 (M=92.26) and standard deviation of 16.72 (SD=16.77) whereas females in single-sex schools have a mean of 96.19 (M=96.20) and the standard deviation (SD=14.29).

This indicates that females in both MS and SS public SHS have positive attitude towards mathematics since the mean scores of the two groups are above 75. However, it can be concluded that females in SS SHS have higher mean (M=96.20, SD=14.288) compared to females in MS SHS (M=92.26, SD=16.774). This implies that female students who attend SS schools have positive attitude towards mathematics compared to female students who attend MS schools.

Research Hypothesis 1

There is no difference in attitude towards mathematics of females in single-sex and mixed-sex public SHS towards mathematics

The hypothesis was developed to determine if there exist a statistically significant difference between the attitude towards mathematics of female students in single-sex and mixed-sex public SHS. An independent samples t-test was used to compare the attitude of females in single-sex [SS] schools and the attitude of female students in mixed-sex [MS] schools. The results are presented in Table 4.18

Table 4.18 presents the results of an independent samples t-test value for the attitude of female students in SS and MS SHS.

Table 4.18: Independent Samples t-Test on SHS female students' attitude

Attitude	N	Mean	Standard deviation	Df	MD	t-value	2-tailed Significant
MS	170	92.26	16.774	356	-3.93	-2.391*	.017
SS	188	96.18	14.287				

Source: Researcher ****Significant, $p < .05$***

As indicated in Table 4.18, the result of the independent samples t-test, based on the response of the female students indicated that t (356) = -2.391 and p = .017 (two-tailed). Since the significant value of p=.017 was less than the significance level of 0.05 ($p < 0.05$), it implies that differences in the attitude of female students in single-sex and female students in mixed-sex SHS towards mathematics is statistically significant, therefore we reject the null hypothesis at an alpha level of .05.

Discussion of research question three

The finding of this research showed there is statistically significant difference between the attitude of females in single-sex senior high schools and mixed-sex senior high schools. This research finding agreed with the findings of Lee and Anderson (2015) who concluded that female students in the single-sex schools have the most positive attitude towards mathematics leading to higher mathematics achievement and females in the coeducational setting have the least positive attitude. The findings are also in line with that of Sullivan, Joshi, and Leonard (2011) who concluded in their study that female students who are educated in single-sex school showed positive attitude; they further explained that single-sex female students are not truant and teenage pregnancy was less among them. Again, this finding agrees with a research conducted by Eshun (2006) in the Central and Western Region of Ghana. He found that, there exist differences in attitude of females in single-sex and mixed-sex schools and he continued that single-sex schools favour female students in doing mathematics.

The result of this study revealed that the school in which learners learn have influence on their attitude as female students in single-sex school environment showed better positive attitude towards mathematics than female students in mixed-sex schools. This finding is supported by Salifu (2017) as he identified major factors causing negative

attitude of females towards Mathematics for which he agreed that there is a major factor in determining or influencing the attitude of female students. Meanwhile, the finding opposes that of Adebule and Aborisade (2014) who conducted a research in Ekiti-Nigeria, and found no significant difference in the attitude of females in single-sex and mixed-sex schools toward mathematics. Just like Adebule and Aborisade Gilson (1999), also found no difference in the attitude of females in the independent single-gender and coeducational schools in San Francisco CA, among 467 high school females and this also contradicts with the findings of this study.

On another hand, the finding contradicts with the findings of Zahra (2019) who concluded that single-sex education has a negative influence on the attitude of female students by negatively affecting their social and emotional development.

Research question four: *Is there a difference in mathematics achievement between female students in single-sex and mixed-sex public senior high schools?*

This question sought to find out if there exist any significant difference in mathematics achievement between female students in single-sex and mixed-sex public senior high school.

Result of research question four

Means and standard deviation were used to compare the mathematics achievement between female students in SS and MS senior high schools. The results are presented in Table 4.19.

Table 4.19 presents the means and standard deviation of female studets in public SS and MS SHS mathematics achievement

Table 4.19: Mean and Standard deviation of students' Achievement

School type	N	Mean	Std. Deviation	Std. Error of Mean
Mixed-sex	170	64.29	19.85	1.522
Single-Sex	188	71.22	20.33	1.483
Total	358	67.76	20.45	1.078

Source: Researcher

The result in table 4.19 shows that female students in mixed-sex schools have a mean (M=64.29) and standard deviation (SD=19.85) lesser than the mean (M=71.22) and the standard deviation (SD=20.33) of female students in the single-sex schools. This shows that SS female students have higher mean score compared to female students in MS SHS on the achievement test.

Comparing the means and standard deviation of female students' mathematics achievement implies that female students in single-sex schools have higher mathematics achievement compared to female students in mixed-sex schools.

Research Hypothesis 2

There is no difference in mathematics achievement between female students in single-sex and mixed-sex public SHS. An independent samples t-test was used to compare the mathematics achievement between female students in SS and MS senior high schools. The results are presented in Table 4.20

Table 4.20 presents the results of an independent samples t-test value for the mathematics achievement of females in SS and MS public SHS.

Table 4.20: Independent Samples t-Test on SHS females' mathematics Achievement Test

Attitude	N	Mean	Standard deviation	Df	MD	t-value	2-tailed Significant
MS	170	64.29	19.854	356	-6.93	-3.256*	.001
SS	188	71.22	20.334				

Source: Researcher ****Significant, $p < .05$***

The hypothesis sought to find out if there exist statistically significant difference in mathematics achievement between SHS female students who attend SS or MS. The t-test revealed that there was statistically significant difference in performance based on the environment in which SHS female students learn mathematics as shown in Table 4.20. The t-test for equality of means showed significant variation in achievement by school type of the female students t (356) = -3.56, ($p<0.05$ at 95% confidence level) since the value of $p = .001$ (2-tailed) is less than the alpha value. From the finding, we reject the null hypothesis at .05 level of significance that there is no difference between single-sex and mixed-sex public SHS female test mathematics achievement. This implies that female students in SS SHS (M=71.22, SD=20.33) performed better on the achievement test than female students (M=64.29, SD=19.85) in MS SHS.

Discussion of research question four

The studies concluded that there is statistically significant difference between the academic achievement of females in single-sex public senior high schools and females in mixed-sex public senior high schools. This finding is in line with Sullivan, Joshi, and Leonard (2011), who concluded in their study that females from single-sex SHS performed better academically and also climbed the academic ladder to earn higher wages later in life. Eisenkopf, Hessami, Fischbacher and Ursprung (2011) also

came up with the result that supports the findings that single-sex schooling improves the performance of female students in mathematics.

In support of what Thom (2006) used single-sex and mixed-sex classes to experiment instruction at Stonewall Jackson Middle School and found significant improvement in single-sex students' mathematics achievement. Woodward, Fergusson, and Horwood (1999) also established that children attending single-sex schools had greater success in the School Certificate Examinations, greater school retention, less likelihood of leaving school without qualifications and less exposure to unemployment than children attending coeducational schools.

The study is also in line with the findings of Lee and Lockheed (1990) who measured mathematics achievement of 1,012 ninth grade Nigerian students and found that females in single-sex schools outperformed females in coeducational schools. The findings of several other researchers (Eisenkopf, Hessami, Fischbacher, & Ursprung, 2011; Zahra, 2019) support the finding that single-sex schooling improves the performance of female students in mathematics than females in mixed-sex schools which agreed with the findings of this research.

Again, a survey on the topic, "Women Graduates of Single-Sex and Coeducational High Schools: Differences in their Characteristics and the Transition to College", by Sax et al. (2009) found that women graduates of single-sex schools exhibit higher academic engagement than do their coeducational counterparts and this is in line with the findings of this research but they recommended that coeducation should be well explored. In addition, (Sullivan, Joshi, & Leonard, 2011) also support the findings of this study by concluding in their study that female students who attended single-sex

schools fared well in examinations and perform better compared to female students who had attended co-educational schools.

Meanwhile Ahmada, Jelasa, and Alia (2010) indicated in their work that it was the learning strategies used in the single gender classes that influenced the high performance of students in mathematics. Also, in contrast, Ian (1998) concluded in his study that, there is no clear winner in the academic achievement of single-sex schools and coeducational schools.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Overview

This chapter summarizes the findings of the study and presents conclusions drawn from the findings. In addition, recommendations and suggestions for further study are presented based on the findings of the study on the topic "comparison of female students' attitude towards mathematics achievement in single-sex and mixed-sex senior high schools."

5.2 Summary of Results

The purpose of this study was to compare attitude of female students towards mathematics achievement in single-sex and mixed-sex public senior high schools. The study employed comparative research design. It was carried out in all the public schools; in Ho Municipality in the Volta Region, Ghana. The main instruments used was a questionnaire comprising attitudinal test on a 5-point Likert scale and mathematics achievement test. Charts, frequencies, percentages mean and standard deviations were used as descriptive statistics to analyze data collected for the research questions whereas independent samples t-test was used in analyzing the hypotheses.

The results of this study were summarized based on the objectives of the study;

i. To identify the attitude of female students in single-sex and mixed-sex public senior high schools towards mathematics. The following: experience, expectation, interest, self-concept and motivation were considered as having influence on the attitude of female students towards mathematics. The result shows that: (a) female students in SS school have good experience in mathematics compared to female students in MS schools, (b) the expectation

of female students in SS school are higher than the expectation of female students in MS school, (c) female students in SS schools are more interested in mathematics as compared to female students in MS schools, (d) female students in SS school have higher self-concept as compared to female students in the MS schools, (e) female students in SS schools are highly motivated towards the learning of mathematics as compared to female students in MS schools, (f) motivation has the highest mean while experience has the least mean.

ii. To identify the mathematics achievement of female students in single-sex and mixed-sex public senior high schools.

(a) Female students in single-sex schools have higher mathematics achievement as compared to female students in mixed-sex schools.

iii. To determine if differences in attitude towards mathematics achievement exist between female students in single-sex and mixed-sex public senior high schools. (a) Female students who attend SS schools have positive attitude towards mathematics as compared to female students who attend MS schools.

(b) There is statistically significant difference in the attitude of female students towards mathematics among females in single-sex and mixed-sex public senior high schools at 0.05 significant level.

iv. To determine if differences in mathematics achievement exist between female students in single-sex and mixed-sex public senior high schools.

(a) Female students who attend single-sex schools performed better of than female students who attend mixed-sex schools.

(b) There is statistically significant difference in the mathematics achievement of female students in single-sex and mixed-sex public senior high schools at an alpha level of 0.05.

5.3 Conclusion

1. In this study, attitude towards mathematics of female students in single-sex schools was better as than the attitude of female student in mixed-sex schools.
2. The present study showed evidence of a predominant tendency for female students attending single-sex schools to obtain higher levels of educational achievement in mathematics compared to female students attending mixed-sex senior high schools.
3. The evaluation of the study provides statistically significant evidence that single-sex education provide a good learning for female students to do better in mathematics.
4. Though the findings of this study revealed that single-sex education does improve female students' attitude towards mathematics achievement, it does not put an end to the debate on "which school favours female students' mathematics achievement?" because, the findings of this research may be due to selection bias of method and sample.

5.4 Recommendations

On the grounds of the findings and the conclusions drawn from this study, it is recommended that:

1. Parents and teachers who help female students to make choices during school selection and placement should explore and guarantee that their female

students choose the school type that will affect their mathematics attitude and achievement positively.

2. People in position to provide information or support anyone undertaking a research, should do so in accordance with the researchers' plan or request rather than suggesting a different thing that may act as an extraneous factor to the findings of the study.
3. The government and private sectors should build more females' schools to support females' mathematics learning. Since it showed in the findings of this study that single-sex schools are more favourable to female students' attitude towards mathematics achievement.
4. The education sector can introduce the practice of single-sex classes in public mixed-sex schools as practiced in some other parts of the world to reduce the cost of building new set of schools for females separately from that of males.

5.5 Suggestions for Further Studies

1. It is hoped that the results of this study will inspire others to investigate single-sex schooling and mixed-sex schooling for female students at all educational levels, more especially in basic schools.
2. This study focused on the comparison of female students' attitude towards mathematics achievement in senior high schools. Future studies could involve the influence of society on female students doing well in mathematics as well as competing with men on equal levels at mathematics fields.
3. Other researches could focus on teaching strategies and approaches that would be most convenient for female students to develop positive attitude towards mathematics in order to perform well in the subject.

4. The researcher used comparative design but other researchers could use experimental design for their findings.
5. This study was conducted in the public senior high schools in the Ho Municipality. It can be replicated in other parts of the country.

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APPENDICES

APPENDIX A

QUESTIONNAIRE

UNIVERSITY OF EDUCATION, WINNEBA

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

The study aims to investigate girls' attitude towards Mathematics achievement in Senior High Schools in Ho Municipal. Information provided will be kept strictly confidential and will be used solely for academic purposes.

SECTION A – PERSONAL DATA

1. Name of school:
   ……..
2. School Type: single-sex [ ] mixed-sex [ ]
3. Programme of Study ……..
4. Age: 14-17 [ ], 18-20 [ ], 21^{+}[ ]

SECTION B – INFORMATION ON STUDENT'S ATTITUDE

This section has statements that you are to decide carefully whether you strongly agree (SA), Agree (A), Unsure (U), Disagree (D), or Strongly Disagree (SD). Put a tick [√] against each statement depending on your feelings. If you make a mistake,

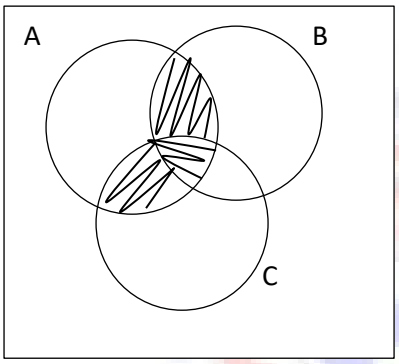
cross by putting (X) through the tick [√] and then tick in the appropriate box in the table below.

	SA	A	U	D	SD
5. Mathematics is fun					
6. Mathematics is stressful					
7. Mathematics is exciting					
8. Math is boring					
9. I feel extremely anxious and fearful, when math exams are mentioned					
10. I am given unnecessary mathematics assignments					
11. I do not perform well in mathematics					
12. I Will further my studies in math after completing SHS					
13. Math will help me to make good decisions in life					
14. Mathematics is not useful to me					
15. I like solving mathematics questions					
16. Mathematics is difficult to learn					
	SA	**A**	**U**	**D**	**SD**
17. Among the subjects taught, mathematics is my favourite					
18. Mathematics should not be a compulsory subject					
19. I do a lot of math exercises on my own					
20. When I study math, I get better grades					
21. Everyone can learn math					
22. I like problem solving in Mathematics					
23. Different approaches to math solution make it more interesting					
24. I am well-provided with mathematics textbooks					
25. Math is just recollection of formulae					
26. I am happy when I get good grades in math					
27. Math help me to think critically					
28. Math is self-rewarding					
29. I am angry when it is time for math					

ACHIEVEMENT TEST

SECTION C (20 MARKS)

Answer all questions in this section by circling the right answer.

1. If $P = \{3, 4.5.6\}$, $Q = \{5, 6, 7\}$ and $R = \{2, 3,7,9\}$.Which of the following represent P∩ (QUR)
   A) {5, 6}
   B) {3, 4, 5}
   C) {3,5, 6}
   D) {3, 4, 5, 6}
2. 

   The shaded portion of the diagram is represented by
   A) $A \cap (B \cup C)$
   B) $B \cap (A \cup C)$
   C) $C \cap (A \cup B)$
   D) $A \cap (B \cap C) \leq 10\}$
3. If A= {1, 2, 3, 4} and B= {1, 4, 10}, find $A \cap B$
   A) {1, 2}
   B) {1, 10}
   C) {1, 4}
   D) {10}
4. What property of addition does the statement $a + (b + c) = (a + b) + c$ illustrate, where $a, b, and\ c$ are real numbers?
   A) Distributive
   B) Commutative
   C) Closure
   D) Associative

5. Express 0.0098 in standard form

   A) 9.8×10^{-3}

   B) 9.8×10^{-2}

   C) 9.8×10^{2}

   D) 9.8×10^{3}

6. Correct 0.0030071 to three significant figures

   A) 0.008

   B) 0.00301

   C) 0.00307

   D) 0.00310

7. Arrange in ascending order of magnitude $\frac{7}{75}, \frac{2}{5} and \frac{1}{3}$

   A) $\frac{2}{5}, \frac{1}{3}, \frac{7}{75}$

   B) $\frac{1}{3}, \frac{7}{75}, \frac{2}{5}$

   C) $\frac{1}{3}, \frac{2}{5}, \frac{7}{75}$

   D) $\frac{7}{75}, \frac{1}{3}, \frac{2}{5}$

8. Simplify $\frac{x^2+2x-3}{x-1}, x \neq 1$

   A) $x + 1$

   B) $x - 1$

   C) $x + 3$

   D) $x - 3$

9. The following subtraction was performed in base four. Find the missing number.

$$\begin{array}{r} 3012 \\ \times\times\times\times \\ \hline 1333 \end{array}$$

   A) 1013

   B) 1113

   C) 1103

   D) 1003

10. Express 25_{ten} as a number in base two

    A) 10011_{two}

    B) 11001_{two}

    C) 11010_{two}

    D) 11100_{two}

11. Solve $4 + 3x < 10, if\ x\ is\ positive$

    A) $x < 2$

    B) $0 < x < 2$

    C) $0 < x < 4\frac{2}{3}$

    D) $x > 2$

    D)

12. Solve the equation $\frac{x-2}{3} + \frac{3}{2} = \frac{x}{2}$

    A) 5

    B) 4

    C) 2

    D) -1

13. Two apples and a coconut cost GH¢3100.00. An apple and two coconuts cost GH¢5,600.00. What is the cost of a coconut?

    A) GH¢520.00

    B) GH¢2700.00

    C) 1,140.00

    D) 1,200.00

14. Simplify $(3 - 2\sqrt{2})(3 + 2\sqrt{2})$

    A) 1

    B) 5

    C) 3

    D) 10

15. If $\sqrt{75} + \sqrt{27} + K\sqrt{3} = 0$. Find the value of K.

    A) -16

    B) -8

    C) 8

    D) 16

16. Simplify $\frac{a^2-1}{a^2+2a+1}$

A) $\frac{1}{a-1}$

B) $\frac{1}{a+1}$

C) $\frac{a-1}{a+1}$

D) $\frac{a+1}{a-1}$

17. Express 112_{seven} as a number in base four.

A) 322

B) 321

C) 232

D) 223

Given that $P = \{1, 2\}$ $Q = \{3, 4, 5, 6\}$ and $U = \{1, 2, 3, 4, 5, 6, 7, 8, 9, 10\}$. Where P and Q are subsets of U. use the information to answer question 19 and 20.

18. Find P∩Q

A) {1, 2}

B) {Ø}

C) {2, 3}

D) { }

19. What is the cardinality of Q?

A) 5

B) 6

C) 7

D) 4

20. What is $P' \cap Q'$

A) {7, 8, 9, 10}

B) {1, 2, 3, 4, 5, 6}

C) { Ø}

D) {1, 2}

APPENDIX B

INTRODUCTORY LETTER

UNIVERSITY OF EDUCATION, WINNEBA
FACULTY OF SCIENCE EDUCATION
DEPARTMENT OF MATHEMATICS EDUCATION
P. O. Box 25, Winneba, Ghana
+233 (020) 2041076

TO WHOM IT MAY CONCERN

Dear Sir/Madam

LETTER OF INTRODUCTION

I write to introduce to you the bearer of this letter **Valentina P. A. K. Dzeshie** a postgraduate student in the University of Education, Winneba who is reading for a Master of Philosophy degree in Mathematics Education.

As part of the requirements of the programme, she is undertaking a research titled—*A comparison of attitude and Mathematics achievement of girls in Mixed sex and Single sex Senior High Schools.*

She needs to gather data for analysis in the said research and she has chosen to do so in your institution. I would be grateful if she is given the needed assistance to enable her carry out this exercise. Thank you.

Yours faithfully,

Prof. Michael Johnson Nabie (PhD)
Head of Department

H. O. D
DEPT. OF MATHS EDUCATION

APPENDIX C

CONSENT LETTER

UNIVERSITY OF EDUCATION, WINNEBA

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS

Thesis Topic: A Comparison of Female Students' Attitude towards Mathematics achievement in Single-Sex and Mixed-Sex Senior High Schools

Student Researcher: Valentina Philipine Afi Kafui Dzeshie

Supervisor: Prof. C.K. Assuah

Dear Ass. Headmaster Academics,

REQUEST TO SEEK YOUR CONSENT TO ALLOW YOUR STUDENTS TO SERVE AS PARTICIPANTS FOR MY STUDY

I am Valentina Philipine Afi Kafui Dzeshie, a student of University of Education, Winneba. I am carrying out a postgraduate research to enable me to compare female students' attitude towards mathematics achievement in single-sex and mixed-sex senior high schools.

It is hoped that the findings of the study will be used to suggest the school environment that is more convenient for senior high school female students to perform well in Mathematics so as to encourage both the public and stakeholders to channel their resources to increase female students' mathematics achievement in the country.

In view of the above, your school has been selected for the study.

Thank you for your consideration.