UNIVERSITY OF EDUCATION, WINNEBA

GENDER DIFFERENCES IN PRE-SERVICE TEACHERS' PERFORMANCE IN MATHEMATICS AND FACTORS INFLUENCING IT: A CASE STUDY OF ENCHI COLLEGE OF EDUCATION

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of the requirements for the award of the degree of
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DECLARATION

STUDENT'S DECLARATION

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

Signature :……………………………………

Date :……………………………………

SUPERVISOR'S DECLARATION

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

Name of Supervisor: Prof. Samuel Asiedu-Addo

Signature :……………………………………

Date :……………………………………

DEDICATION

To my wife, Charlotte and my children Gaddiel, Emerald and Esteban.

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It has not been easy putting pieces together to form this whole intellectual work, and I couldn't have done it unaided. It is my pleasure to acknowledge those who in one way or another contributed to the success of this thesis.

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ABSTRACT

This study was to explore the gender differences in pre-service teachers' performance in mathematics and related factors influencing it in Enchi College of Education in the Western North of Ghana. For accuracy in the interpretation of the characteristics of participants, a descriptive survey design was adopted for this study. A total of 120 students consisting of 60 males and 60 females were randomly selected for the study. Five mathematics tutors were also randomly selected for this study. A questionnaire and the end of semester examination were the instruments used to collect data which were analysed using both descriptive statistics and inferential. The means of (M=70.70) and (M=64.35) of the male and female students respectively showed that male students performed better than female students in the examination. It was found that female pre-service teachers' level of Mathematics anxiety was higher than their male counterparts in the college. It was observed that the various student-related perspectives influenced gender differences in performance positively in favour of the males. Also, it was observed that the tutors' views especially both inside and outside classroom have negative influence on females' performance and positive influence on males' performance in mathematics. It was recommended that the College of Education Management, in collaboration with the Gender, Equality and Social Inclusion Unit and Quality Assurance, should organize workshops to provide further training in gender sensitive techniques for tutors to transform the negative attitudes and behaviours toward females in classrooms.

CHAPTER ONE

INTRODUCTION

1.0 Overview

This chapter describes the background of the study, statement of the problem, the purpose of the study, objectives and research questions that the study sought to find answers to. Other areas covered in this chapter include the significance of the study, the limitations of the study, the delimitations of the study and definitions of the terms used in the study.

1.1 Background of the Study

Education continues to be the biggest enterprise in any civilized society as well as a key investment in communities striving to raise individuals that can thrive within a knowledgeable and informed society. Granted the fact that education is one of the most important tools for national development, it becomes the responsibility of any progressive government anywhere to provide and promote sound educational policies as well as infrastructure that will help its people to acquire knowledge, skills and attitudes that enable them to develop their potentials.

However, the quality of teaching and learning of mathematics has been one of the major challenges and concerns of educators. For example, in presentation by Reys et al. (2010), on 'some pressing issues and challenges related to teaching and learning mathematics, including what is working and what needs attention', she opined that too many teachers don't know the mathematics they need to know, in the way they need to know it, to help students learn. Similarly, according to Ball, Hill and Bass (2005), no curriculum teaches itself, and standards do not operate independently of professionals' use of them. To implement standards and curriculum effectively, school systems depend upon the work of skilled teachers who understand the subject matter. They further clarified that, well teachers know mathematics is central to their capacity to use instructional materials wisely, to assess students' progress, and to make sound judgments about the presentation, emphasis, and sequencing. Therefore, from the finding of Ball, Hill and Bass (2005), it could be asserted that the quality of mathematics teaching depends on teachers' knowledge of the content and the ability to connect mathematics to real life and the immediate environment. Thus, connecting mathematics to real life problem influence students' motivation in learning mathematics and improve their level of understanding. It can also be concluded that, mathematics educators need to double up the steps in connecting mathematics to real life problem since it increases their motivation, interest and their level of problem-solving in the subject matter.

Problem-solving has a long tradition in school mathematics. Usually, it has been taught (and is still taught in some schools even today) by the method of "learning from the master": The teacher shows a method, with some examples, which students then apply to similar problems. Now and then, such a teaching style is criticized as formal and schematic, but so far, attempts to shake off formal teaching methods have never been successful (Pehkonen, 1997) as cited by Tok (2015). In the same way, according to Hirsh (2010), mathematics was often thought of as memorization of facts and algorithms. Many mathematics textbooks, workbooks, and resources reinforced this traditional memorization methodology.

Asiedu–Addo and Yidana (2000) indicated that the low performance in mathematics at the pre-tertiary level of the Education system could be attributed to the low content base of teachers of mathematics. In their study on Mathematics Teachers' Knowledge of the Subject Content and Methodology, however, the problem of poor performance in mathematics was traced to pre-service teachers' lack of "Mathematical Knowledge for Teaching" (MKT). The study embraces the MKT research whose proponents have conceived that teachers' opportunities to learn must equip them with the mathematical knowledge and skill needed which will enable them to teach mathematics effectively (Ball, 2003). This study, therefore, draws largely from the MKT work of a team of researchers from the University of Michigan (Ball, Hill and Bass, 2004).

A critical examination of the way teachers are prepared in Ghana seems to support the view that teachers are to be blamed for the poor performance in the subject. A study conducted by Obeng, Opare and Dzinyela (2003) indicated that trainees were not strong enough in subject matter content. Akyeampong, Pryor & Ampiah (1999) pointed out earlier that graduates of teacher training colleges are ill-prepared in facilitating learning in basic schools. This, Quagrain (1999) also made a similar observation that most beginning teachers are seen as woefully unprepared for the complex and demanding tasks of the classroom, and pre-service teacher education has been regarded as pathetically weak and beginning teachers are found wanting and desperate in their initial experience. Quagrain's observation has not changed because pre-service teachers are still exhibiting weak performances in their 'End of Semester Examination' in relation to Mathematics. These give the impression that there has been little improvement in mathematics education. This is to be expected because most teachers like most other adults in this country are graduates of the very system we seek to improve. Their opportunities to learn mathematics have been uneven, and often inadequate, just like those of their non-teaching peers (Asante and Mereku, 2012).

Mathematics is perceived by society as the foundation for scientific and technological knowledge that is cherished by societies worldwide. It is an instrument for political, socio-economic, scientific and technological developments (Githua & Mwangi, 2003; and Mutai, 2016). Okebukola (1992) referred to mathematics as the central intellectual discipline of technological societies. Aminu (1990) argues that mathematics is not only the language of sciences but essential nutrient for thought, logical reasoning and progress. Mathematics liberates the mind and also gives individuals an assessment of the intellectual abilities towards the direction of improvement. The author concludes by saying that mathematics is the basis of all sciences and technology and all human endeavours. Application of mathematics cuts across all areas of human knowledge (Aminu, 1990). Several studies (Cockcroft, 1982; Stanic and Hart, 1995) suggest that mathematics need not be learned by students in secondary for the sake of career choice or advancement but students should be able to learn mathematics with understanding and to apply mathematical ideas later in life. In support of this, (Assan-Donkoh et al., 2019) were of the view that 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 helps students develop sophisticated perspectives and offers more career options.

Students' interest in mathematics is key in their performance and achievement. Achievement and performance have as a result been the subject of investigation for mathematics educators, researchers and other stakeholders (Bong, 2004; Skaalvik & Skaalvik, 2008; Asiedu-Addo, Assuah & Arthur, 2017). The mathematics interest construct has received very little attention in stakeholders' quest to find the solution to the poor performance of mathematics among students across the globe, especially in Africa (Linnenbrink-Garcia et al., 2010; Asiedu-Addo, Assuah & Arthur, 2017). Several researchers (Amarto & Watson, 2003; Chick, 2002; Morris, 2001) have also reported that student teachers do not always have the conceptual understanding of the mathematics content they will be expected to teach.

According to Altintas (2018), mathematics is today a necessity and a high-priority requirement in every area, which requires high-level mathematics teaching practices to facilitate students' permanent and pragmatic learning. Additionally, there is a need for people who know and love mathematics to be advanced in mathematics. Negative beliefs about mathematics begin at an early age and grow exponentially. Because of this, Zakaria and Yusoff (2009); Effandi and Normah (2009) further highlights that students' attitudes towards mathematics are very much related to their attitude towards problem-solving in general. They add that negative attitudes need to be overcome so that later in life, students will not suffer from poor problem-solving skills. It is important to master problem-solving skills as these skills are essential for dealing competently with our everyday life. Their claim is supported by O'Connell (2000) who points out that students must have a positive attitude towards problem-solving if they are to succeed. He proposes that solving problems require patience, persistence, perseverance and willingness to accept risks. This concurs with Papanastasiou (2000) claims that students with a positive attitude towards mathematics will generally excel at it.

In spite of the significant role that mathematics plays, some students of Enchi College of Education find it very difficult subject. Mathematics often involves multi-step problems, and students need to be able to perform several consecutive steps to find a solution. This requires staying actively focused on the task at hand. When complex mathematics procedures are being taught, Enchi College of Education students often lose focus and become distracted during the lesson. As a result, he or she may miss important steps in the problem-solving process, and later struggle with mathematics when trying to complete problems on their own.

If students do not fully understand a previous lesson's concept, they are likely to struggle when newer concepts are introduced. To reduce fractions, students need to know division first; to do algebra, students need to be comfortable with multi-step arithmetic, and so on. With respect to Algebra, there is the need to do auditing of subject knowledge to establish and address student teachers' learning needs, perceptions and misconceptions in Number and Algebra. Knowledge, skills and understanding of fundamental concepts of Number and Algebra, as well as, the ability to identify one's own individual characteristics (culture, ethnicity, religion, family constellation, socio-economic background, dis/ability, etc.), can lead to a student teacher's ability to apply these two areas of mathematics in patterning, generalisation and algebraic reasoning in reminding the student teachers of the role of deductive reasoning in developing mathematical ideas.

Algebra is about generalized mathematical thinking arising from seeing patterns and relationships. Strong foundations in Number and Algebra can help student teachers to develop confidence in demonstrating their mathematical abilities. For that reason, this course is designed to help pre-service teachers to develop demonstrable confidence to explain or justify their thinking, based on their observations, the patterns they have observed, or what they know about numbers and algebraic relationships. As they do so, they develop confidence in teaching related topics in Number and Algebra to their pupils at the respective grade levels.

Topics in Number and Algebra include recognizing and developing patterns, using numbers and number operations, properties of numbers, concept of sets, number bases and modulo arithmetic, and algebraic expressions. In addition, student teachers will explore operations on algebraic expressions, apply mathematical properties to algebraic equations and functions. Using many examples of different local and global contexts, student teachers will solve mathematical problems using equations, graphs and tables to investigate linear and quadratic relationships. ICT tools and other manipulative materials will be used to introduce student teachers to the concepts listed above and to extend their conceptual understanding of the areas under study.

The course (TEEG/TEUP/TEJS 107) focuses on Mathematical Content on one hand and the strategies and learning experiences in doing mathematics on the other hand. These are combined to form an integrated instructional approach that addresses the course learning outcomes. Differentiated approach to teaching was applied to ensure that student teachers are well supported in the area of Number and Algebra. The instructional strategies of the course pay attention to all learners, especially girls and students with Special Education Needs.

Unfortunately, Enchi College of Education pre-service teachers feel uncomfortable or embarrassed asking questions in class when their tutor has already moved on to the next lesson. Mathematics concepts are like building blocks, and the foundation always needs to be laid before moving forward. If the foundation isn't there, the student will struggle in class and may not fully realize why they are struggling with math when their peers seem to be progressing along. Again, some pre-service teachers of Enchi College of Education simply don't spend enough time practicing mathematics concepts. Other pre-service teachers may not realize they need more time reviewing certain areas. Sometimes a pre-service teacher will feel like they understand a concept, but when attempting to do a problem themselves, they don't know how to begin (or end up struggling through the process).

After analysis of the first quiz in year-one semester-one on Introduction to Learning and Applying Number and Algebra (TEEG/TEUP/TEJS 107), the researcher realised that there were lots of disparities in the scores obtained by the students. Out of the 20 marks awarded, about 210 students (representing 52.63%) scored less than 12 marks. The researcher, again, realised that out of the 210 students who scored less than 12 marks, about 132 students (representing 62.86%) were female pre-service teachers.

Mathematics interest is a complex behavioural aspect of mathematics. It has so many characteristics and it can be attributed to as many situations as we discuss in mathematics education. The key strategy of mathematics teaching should focus on keeping the student's interest in mathematics. If the students are interested in learning mathematics that should be helpful for their academic achievement and also teacher tasks become easier. The importance of interest in mathematics cannot be overestimated (Charles, 2017). He further explained that we are living in a very important time in human history, where people are witnessing more and more advertisements and persuasive communications than ever before. Mathematics Interest is a key interest of psychologists, advertisers, and more to understand what makes people change their beliefs or opinions.

However, other researchers have also documented that many students have learning difficulties in mathematics (e.g., Gutierrez, Jaime, & Fortuny, 1991; Halat, 2007). There are many variables, such as teacher-beliefs, instruction, gender, environment, task-difficulties, lack of parental support, lack of self-confidence, learning styles, mathematics anxiety, mathematics teaching anxiety and helplessness appearing to affect student's mathematics learning (Vinson, 2001; Sloan, Daane, and Giesen, 2002; Uusimaki & Nason, 2004; Brady & Bowd, 2005; Peker, 2005; Iossi, 2007).

In the mid-semester (semester one – 2019/2020 academic year) quiz on Learning and Applying Algebra (TEEG/TEUP/TEJS 107), it was observed that there was a gap between the differences in performance of males and females. There were lots of concerns raised with regards to males' and females' performance. One specific issue which has generated much debate in mathematics achievement over the years is a question of whether differences in performance exist or not between males and females in a defined learning task. A definite answer to this question seems to be a complex one (Sam, 2015). Thus, gender issues are currently the main focus of discussion in the world over and Ghana is not an exception. Again, Sam (2015) clarified that gender issue within the educational literature is an area which has attracted a lot of attention. Many studies integrate gender as a peripheral aspect of the work, focusing more on factors determining performance rather than raising gender as the key research question. According to Oluwatayo (2011), the complexity in gender issue arises because empirical and theoretical works of literature have produced diverse and contradictory results.

A wide gap between male and female has existed over the years and deliberate efforts have been made by the United Nations to address it. These efforts include a declaration of a decade for women, which culminated in the Beijing conference of 1985, Education for All, Millennium Development Goals (MDGs) etc. (UN 2000; UNDP 2001). Gender refers to the social relations between men and women. It refers to the relationship between men and women, boys and girls, and how this is socially constructed. Gender refers to human traits linked by culture to each sex (Holborn and Haralambos, 2004). They further elaborated that gender is the difference that sex makes within a society, guiding how we are to think of ourselves, how we interact with others, the social opportunities, occupations, family roles and prestige allowed to males and females.

The concept of gender needs to be understood clearly as a cross-cutting socio-cultural variable. It is an overarching variable in the sense that gender can also be applied to all other cross-cutting variables such as race, class, age, ethnic group, etc. Gender systems are established in different socio-cultural contexts which determine what is expected, allowed and valued in a woman/man and girl/boy in these specific contexts. Gender roles are learned through socialization processes; they are not fixed but are changeable. Gender systems are institutionalized through education systems, political and economic systems, legislation, and culture and traditions. In utilizing a gender approach, the focus is not on individual women and men but on the system, which determines gender roles/responsibilities, access to and control over resources, and decision-making potentials. It is also important to emphasize that the concept of gender is not interchangeable with women. Gender refers to both women and men, and the relations between them. Promotion of gender equality should concern and engage men as well as women.

Over the past years, a large body of scholarly literature has developed to address gender differences in the developed world, and suggestions for reducing the gender gap are well documented in the literature. However, still lacking in research is why there are gender differences in mathematics education in African schools (Forgasz & Rivera. 2012). In particular, regarding mathematics education, it is seen that issues related to gender and mathematics are complex. A study by Tsui, Xu, Venator and Wang (2016) examines the relationship between gender and mathematics achievement among students in China and the United States, with an emphasis on the gender gap among mathematically talented students. The results showed that in neither the U.S. nor China are there gender differences in eighth-grade math-achievement test scores. This situation is not different in Ghana where Tetteh, Wilmot and Ashong (2018) found in a research that there was no statistically significant difference in performance in mathematics of male pre-service teachers than their female counterparts.

However, it was realised from the quiz on Learning and Applying Algebra (TEEG/TEUP/TEJS 107) that, there were gender disparity factors that also affect the performance of students in mathematics. Some of these factors were Anxiety; Social-Cultural factors; Self-concept/ Self-confidence and attitude; Socio-economic factors and Inside school factors.

Anxiety

Anxiety is the total response of a human being to threat or danger. Each experience of anxiety involves a perception of danger, thoughts about harm, and a process of physiological alarm and activation (Moss, 2002). One type of anxiety, Mathematics Anxiety, is of particular interest to researchers. Mathematics Anxiety is a negative emotional reaction to mathematics that can be debilitating. It has been defined as "a feeling of tension and anxiety that interferes with the manipulation of numbers and the solving of mathematical problems in … ordinary life and academic situations (Carey, Devine, Hill, & Szűcs, 2017). The severity of Mathematics Anxiety can range from a feeling of mild tension all the way to experiencing a strong fear of mathematics.

In summary, Mathematics anxiety is not necessarily related to one's actual mathematical ability; individuals who are proficient in mathematics may still experience anxiety. It often stems from negative experiences, fear of failure, societal expectations, or a lack of confidence in one's mathematical abilities. Early negative experiences in math can contribute to the development of mathematics anxiety, and these negative emotions can persist into adulthood.

Social-Cultural Factors

Every society and or organization is made up of people who originate from different cultural background and these cultures affects their attitude, values, abilities, philosophies and performances in one way or the other (Nwibere, Emecheta, & Worlu, 2011) and since individuals do not exist in a vacuum but social context, the tendency of their attitude being influenced by societal norms is pivotal; That is to say the performance of pre-service teachers in mathematics cannot be improved without an understanding of the environment upon which he/she operates. The socio-cultural factor which constitutes the structure of society plays vital role in the academic performance of pre-service teachers.

Social-cultural factors can have a significant impact on an individual's mathematics performance, examples are; Cultural Attitudes Toward Education; Parental Expectations and Involvement; Teaching Styles and Cultural Relevance; Language and Communication Styles, etc.

Self-concept/ Self-confidence

Self-concept/Self-confidence is not fixed; it can evolve and change over time based on experiences, feedback, and personal growth. Positive self-concept is generally associated with greater psychological well-being, resilience, and adaptive behaviors, while negative self-concept can contribute to issues such as low self-esteem, anxiety, or depression. It's important to note that self-concept is a complex and dynamic construct influenced by various factors, including social interactions, cultural context, personal achievements, and feedback from others. Positive experiences, supportive relationships, and a healthy self-perception contribute to the development of a positive self-concept.

Self-concept/Self-confidence can have a significant influence on mathematics performance. The way individuals perceive themselves in relation to their mathematical abilities and their beliefs about their capacity to succeed in mathematical tasks can impact their actual performance.

Socioeconomic Factors

Socioeconomic factors refer to the social and economic conditions that influence the well-being, opportunities, and quality of life of individuals and communities. These factors encompass a range of elements related to an individual's financial, educational, and social standing, and they play a significant role in shaping various aspects of life.

Some key socioeconomic factors include; income, occupation, employment status, housing and neighbourhood, healthcare access, social capital, poverty, etc. Socioeconomic factors can have a profound influence on mathematics education and performance. These factors shape the learning environment, resources, and opportunities available to individuals, ultimately impacting their mathematical abilities and achievements.

Understanding socioeconomic factors is essential for addressing inequalities and developing policies and interventions to promote social and economic well-being. These factors often intersect and can have cumulative effects on individuals' opportunities and life outcomes.

Inside school factors

Inside school factors refer to the elements within the educational environment that can influence students' learning experiences, academic achievement, and overall well-being. These factors are typically under the control of the school administration, teachers, and staff. Understanding and addressing these factors are essential for creating a positive and effective learning environment.

Inside school factors play a significant role in shaping students' experiences and outcomes in mathematics. The quality of teaching, classroom environment, curriculum design, and various other elements within the school setting can influence students' engagement, understanding, and achievement in mathematics.

Teaching and learning are dynamic processes that are constantly adapting to changing needs and opportunities. Slater and Teddlie (1992) argue that effective schools/teachers are expected to change in order to remain effective as their contexts change; they must adapt their schooling to the changing con-text. Therefore, effective schooling should be treated as a dynamic, ongoing process. This idea is consistent with the contingency theory

(Donaldson, 2001; Mintzberg, 1979) and with the main assumptions upon which the dyna-mic model of educational effectiveness is based (Creemers & Kyriakides, 2008).

Studies revealed the belief that boys do better in Mathematics than girls. This belief tends to affect the attitude of girls towards Mathematics (Farooq & Shah (2008). In comparative studies, comparing girls to boys, girls lacked confidence, had debilitating causal attributional patterns, perceived Mathematics as a male domain and were anxious about Mathematics (Ayebale, Habaasa & Tweheyo, 2018; Kearney & Garfield, 2019).

From the foregoing, it is clear that despite spirited gender awareness efforts by researchers, gender disparity in students' performance in Mathematics persists with some underlining factors. These discussions so far have prompted the researcher to undertake a thorough study on the gender differences in pre-service teachers' performance in mathematics and factors influencing it.

1.2 Statement of the Problem

In spite of the significant role that mathematics plays, some pre-service teachers of Enchi College of Education find it very difficult subject. Mathematics often involves multi-step problems, and pre-service teachers need to be able to perform several consecutive steps to find a solution. This requires staying actively focused on the task at hand. When complex mathematics procedures are being taught, pre-service teachers of Enchi College of Education often lose focus and become distracted during the lesson. As a result, he or she may miss important steps in the problem-solving process, and later struggle with math when trying to complete problems on their own.

If pre-service teachers do not fully understand a previous lesson's concept, they are likely to struggle when newer concepts are introduced. To reduce fractions, pre-service teachers need to know division first; to do algebra, they need to be comfortable with multi-step arithmetic, and so on. Unfortunately, pre-service teachers of Enchi College of Education feel uncomfortable or embarrassed asking questions in class when their tutor has already moved on to the next lesson. Mathematics concepts are like building blocks, and the foundation always needs to be laid before moving forward. If the foundation isn't there, the pre-service teacher will struggle in class and may not fully realize why he or she is struggling with mathematics when his or her peers seem to be progressing along. According to Kirwan (2001), students learn best when they are active rather than passive learners. When a student develops a solid foundation in math, they can then take on any concept in math with fewer struggles and more enjoyment. They may even begin to enjoy math and think it's fun.

Again, some pre-service teachers of Enchi College of Education simply don't spend enough time practicing mathematics concepts. Other pre-service teachers may not realize they need more time reviewing certain areas. Sometimes a pre-service teacher will feel like he or she understands a concept, but when attempting to do a problem, he or she doesn't know how to begin, hence end up struggling through the process.

Males and females have different biological roles when it comes to propagation of the species, but how much they differ psychologically is a more controversial question, one that requires empirical research to answer adequately. Whether the underlying causes of psychological gender differences are evolutionary or socio-cultural, understanding how men and women differ in how they think, feel, and behave can shed light on the human condition (Weisberg, DeYoung & Hirsh, 2011).

Gherasim, Butnaru, and Mairean (2013) found gender effects in such variables as achievement goals, classroom environments and achievement in mathematics among young adolescents showing that girls obtained higher grades in mathematics than boys. Girls reported (a) higher classroom support, lower performance-avoidance goals (Shim, Ryan, & Anderson, 2008) and (b) more mastery of the learning materials (Pekrun, Elliot, & Maier, 2006). Another important aspect found by researchers was teaching practice, especially the behaviour of the teacher, such as (a) being responsive and helpful (Patrick, Ryan, & Kaplan, 2007; Puklek Levpuscek & Zupancic, 2009) (b) being supportive (Ahmed, Minnaert, van der Werf, & Kuyper, 2010). Yet another aspect, students' attitudes, was studied by Jones and Young (1995), who found that boys had more favourable attitudes towards mathematics and science than girls. Emotions towards mathematics were studied by Frenzel, Pekrun, and Goetz (2007) who found that girls experienced less enjoyment and pride than boys. Boys, on the other hand, experienced less anxiety and less hopelessness towards mathematics than girls. They also found that girls felt slightly more shame than boys (Frenzel et al., 2007).

Educators, trainers, and researchers have long been interested in exploring factors contributing effectively to quality of performance in mathematics of learners. These factors are inside or outside school and affect students' quality of academic achievement in mathematics. These factors may be termed as student factors, family factors, school factors and peer factors (Crosnoe, Johnson & Elder, 2004). It is therefore, an undisputable fact that the successfulness of learning mathematics is dependent on numerous factors which include anxiety, social-cultural, self-concept/ self-confidence and attitude, socioeconomic and inside school factors. However, despite the many explanations and intervention strategies, gender influence on the aforementioned factors in performance in mathematics still seem to persist (Sam, 2015).

Some researchers have conducted various studies on gender differences in academic performance in subject areas like mathematics, science, agricultural science (Hopko, 2003; Hendricks, 2012 and Ames & Archer, 1998) but not on how gender influences the performance of pre-service teachers in Enchi College of Education. The conclusion drawn from the result of a study by Tetteh, Wilmot & Ashong (2018) indicated that there was no statistically significant difference in performance between male and female pre-service teachers in mathematics in the public College of Education in the Brong-Ahafo region of Ghana. Accordingly, Bassey, Joshua and Asim (2008) opined that there is no significant difference between male and female students' performance in Mathematics in senior high schools.

Further, Asante (2012) indicated a clear-cut difference in attitudes towards mathematics between boys and girls in senior high schools in Ghana. It is pertinent to note that varied opinions have been given concerning gender and mathematics performance of various students. Kyei, Apam and Nokoe, (2011) concluded in their study that there is gender difference in the outcome of mathematics examinations in mixed senior high schools in the Upper East Region of Ghana. Specifically, their investigation showed that there is gender difference with boys performing better than girls.

The question of gender difference in mathematics performance is of continuing concern. Over the past years, a large body of scholarly literature has developed to address gender differences in the developed world, and suggestions for reducing the gender gap are well documented in the literature. However, still lacking in research is why there are gender differences in mathematics education in African schools. (Forgasz & Rivera. 2012 and Hendricks, 2012).

Even though numerous gender-related studies have been carried out (Benbow & Stanley, 1980; Chung & Monroe, 1998; Bowd & Brady, 2003; Asare-Nkoom, 2007; Birgin, Baloğlu, Çatlıoğlu, Gürbüz, 2010), little is known about the influence that gender may play on the performance of mathematics of pre-service teachers. As Gherasim et al. (2013) argue, there is a need for more studies on gender differences to fill the gaps regarding mechanisms that are conducive to mathematical performances. No similar studies have been undertaken in Enchi College of Education.

This study, therefore, investigated gender differences in pre-service teachers' performance in mathematics and related factors influencing it.

1.3 Purpose of the Study

The purpose of this study was to explore the gender differences in pre-service teachers' performance in mathematics and related factors influencing it in Enchi College of Education in the Western North of Ghana.

1.4 Objectives of the Study

This study was designed to achieve the following objectives;

1. To determine the differences between Enchi College of Education male and female pre-service teachers' performance in mathematics.
2. To examine gender related factors that influence pre-service teachers' performance in mathematics in Enchi College of Education.
3. To examine pre-service teachers' and their mathematics tutors' views about gender differences in pre-service teachers' performance in mathematics in Enchi College of Education.

1.5 Research Questions

This research study aimed at answering the following research questions:

1. How different is the performance in mathematics of male and female pre-service teachers in Enchi College of Education?
2. What gender related factors influence pre-service teachers' performance in mathematics in Enchi College of Education?
3. What are pre-service teachers' and their mathematics tutors' views about gender differences in pre-service teachers' performance in mathematics in Enchi College of Education?

Hypothesis

H_0: There is no statistically significant difference between Enchi College of Education male and female pre-service teachers' performance in mathematics.

1.6 Significance of the Study

The findings of this study will be useful for the following:

1. College of Education mathematics tutors: The results from the study will provide information concerning gender differences in mathematics to tutors of Enchi College of Education. These results will enable them to implement the various strategies and policies recommended to reduce the gender gap in mathematics performance.
2. The Ministry of Education (M.O.E): The findings of this study will also be of great importance to the Ministry of Education in emphasizing the causes of gender differences in mathematics performances by pushing for the implementation of the recommended policies.
3. The mathematics education department in Enchi College of Education: The study will add to the literature which will be adopted and used to compare to other studies conducted.
4. Teacher trainers: The findings of this study will be used by teacher training institutions to improve the quality of training. This is because the study recommends possible solutions to deal with causes of gender difference in mathematics performance in colleges.

1.7 Limitations of the Study

Limitations of any particular study concern potential weaknesses that are usually out of the researcher's control, and are closely associated with the chosen research design, statistical model constraints, funding constraints, or other factors. In this respect, a limitation is an 'imposed' restriction which is therefore essentially out of the researcher's control (Theofanidis & Fountouki, 2018).

The limitations as usual of most research studies such as finance, time and access to respondents and their biases were imminent. Also, the use of a survey instrument to gather information had inherent limitations since it was limited to those who responded. The rate of response placed limits on the information collected in the study since the number of responses had a statistical effect. The information collected may not be true for other geographical areas and the results of the study may not be representative elsewhere.

1.8 Delimitation of the Study

Delimitations are in essence the limitations consciously set by the authors themselves. They are concerned with the definitions that the researchers will decide to set as the boundaries or limits of their work so that the study's aims and objectives do not become impossible to achieve. In this respect, it can be argued that delimitations are in the researcher's control (Theofanidis & Fountouki, 2018).

The following delimitations were set:

Enchi College of Education, located in the Western North region, one of the newly created regions in Ghana was chosen for this study. This college was selected purposively because of its special characteristics for the objectives of the study. It was also selected because the researcher has worked in there for many years and the problem of the study was identified during this period.

Secondly, the population of the study consisted of first-year students (level 100) in the selected college. Even though there were other levels in the college, the study only focused on level 100 students. Because of this, the findings, thus will not be generalized for all levels in the colleges in Ghana.

Finally, the sample used in this study was selected using a systematic random sampling technique. Even though there are many sampling techniques, the researcher used systematic sampling because that enabled the researcher to select samples from each stream using class registers or lists without disrupting contact hours. Systematic sampling was also adopted because of its simplicity in selecting samples from a large population.

CHAPTER TWO

LITERATURE REVIEW

2.0 Overview

This study investigated the effects of gender differences in pre-service teachers' performance in mathematics and factors influencing it in Enchi College of Education. This chapter provided reviews of literature based on the research questions. Taking into consideration, the purpose and objectives of the study, this chapter is organized chronologically on the following thematic areas;

i. Theoretical Framework
ii. Conceptual Framework
iii. Differences between male and female performance in mathematics
iv. Gender related factors that influence male and female performance in mathematics
v. Mathematics tutors' views about gender differences in performance in mathematics

2.1. Theoretical Framework

The theoretical framework of this study was rooted in the implicit theories of ability. Factors to be considered under the implicit theories of ability include achievement goals and goal orientation, attributional patterns, mathematics interest, Mathematics achievement, domain specific implicit theories.

Implicit theories are the views or beliefs that people hold about their various personality traits, such as intelligence or mathematics ability (Burkley, Parker, Stermer, & Burkley, 2010; Dweck & Leggett, 1988). According to Dweck and Leggett (1988), there are two types of implicit theories: an entity theory and an incremental theory. Individuals with an entity view of their intelligence believe it is "fixed" or that they have a set amount of intelligence that cannot be changed. Individuals with an incremental view of their intelligence believe it is malleable and can be further developed through hard work and effort (Hendricks, 2012).

Research suggests that younger children typically hold an incremental theory of intelligence and beginning at 10 to 12 years of age may begin to adopt an entity theory of intelligence (Dweck, 2000; Elliott & Dweck, 1988). Gender differences in implicit theories of intelligence have been found in some studies. In one study, high-achieving (defined by grades) eighth-grade boys were more likely to have an incremental theory of intelligence while high-achieving eighth-grade girls were more likely to have an entity view of intelligence (Henderson & Dweck, 1990). Findings of gender differences in implicit theories of intelligence are important because research indicates that entity and incremental theories of intelligence lead to different achievement outcomes (Dweck, 2000). Holding a fixed entity belief is negatively related with high performance in academics (Siegle, Rubenstein, Pollard, & Romey, 2010). Among Junior High School students, having an incremental theory of intelligence was shown to predict higher mathematics grades and having an entity theory of intelligence predicted stagnation in mathematics grades (Blackwell, Trzesniewski, & Dweck, 2007).

2.1.1. Achievement Goals and Goal Orientation

Achievement goals are defined as the cognitive representations that direct individuals in achievement situations (Elliot & McGregor, 1999). A learning (also termed mastery) goal is characterized by a focus on learning and self-improvement whereas a performance (also termed ego) goal is defined by a focus on being judged as competent by others (Schunk, Pintrich, & Meece, 2008). According to Schunk et al. (2008), the type of goal an individual is oriented toward has been shown to relate to various motivational, affective, cognitive, and behavioural outcomes. A learning-goal orientation is associated with more adaptive attributional patterns, positive attitudes toward learning, the use of deeper processing strategies and self-regulation, and a willingness to take on challenges or seek help (as cited by Hendricks, 2012). Schunk (1996) also established a causal relationship between goal orientations and achievement outcomes with young children directed to work under a learning-goal orientation displaying higher levels of academic performance and task involvement than children directed to work under a performance goal orientation (as cited in Covington, 2000).

Typically, a learning-goal orientation is more likely to be seen in younger children and a performance-goal orientation is more likely to be seen in older children (Schunk et al., 2008). In a study by Preckel, Goetz, Pekrun, and Kleine (2008), they found that gifted boys were more likely to demonstrate a mastery-goal orientation than gifted girls. Individuals with an entity theory of intelligence are oriented toward performance goals while those with an incremental theory of intelligence are oriented toward learning goals (Ames & Archer, 1988; Dweck & Leggett, 1988; Elliott & Dweck, 1988).

2.1.2. Attributional Patterns

When individuals encounter success or failure, their perceived causes of these outcomes (or attributions) have important effects on their motivation and behaviour (Schunk et al., 2008). According to (Schunk & Gunn, 1986), there are many different potential attributions one can make, and all these attributions can be categorized according to three dimensions: stability, locus, and control. The researchers explained that stability dimension refers to whether the cause is stable or unstable across situations and over time. For example, effort would be considered an unstable cause, whereas ability would be considered a stable cause. The locus dimension concerns whether the cause is viewed as internal or external to the individual. Effort and ability are both considered internal causes; an example of an external cause would be task difficulty. (Schunk & Gunn, 1986) further explained that the control dimension refers to whether the cause is perceived as controllable or uncontrollable. For instance, effort is a controllable cause while luck is not.

In general, a study by Hendricks (2012) has shown that academic achievement is improved when learners attribute both their academic successes and failures to internal causes, specifically attributing success with ability while attributing failure with effort and the use of study strategies. However, academic achievement is hindered when individuals attribute their failure to stable causes such as lack of ability and attribute their success to unstable causes such as luck (Graham, 1991).

Several studies have shown that females are more likely than males to attribute success to unstable causes and attribute failures to stable causes such as lack of ability; however, other studies have not found this gender difference (Eccles, 1987; Licht, Stader, & Swenson, 1989; Lloyd, Walsh, & Yailagh, 2005; Schunk et al., 2008). One study found that attributions did not vary across academic domains, but rather girls had an overall tendency to attribute their failures to low ability more than boys and attribute their successes to high ability less than boys and to an easy task more than boys (Licht et al., 1989). Some studies have also found that high-achieving girls ("A" students) are more likely than high-achieving boys to attribute their failures to lack of ability (Licht, Linden, Brown, & Sexton, 1984; Hendricks, 2012). Other research suggests gender differences in attributions can occur specifically with mathematics achievement, with girls more likely to attribute their mathematics successes to external factors and their failures to lack of ability (Lloyd et al., 2005). In sum, research indicates that both gender and implicit theories can play a role in the types of causes students attribute to their achievement, thereby potentially contributing to the gender gap in mathematics achievement.

2.1.3. Mathematics Interest

A research conducted by Arthur, Asiedu–Addo & Assuah (2017) on student mathematics interest in Ghana: the role of parent interest, gender, basic school attended and fear of basic school mathematics teacher, suggested that the fear imposed on students during their basic education has significant effect on the students' interest in working mathematics. They therefore, recommended that parents who don't like mathematics should make effort in showing interest in their children's lessons and classwork in mathematics since their interest will significantly impact on their children's interest. Arthur, Asiedu–Addo & Assuah (2017) further recommended in their study that teaching of mathematics should be made interesting and student should be allowed to participate in class without any fear of being beaten when they are wrong in their course of contributing in the classroom.

Again, a study by Arthur, Asiedu–Addo & Assuah (2017) on students' perception and its impact on Ghanaian students' interest in mathematics: multivariate statistical analytical approach, investigated how certain misconceptions held by students about Mathematics affects students' interest in Mathematics. They concluded that the greater majority of the participants believe that student interest in mathematics is influenced by student perception that only bright student can perform well in Mathematics. They further recommended that, educational leadership should take notices of the effect of misconception of Mathematics on the students' interest, which will negatively influence the students' interest.

Hidi and Renninger (2006) proposed a four-phase model of interest development and made a distinction between individual and situational interest. Interest is defined as a psychological state that can also develop into a tendency to reengage content. Situational interest is the initial psychological state of focused attention and effect in response to some environmental stimuli. Individual interest refers to the relatively stable tendency to reengage content over time. The first phase of the model is "triggered situational interest" which may evolve into the second phase, recognized as "maintained situational interest". The third phase, an "emerging individual interest" may then develop, which if sustained, can progress into a "well-developed individual" interest. Interest can greatly impact students' learning (Hidi & Renninger, 2006). Interest has been shown to be positively related to achievement on related tasks (Evans, Schweingruber, & Stevenson, 2002).

Individual interest can positively affect persistence and effort and academic motivation. Interest also predicts many choices, both educational and vocational (Su, Rounds, & Armstrong, 2009). Interest is also domain-specific (Marsh, Trautwein, Lüdtke, Köller, & Baumert, 2005). A small number of studies have been conducted with a specific focus on mathematics interest. High interest in mathematics was shown to correlate with mathematics achievement in Taiwan, Japan, and the United States (Evans et al., 2002). Interest in mathematics has been shown to decline across the developmental period. Eccles and Wigfield (2002) put forth an expectancy-value theory that emphasizes an individual's expectancies for academic success and their perceived value for academic tasks. The value component of this theory is also referred to as interest and several studies have addressed how the expectancy-value theory could explain gender differences in mathematics achievement, course enrollment, and career selection (Eccles, 1984; Eccles, 1987; Eccles, 1994; Eccles, Adler, & Meece, 1984; Eccles, Wigfield, Harold, & Blumenfeld, 1993), so findings from this research are relevant to the current discussion. Eccles et al. (1984) found gender differences in mathematics values among adolescents, with boys valuing mathematics more than girls.

Among students headed to college, differences in value for mathematics mediated the gender differences in advanced mathematics course enrollment; girls felt that mathematics was less important, less useful, and less enjoyable than boys. Some studies have found gender differences in mathematics values among elementary school children (Eccles et al., 1993; Hendricks, 2012), while others have not (Wigfield & Eccles, 1994). Recent studies have found gender differences in mathematics interest, with boys showing higher interest in mathematics than girls (Evans et al., 2002; Köller, Baumert, & Schnabel, 2001; Linver & Davis-Kean, 2005; OECD, 2004; Preckel, Goetz, Pekrun, & Kleine, 2008). One study found such gender differences in mathematics enjoyment as early as grade 4 (Frenzel, Goetz, Pekrun, & Watt, 2010). By adolescence, boys have higher interest levels in mathematics. One study conducted with high school students found that interest and belief about ability predicted mathematics participation, more strongly for girls than for boys (Watt, Eccles, & Durik, 2006). Watt et al. (2006) found no statistically significant gender differences in mathematical achievement; however, boys rated their mathematics abilities and their expectancies of success in mathematics significantly higher than girls.

Frenzel et al. (2010) conducted a longitudinal study with German students in grades 5 through 9 and found that boys had higher individual interest in mathematics than girls throughout the entire period of the study. Frenzel et al. (2010) also found a steep drop in girls' interest levels at grade 7, while boys' interest level was stabilized. Another study conducted with German students in grades 7, 10, and 12 found gender differences in interest, with boys being more interested in mathematics than girls (Köller et al., 2001). A third German study of sixth-grade students found gender differences in mathematics interest, with larger differences in gifted students than in average students, and again boys were found to show more interest in mathematics than girls (Preckel et al., 2008).

In 2003, the Programme for International Student Assessment (PISA) assessment showed that boys in all participating countries consistently reported higher interest in mathematics than girls (OECD, 2004). In a comparison among eleventh-grade students in Taiwan, Japan, and the United States, Evans et al. (2002) found that in all three cultures boys were more likely to prefer mathematics than girls. A Germany study with sixth graders found that girls showed lower interest in mathematics than boys and that this gender gap was even more pronounced in gifted (defined by a rank of at least 95% on a nonverbal reasoning subscale of the German Cognitive Abilities Test) than in average-ability students (Preckel et al., 2008).

While few studies have focused specifically on mathematics interest, even fewer studies have addressed the relation between implicit theories of abilities and mathematics interest. A study conducted in Germany found that boys were more interested in their physics education than girls at the end of eighth grade (Broome, 2001). Additionally, both boys and girls with an incremental view of physics ability were more interested in their physics education than those students who held an entity view of physics ability. Another study conducted with female college students found that women with a fixed view of their mathematics ability reported less enjoyment of math-related subjects, less likelihood of pursuing a mathematics major, and less likelihood of pursuing a mathematics career (Burkley, Parker, Stermer, & Burkley, 2010).

2.1.4. Mathematics Achievement

Concerns about gender differences in mathematics achievement began in the 1970s (Hyde, Fennema, Ryan, Frost, & Hopp, 1990). According to Hyde (2005), studies from the 1970s through 1990 indicated that gender differences in mathematics performance were small or nonexistent during the elementary school years and the gender difference favouring boys appeared around ages 12 and 13. These studies also indicated boys were better at complex mathematical problems, while females were better at mathematics computation. However, a more recent meta-analysis by Hyde (2005) revealed a small gender difference favouring girls in computation in elementary school and middle school and no gender difference in computation in the high school years. Additionally, no gender difference in complex problem solving was found in elementary school or middle school, though a small gender difference favouring males emerged in the high school years (Hendricks, 2012).

Many studies have found that boys show slightly greater variability in their scores (Hyde, Lindberg, Linn, Ellis, & Williams, 2008). The greater male variability hypothesis was proposed in the 1800s to explain why there are more males at both tails of the distribution of scores. It suggests that the disproportionate number of males scoring at each end of the distribution is due to a combination of a small average difference in mathematics performance favouring males and a larger standard deviation for males. Gender differences favouring boys in science and mathematics achievement and ability are indeed smaller for individuals of average achievement and ability than they are for those with the highest levels of achievement and ability (Halpern, Benbow, Geary, Gur, Hyde, & Gernsbacher, 2007). However, (Hyde & Mertz, 2009) specified that even at the highest levels this difference remains small.

Some researchers have offered evidence against the greater variability hypothesis (Hyde & Mertz, 2009). These studies suggest females have reached parity with males, with a considerably reduced difference in mean achievement scores between girls and boys (Hyde, 2005; Hyde et al., 2008). Achievement scores at the low end of the distribution are now essentially equal between the two sexes (Hyde & Mertz, 2009). Under the greater variability hypothesis, one would expect to see differences at both ends of the distribution, not just one. Hyde and Mertz argue that research indicates that greater male variability in regards to mathematics is not universal and that greater male variability correlates with several measures of gender inequality.

The gender similarities hypothesis maintains that males and females are similar in most of their abilities, including mathematics ability (Hyde, 2005). Hyde (2005) reviewed 46 meta-analyses and found evidence to support the gender similarities hypothesis. Hyde et al. (2008) found that no gender difference in mathematics skills is found for the general population for students in grades 2 through 11.

Research suggests that gender differences favouring boys in mathematics achievement are thought to appear at the end of middle school and beginning of high school, although such gender differences have been found in early elementary school by some studies (Penner & Paret, 2008). Penner and Paret (2008) further argue that even if these early gender differences are small compared to gender differences found later in school, their existence is important because such early gaps could lead to even larger gaps later. Therefore, research on the nature and extent of gender differences in mathematics achievement is of great value.

2.1.5. Domain Specific Implicit Theories

Implicit theories of ability may vary by domain (Schunk et al., 2008; Vogler & Bakken, 2007). Younger elementary students tend to hold more generalized implicit theories of their attributes; however, starting with third grade, students begin to develop more differentiated implicit theories of their abilities (Bempechat, London, & Dweck, 1991; Burhans & Dweck, 1995). Although many studies have focused on implicit theories of intelligence, few studies have sought to measure implicit theories about the specific domain of mathematics ability. Chen and Pajares (2010) conducted a study with sixth-grade science students and measured their implicit theories of science ability specifically, a domain not addressed by the current study but one that remains relevant to the discussion. Students with an incremental theory of science ability were more likely to hold a learning-goal orientation, while students with an entity view of science ability were more likely to hold a performance-goal orientation that centered on avoidance.

An incremental view of science ability had a positive indirect effect on science achievement, while an entity views of science ability had a negative indirect effect on science achievement (Chen & Pajares, 2010). Chen and Pajares also found that, although in general both boys and girls held more incremental views of their science ability, boys reported more incremental views than did girls.

Broome (2001) conducted a similar study in Germany with eighth grade physics students and measured their implicit theories of physics ability specifically. While there were no gender differences in intelligence or physics knowledge, girls received significantly poorer grades. Both boys and girls with an entity theory of their physics ability showed more helplessness than boys and girls with an incremental theory of their physics ability.

Another recent study measured undergraduate females' implicit theories of intelligence in general and their implicit theories of mathematics ability specifically (Burkley et al., 2010). Burkley et al. (2010) found that after experiencing mathematics failure, females with an entity view of their mathematics ability identified with the mathematics domain less than women with an incremental view of their mathematics ability. Females with an entity view of their mathematics ability also reported less enjoyment of math-related subjects and less interest in pursuing a mathematics major and a mathematics career. Females' implicit theories of intelligence in general were not predictive over and above the specific measure of implicit theories of mathematics ability, which suggests that using domain-specific measures may be more useful when assessing differences in motivational patterns in a particular achievement domain.

2.2. Conceptual Framework

A conceptual framework is a structure which the researcher believes can best explain the natural progression of the phenomenon to be studied (Camp, 2001). According to Grant & Osanloo (2014), conceptual framework offers many benefits to a research. For instance, it assists the researcher in identifying and constructing his/her worldview on the phenomenon to be investigated. The conceptual framework of this study comprised, gendered-competency expectations, students' academic performance, gender difference and mathematics achievement, mathematical knowledge for teaching, content knowledge and pedagogical content knowledge. These concepts have been explained in the paragraphs that follow.

2.2.1. Gendered-competency Expectations

Müller, Klatt, Sandström, & Callerstig, (2016) identified how a review of the literature in their field of gender diversity demonstrates that one of the main effects of gender diversity on team performance is related to gender bias – how it can negatively impact on performance through underutilisation of available expertise in teams. There is a range of factors linked to gender bias that can undermine the optimal sharing of information: status differentials, formal power relations, homophily or sexual harassment amongst team members (Müller et al. 2016). Accordingly, Ridgeway (2014) looked at how gender affects and is affected by hierarchical relations in groups. She built on Berger, Cohen and Zeldich's (1972) expectation status theory which attempted to explain it as a task-oriented group which is differentiated with respect to some external status characteristic, this status difference determines the observable power and prestige within the group whether or not the external status characteristic is related to the group task.

Ridgeway (2014) further explained that biased expectations for competence and authority are important because their effects are self-fulfilling and that these are intrinsically linked to status beliefs. Status beliefs about social difference are activated in contexts where people differ in terms of social distinction and where this is deemed relevant for context goals (Ridgeway, 2014). The effects of these status beliefs – specifically in relation to gender – have been shown to be amplified in male/female-dominated contexts. Gender competency expectations vary across scientific disciplines, depending on the relative minority status of women. This means that competency expectations for women in male-dominated teams, for example in engineering, are particularly strong (Callerstig & Müller, 2016, p.88). This can have important effects – limiting optimal information sharing: "silencing often non-redundant and most valuable information from low status-low power members" (Callerstig & Müller 2016, 87).

2.2.2. Students' Academic Performance

Individual student academic performance is a core concept within schools. During the past years, educational researchers have made progress in illuminating and increasing the performance concept (Campbell, 1990). Furthermore, recommendations have been made in clarifying key predictors and processes linked with students' performance. With the foregoing convert that we are witnessing within schools today, the performance concepts and performance requirements are undergoing alteration as well (Ilgen & Pulakos, 1999). Ankomah (2011) defines academic performance as the measured output of students at the end of a series of assessments. Tetteh (2011) also sees academic performance as the reach of gain by effort or accomplishment of one's goal. The Wisconsin Education Association Council (1996) also set their definition of performance as the one requiring students to demonstrate skills and competencies by performing or producing something. Danso (2011) in defining academic performance said, academic performance refers to the series of action of a person on a learning task. When performance is used in education, it is often presented as synonymous with achievement or attainment.

In addition, academic achievement is seen as a process in which students' show their ability to pursue tasks. In other words, what a student is able to achieve when he or she is tested on what has been taught usually in formal education. Thus, at the end of a period of carefully planned mode of instruction, students may have to be assessed after having undergone such series of instruction. This will enable educators to measure and categorize the output of the students and eventually establish their performance. Nevertheless, performance is highly important for an institution as a whole and for the individuals in the institution themselves. Researchers (Campbell, McCloy, Oppler, & Sager, 1993; Roe, 1999), strongly agree that when visualising academic performance, one has to segregate between an action (i.e., behavioural) aspect and an outcome aspect of performance.

According to Kanfer (1990), behavioural aspect of performance encompasses student behaviours such as attending to classes, performing class assignment, presenting home work on time and any other school activities as well as teachers teaching basic reading skills to school children. It is of essence to note that not every action of students is subsumed under the performance concept, but only action which is very important for the school goals and objectives. Academic performance is what the schools admit students to do, and do well (Campbell et al., 1993). Thus, performance is not defined by the action itself but by judgmental and evaluative processes (Ilgen & Schneider, 1991).

Actions which can be measured are considered to represent performance. The outcome aspect of performance refers to the result of the student's behaviour. The described behaviours may result in outcomes such as numbers of class test and assignment done and pupils' mathematical ability. In many situations, the behavioural and outcome aspects are related empirically, but they do not overlap completely (Motowidlo, Borman and Schmit ,1997). Low performance and not achieving the goals of an individual might be experienced as dissatisfying or even as a personal failure. Thus, performance is a major, although not the only, prerequisite for future career development and success in a competitive environment. Although there might be exceptions, high performers get promoted more easily in a school and generally have better career opportunities than low performers (VanScotter, Motowidlo & Cross, 2000).

Educational institutions need highly performing individuals in order to meet their goals and to achieve competitive advantage over other institutions as performance is important for the individual as well as the schools they attend. Accomplishing tasks and performing at a high level can be a source of satisfaction, with feelings of mastery and pride.

2.2.3. Gender difference and mathematics achievement

It has become a general feeling or stigma that mathematics is boys' domain. A study through a meta-analysis reveals that males tend to do better on mathematics tests that involve problem-solving (Anjum, 2015). Females tend to do better in computation, and there is no significant gender difference in understanding mathematics concepts. Another study shows that females tend to earn better grades than males in mathematics (Kimball, 1989). Fennema and Sherman (1978) identified as critical, beliefs about the usefulness of and confidence in learning mathematics, with males providing evidence that they were more confident about learning mathematics and believed that mathematics was, and would be, more useful to them than did females. Females were found to be strongly not believing in stereotype that mathematics was not their subject while their male counterparts did not strongly stereotype mathematics as a male domain. The importance of these variables (confidence, usefulness and male stereotyping), their long-term influence, and their differential impact on females and males was re-confirmed by many other studies (Hyde *et al.*, 1990; Leder, 1992; Anjum, 2015)

Another study, which was conducted to analyze factors that affect mathematics achievement of 11th graders in mathematics classes with an identified gender gap, also showed that males scored higher than females on 11th grade mathematics achievement test, but this difference decreased from 10th grade (Campbell & Beaudry, 1998). It has been revealed by some recent studies that line of gender differences in mathematics education in many countries seems to be narrowing. However, studies show that as students reach higher grades, males tend to show elevated levels of mathematics achievement (Ercikan, McCreithb & Lapointe, 2005).

2.2.4. Mathematical Knowledge for Teaching (MKT)

Asiedu–Addo and Yidana, (2000) indicated that the low performance in mathematics at the pre-tertiary level of the Education system could be attributed to the low content base of teachers of mathematics (Asante & Mereku, 2012). In a similar study conducted by Asante & Mereku, (2012), the problem of poor performance in mathematics was traced to pre-service teachers' lack of "Mathematical Knowledge for Teaching" (MKT). In their study, it was revealed that having a deep understanding of content knowledge is necessary but not sufficient to teach mathematics and it is not possible to teach mathematics effectively without having MKT as well.

The connection between mathematical knowledge for teaching and the quality of instruction is, however, complex (Mosvold & Hoover, 2017). Hill, Umland, Litke, and Kapitula (2012) report evidence that weak mathematical knowledge for teaching predicts low instructional quality, and strong mathematical knowledge for teaching predicts high instructional quality, yet they also report that there is much more variation in teaching quality as well as in student achievement with teachers who perform in the midrange on measures of mathematical knowledge for teaching. Similarly, Hill et al. (2008) suggest that professional development, supplemental curriculum materials and teacher beliefs are all factors of potential influence, but these factors may cut both ways depending on the teachers' mathematical knowledge for teaching. In addition, efforts to clarify the conceptualization of mathematical knowledge for teaching continue to be concerned with the dynamic nature of mathematical knowledge for teaching, the usefulness of knowledge, and whether, when, and how it plays in teaching (Ball, 2016; Kersting, Givvin, Thompson, Santagata, & Stigler, 2012; Mosvold & Hoover, 2017).

A study by Tanase (2011) investigated the connection between four Romanian first grade teachers' mathematical knowledge for teaching place value and their classroom practice. The participants were selected from a well performing and an average performing school in Romania. One experienced and one less experienced teacher from each school was selected for participation, and data collection included teacher interviews, classroom observations and student assessments. Although all four teachers displayed good understanding of place value, Tanase suggested that teachers' knowledge goes beyond their own mathematical understanding. Differences were observed in teachers' ability to make connections between place value concepts and other mathematical concepts, how they set different objectives for students as well as the extent to which they challenge students in their mathematical work. Tanase also observed that although teachers have strong mathematical knowledge for teaching, and this knowledge impacts the quality of their instruction, their students may still not perform well. She suggested that student achievement is also influenced by external factors inside and outside of school.

Teachers need to have more than a student's understanding of the mathematics in these grades. … For example, an elementary teacher needs to know how the associative, commutative, and distributive properties are used together with place value in algorithms for addition and multiplication of whole numbers, and the significance of these algorithms for decimal arithmetic in later grades." (CBMS 2012, p. 1-2). Others such as Liping Ma (1999, 2010) describe the need for elementary teacher candidates to develop "profound understanding of fundamental mathematics."

2.2.5. Content Knowledge (CK) for Teaching

The mathematical knowledge needed for teaching is more than what is needed by the average adult; it is even different from that needed by mathematicians (Ball, 2003). Yet, subject matter knowledge (Content Knowledge) for teaching is not a watered-down version of formal mathematics (Ball & Bass, 2003). In fact, teachers with specialized content knowledge possess common knowledge of division as well as the knowledge to explain why division procedures work, how division can be interpreted using equal sharing, measurement and missing factor interpretations, how remainders can be interpreted, and under what circumstances quotients are smaller, equal to, or larger than the dividend. They can generate different types of application problems that are solved using the operation (Ball, 1999; Ball & Bass, 2000; Ball & Bass, 2003).

Content knowledge for teaching refers to the deep understanding that educators need to effectively teach a particular subject. It goes beyond simply knowing the content itself; it involves an understanding of how to teach that content to diverse learners, recognizing common misconceptions, and being able to adapt instructional strategies to meet the needs of students. Content knowledge for teaching mathematics refers to the specialized understanding and expertise that educators need to effectively teach mathematical concepts and skills. It goes beyond a general knowledge of mathematics and involves an in-depth understanding of the subject matter, as well as the ability to convey that understanding to diverse learners. Some key aspects of content knowledge for teaching: deep understanding of the subject matter; knowledge of student understanding; instructional strategies; instructional strategies; assessment and feedback; cultural competence; problem-solving skills and reflective practice.

2.2.6. Pedagogical Content Knowledge (PCK)

The concept of Pedagogical Content Knowledge (PCK) was developed by Lee Shulman in the mid-1980s. He argued that, on top of subject knowledge and general pedagogical skills, teachers must know how to teach topics in ways that learners can understand. So, they need to know what makes learning specific topics easy or difficult. This includes appreciating what preconceptions students might have and knowing the best strategies to address any misconceptions (Loewenberg Ball, Thames, & Phelps, 2008).

According to Loughran, Berry & Mulhall (2012), Pedagogical Content Knowledge (PCK) is an academic construct that represents an intriguing idea. It is an idea rooted in the belief that teaching requires considerably more than delivering subject content knowledge to students, and that student learning is considerably more than absorbing information for later accurate regurgitation. PCK is the knowledge that teachers develop over time, and through experience, about how to teach particular content in particular ways in order to lead to enhanced student understanding

In their literature review, Coe et al. (2014) identify strong evidence that PCK is a key element in effective teaching. Empirical studies show that teachers' content knowledge must blend with knowledge of how learners respond to content (i.e., PCK). And PCK isn't static – teachers reason about why learners respond as they do to work out why they make certain errors.

The research findings on PCK have added knowledge and expanded the available literature related to it. Subsequently, researchers identified inadequateness in Shulman's PCK conception and they began to refine, modify, expand and derive new PCK conceptions. Theoretically, PCK is an academic construct (Loughran, Mulhall & Berry, 2004). In the modified versions of its conceptions, constructs are added either singly or in a combined manner. Similar to teaching, PCK is also complex, difficult to define and articulate by the holders, thus, researchers often face great difficulty in capturing and documenting it (Loughran et al., 2004).

Pedagogical Content Knowledge (PCK) in teaching mathematics refers to the specialized knowledge and skills that educators need to teach mathematical concepts effectively. It involves the integration of pedagogical knowledge (knowledge about teaching and learning) with deep content knowledge (knowledge about the subject matter). In the context of mathematics education, PCK is crucial for helping students develop a deep understanding of mathematical concepts, problem-solving skills, and a positive attitude towards the subject.

2.3. Differences Between Male and Female Performance in Mathematics

Mathematics achievement concerns about gender differences in mathematics achievement began in the 1970s (Hyde, Fennema, Ryan, Frost, & Hopp, 1990). According to Hyde (2005), studies from the 1970s through 1990 indicated that gender differences in mathematics performance were small or nonexistent during the elementary school years and the gender difference favouring boys appeared around ages 12 and 13. These studies also indicated boys were better at complex mathematical problems, while females were better at mathematics computation. However, a more recent meta-analysis by Hyde (2005) revealed a small gender difference favouring girls in computation in elementary school and middle school and no gender difference in computation in the high school years. Additionally, no gender difference in complex problem solving was found in elementary school or middle school, though a small gender difference favouring males emerged in the high school years. Many studies have found that boys show slightly greater variability in their scores (Hyde et al., 2008).

According to Hendricks (2012), the greater male variability hypothesis was proposed in the 1800s to explain why there are more males at both tails of the distribution of scores. It suggests that the disproportionate number of males scoring at each end of the distribution is due to a combination of a small average difference in mathematics performance favouring males and a larger standard deviation for males. Gender differences favouring boys in science and mathematics achievement and ability are indeed smaller for individuals of average achievement and ability than they are for those with the highest levels of achievement and ability (Halpern et al., 2007). However, even at the highest levels this difference remains small (Hyde & Mertz, 2009). Some researchers have offered evidence against the greater variability hypothesis. These studies suggest females have reached parity with males, with a considerably reduced difference in mean achievement scores between girls and boys (Hyde, 2005; Hyde et al., 2008; Hyde & Linn, 2006).

Achievement scores at the low end of the distribution are now essentially equal between the two sexes (Hyde & Mertz, 2009). Under the greater variability hypothesis, one would expect to see differences at both ends of the distribution, not just one. Hyde and Mertz (2009) argue that research indicates that greater male variability in regards to mathematics is not universal and that greater male variability correlates with several measures of gender inequality. The gender similarities hypothesis maintains that males and females are similar in most of their abilities, including mathematics ability (Hyde, 2005). Hyde (2005) reviewed 46 meta-analyses and found evidence to support the gender similarities hypothesis. Hyde et al. (2008) found that no gender difference in mathematics skills is found for the general population for students in grades 2 through 11.

Research suggests that gender differences favouring boys in mathematics achievement are thought to appear at the end of middle school and beginning of high school, although such gender differences have been found in early elementary school by some studies (Penner & Paret, 2008).

According to Janson (1996), Mullis' study (as cited in Tetteh, Wilmot & Ashong, 2018) it was revealed that male advantage in mathematics performance is a universal phenomenon. Additionally, researchers have found that boys show higher achievement in mathematics beginning as early as first grade (Penner & Paret, 2008). They argue that even if these early gender differences are small compared to gender differences found later in school, their existence is important because such early gaps could lead to even larger gaps later.

Therefore, research on the nature and extent of gender differences in mathematics achievement is of great value. Gender differences in mathematics performance have been a great controversy issue in educational domain and research documents show great discrepancies performance among girls and boys in school mathematics (Sprigler & Alsup (2003).

2.4. Gender-related Factors that Influence Mathematics Performance of Students

Factors contributing to the gender academic performances differences are many and complex and have been classified in various groups such as biological, innate, out of school and inside school factors. Traditionally, males' academic performance was considered superior to that of females especially in male dominated subjects like mathematics and sciences because of higher levels of innate spatial ability (Benbow & Stanley, 1980) cited by Sam (2015). At the same time, females' performance was placed above their male counterparts in language because of their greater verbal and reasoning abilities (Wilberg & Lynn, 1999). However, the current thinking is that gender difference in academic performance is not solely attributed to innate differences in males and females. But there are other numerous factors influencing educational ability, including, but not limited to economic, cultural, social, and differences in educational systems and techniques (Gallagher, 2001). Due to the abundant and multifaceted nature of the factors which influence gender differences in academic performance, these factors are categorised into the following:

2.4.1 Anxiety

Obviously, one tends to do things that one has confidence in, and avoids those things which one thinks may arouse anxiety. Tobias & Weissbrod (1980) and Asare-Nkoom (2007) cited anxiety as a strong factor for girls to avoid mathematics and mathematics related courses, as they tend to suffer more from "Mathematics Anxiety" than boys. This anxiety has been described by them as a kind of panic or helplessness that develops when a mathematics problem is presented. A classroom characterized by heightened anxiety is seen as threatening, bewildering and leading to guilt, embarrassment or shame (Buxton, 1981). Eshun (2004) reported that high anxiety is associated with lower achievement in mathematics and also that there is a positive relationship between self-esteem and mathematics achievement. He also reported that girls trained in single-sex environment demonstrate lower level of fear of success in any field of endeavour.

Malinsky, Ross, Pannells, & McJunkin (2006) conducted a study with 481 pre-service elementary school teachers and investigated the mathematics anxiety. They found that the pre-service female teachers' mathematics anxiety level was higher than that of males. In other words, they claimed that there was a statistically significant difference in regard to mathematics anxiety between pre-service male and female teachers. That was in favor of the pre-service female teachers. Similarly,

Bowd and Brady (2003) studied with 357 final-year pre-service teachers at a small Canadian University. They found that male and female participants did not differ in mathematics achievement, but pre-service female teachers had significantly greater mathematics anxiety than that of male. With regard to teaching at the university level, Fish and Fraser (2001) stated that among the university professors surveyed about teaching anxiety, gender was a factor, with female faculty reporting more teaching anxiety than males.

The majority of studies addressing gender differences in adults regarding levels of mathematics anxiety have shown that women reported higher levels than men (Hembree, 1990; Miller and Bichsel, 2004; Ferguson, Maloney, Fugelsang, and Risko, 2015; Jansen, Schmitz, and Maas, 2016). Based on reports by Hembree (1990) and Hopko (2003), Ashcraft and Moore (2009), they calculated that females scored approximately 0.3 standard deviation (SD) higher on mathematics anxiety scales than men from grade 6 through college, with mathematics anxiety levels peaking at grades 9 to 10. Significant gender differences regarding mathematics anxiety were found in junior and senior high school students, with girls reporting higher levels of mathematics anxiety than boys (Else-Quest, Hyde, & Linn, 2010; Hill, Corbett, & Rose, 2010; Goetz, Bieg, Lüdtke, Pekrun, & Hall, 2013).

In a longitudinal study mathematics anxiety levels and mathematics performance were studied in boys and girls from grade 7 to grade 12 (Ma and Xu, 2004). The authors found that stability effects for mathematics anxiety were significantly stronger for girls than for boys, suggesting that mathematics anxiety is passed on from year to year from junior to senior high school among girls. This implies that when girls develop mathematics anxiety during early (high) school years, there is a tendency that the anxiety is sustained regardless of mathematics performance. The majority of studies involving elementary school children report an absence of gender differences regarding mathematics anxiety scores (Chiu and Henry, 1990; Young, Wu, and Menon, 2012; Harari, Vukovic, and Bailey, 2013; Ramirez, Gunderson, Levine, & Beilock, 2013; Erturan and Jansen, 2015; Schleepen and Van Mier, 2016; Kucian, McCaskey, Tuura, & von Aster, 2018). Mathematics anxiety seems to be higher in females than in males, although gender related differences regarding mathematics performance are small or non-existent. Usually, a significant negative link between mathematics anxiety and mathematics performance is reported. Studies addressing gender differences regarding this link showed that it was only significant for girls and women (Van Mier, Schleepen and Van den Berg, 2019).

The relationship between gender and mathematics anxiety has also been studied extensively; but findings have not been consistent. There are many studies that have found significantly greater levels of mathematics anxiety in females than males (Betz, 1978; Yüksel-Şahin, 2008; Jain and Dowson, 2009; Else-Quest, Hyde & Linn, 2010). However, there are also many studies that show no gender differences in mathematics anxiety (Dede, 2008; Ma, Xu, 2004; Chinn, 2009; Birgin, Baloğlu, Çatlıoğlu, Gürbüz, 2010; Devine, Fawcett, Szűcs, & Dowker, 2012).

In comparison to the number of studies that have investigated gender differences in overall levels of mathematics anxiety, relatively few studies have explored whether the relationship between mathematics anxiety and mathematics performance or mathematics achievement differs by gender. Betz (1978) found that correlations between mathematics anxiety and mathematics performance for university students differed according to gender and course: female psychology students showed a significant correlation between mathematics anxiety and mathematics achievement test scores, whereas males did not; in contrast, correlations between mathematics anxiety and mathematics achievement test scores emerged for both genders in students enrolled in an advanced mathematics course. Hembree's meta-analysis revealed that females' higher mathematics anxiety did not result in poorer mathematics performance and that mathematics anxiety was more predictive of mathematics performance in males (Hembree, 1990).

Similarly, Miller and Bichsel (2004) found that mathematics anxiety was more predictive of basic mathematics performance in males than in females; but mathematics anxiety was not more predictive of applied mathematics performance in either gender. Ma and Xu (2004) also found gender differences in the relationship between mathematics anxiety and achievement. Specifically, they found that boys' prior low mathematics achievement predicted later high mathematics anxiety at all grade levels, however girls' prior low mathematics achievement only predicted later high mathematics anxiety at critical transition points during schooling (for example, transferring from middle school to secondary school). A possible explanation for the findings of a greater relationship between mathematics anxiety and achievement in males is that girls tend to experience mathematics anxiety whether or not they have any intrinsic difficulties in mathematics, whereas mathematics anxiety in boys is more likely to reflect initial problems in the subject. Alternatively, according Devine, Fawcett, Szűcs & Dowker (2012), boys' performance may be more negatively affected by anxiety, perhaps because it is less socially acceptable for them to communicate their anxieties, and thus they may be less likely to develop or be shown effective strategies of dealing with anxiety

2.4.2 Social-Cultural Factors

It is argued under gender theory that males and females come into educational systems with different sets of behaviours, attitudes and values which are a result of childhood socialisation. When a child is born into a certain society, he or she is raised in a culture that has already divided social responsibilities into masculine and feminine roles. This segmentation of responsibilities serves to generate male and female cultural identities which tend to influence behaviour, values and attitude of that child which in turn affect his or her future academic achievement. Gender stereotypes in most societies carry the belief that the appropriate behaviour for boys is to be more aggressive and for girls is to be more passive. Females are to remain home and take care of children and carry out household duties while men go out to seek employment to feed the family. These social cultural stereotypes tend to shape the intellectual achievement. For example,

Steele (1997) argued that low expectations of teachers, family and societal gender roles in which mathematics was seen as unfeminine could reduce a woman's sense of good prospects in the subject. A recent study conducted by Hoffman, Gneezy, and List (2011) in two Indian tribes which are substantially alike except how they treat women, revealed once again the effect of culture on academic attainment. The study tested the ability of students in solving a spatial puzzle in less than 30 seconds. Hoffman and associates found that among the patrilineal tribe of Karbi men were 36% faster than women in solving the four-piece spatial puzzle. However, among the matrilineal tribe of Khasi, men were not faster than women. On the other hand, Wilkinson (1994) had argued that remarkable improvement in females' educational performance was attributed to what is termed "gender quake" which brought fundamental changes in attitudes towards female role in society. Harding (1986) asserted that feminism itself was responsible for bringing about radical changes in the way girls perceived themselves, where they could no longer perceive their identify in mainly domestic terms but rather as much as workers as homemakers.

Warrington, Younger and Williams (2000) revealed that because of "macho" male culture boys were more likely than girls to be ridiculed by their peers for working hard at school, and frequently resorted to “laddish” behaviour such as challenging authority, drawing attention to themselves and pretending not to care about school work in order to gain acceptance from their peer group. Gallagher (2001) holds the view that boys and girls display different academic performance not because they differ in their physical, emotional and intellectual development but rather due to some social and cultural factors. Gallagher (2001) cites these factors to include students’ familiarity with subjects, changes of career aspiration, gendered perceptions of specific subjects, presentational styles of boys and girls, and teachers’ expectations.

A research by Gibbs (1994) and Parajuli & Thapa (2017) stated that boys talk more than girls in the classroom. It seems even associated with the values of a person or society. For example, when boys call out teachers, it seems acceptable whereas when a girl calls out, she is sometimes scolded and is told that calling out teacher by a girl is not an appropriate behaviour. This strongly indicates that boys should be more assertive and girls should be passive which may lead to poor performance and failure in girls. Some other researchers have also focused on the society’s negative reactions to women in the workplaces that are perceived as male dominated (Heilman and Okimoto 2007; Heilman, Wallen, Fuchs, & Tamkins, 2004). Heilman et al. (2004) in their study, found that women who were acknowledged to have been successful in the STEM workplace were less liked than equivalently successful men. Moreover, they found that being disliked can have impacts on the career in terms of overall evaluation and for recommendations for reward allocation. These findings further highlight the impact of social and cultural factors in women decision to choose or stay in ‘male gender-typed’ jobs (Ghasemi & Burley, 2019).

2.4.3. Self-concept/ Self-confidence and Attitude

According to (Marsh and Craven, 2006), positive self-beliefs are at the heart of the positive psychology movement and enhancing self-concept is enshrined in educational policies internationally. For example, the Melbourne Declaration on Educational Goals for Young Australians emphasizes that students should "have a sense of self-worth, self-awareness, and personal identity that enables them to manage their emotional, mental, spiritual, and physical wellbeing". Further, positive self-concept has been demonstrated "to impact on a wide range of critical wellbeing outcomes and serve as an influential platform for enabling full human potential" (Craven and Marsh, 2008). Numerous studies have identified strong relations between self-concept and outcomes such as well-being, coursework selection, rate of school completion, adaptive academic behaviors, coping mechanisms, enhanced academic achievement, and reduced mental health problems (e.g., Craven and Yeung, 2008; Marsh and Craven, 2006).

In the school context, academic self-concepts in different school subjects have been consistently demonstrated that they are not only causes for cognitive outcomes; but are also triggers of desirable psychological outcomes. Past self-concept research focusing only on competence has indicated that in general boys tend to have higher competence beliefs than girls (Midgley, Kaplan, & Middleton, 2001). Boys sometimes overestimate their competence whereas girls tend to underestimate theirs, even though such self-perceptions of abilities may not match their real ability.

The relationship between mathematics self-concept and mathematics achievement is an area that has been investigated by researchers (Marsh, 1993; Hamachek, 1995).

Low self-concept tends to appear together with students' underachievement. Most findings in this area showed that those who have higher self-concept, i.e., having more confidence in math, gain higher scores in mathematics (Wilhite, 1990). Not only self-concept influences students' mathematics achievement but also as Franken (1994) concludes, it forms the basis of all motivated behaviours. Many investigators consider the improvement of a student's academic self-concept as the basic educational outcome (Koutsoulis & Campbell, 2001).

Gender differences of mathematics self-concept have generally been consistent with traditional gender role expectations and stereotypes, with research showing higher mathematics self-concept scores for males (Eccles, Wigfield, Harold, & Blumenfeld, 1993; Marsh & Yeung, 1997) and higher mathematics self-efficacy scores for males (Pajares & Miller, 1994; OECD, 2004). As early as school-entry age, children have been shown to make distinct judgments about their abilities in different domains (Eccles et al, 19931993). These competency beliefs decline over the course of schooling, although the rate of change differs by gender and ethnicity (Jacobs, 1991). Higher self-perception of mathematics ability in boys has been found to be relatively independent of performance history (e.g., Frome & Eccles, 1998), achievement level, and ability (Holling & Preckel, 2005).

Several studies give evidence that compared to boys, girls lack confidence in doing mathematical sums and viewed mathematics as a male domain (Meelissen & Luyten, 2008). Naturally, girls lack of self-confidence in their ability to perform in mathematics. Shield (1991) stated in his article, Girls, mathematics and the glass ceiling that: confidence is one part of self-concept and has to do with how sure a student is of his/her ability to learn new mathematics and do well on mathematical tasks. Confidence influences as student's willingness to approach new material and to persist when the material become difficult. Despite the immediate difficulty of the task, the student persists when he/she is confident that a solution will be found or that the material will be understood.

On the other hand, there are many studies that suggest that there is no significant difference between attitude towards mathematics among male and female students (Mohd, Mahmood, & Ismail, 2011; Köğce, Yıldız, Aydın, & Altındağ, 2009; Nicolaidou & Philippou, 2003). Again, several studies had been conducted to find out the relationship between attitude towards Mathematics and academic achievement of the students. Most of these studies showed that there is a positive correlation between students' attitude towards Mathematics and academic achievement of students (Bramlett & Herron, 2009; Papanastasiou, 2000; Mohd et al, 2011). Similarly, in a research by Mohd et al (2011), it was shown that students' attitude towards problem solving in terms of patience, confidence and willingness has a positive relation with students Mathematics achievement.

2.4.4. Socioeconomic Factors

From the beginning parents are the primary persons involved in raising children in every society that is why the family is recognised as an important agent of socialization. Therefore, the importance of parent/family cannot be overemphasized (Usaini & Abubakar, 2015). The efforts and abilities of parents enable children to socialize in order to become productive citizens where the entire society and the nation at large would benefit. According to Vellymalay, (2012), a child's capability to succeed in school depends on how successfully the child is managed by his/her parent in the environment. It is important to note that not every child comes from a home that could provide them with the requisite educational resource necessary for their academic success. In agreement with that, apparent socioeconomic status plays a significant role in providing these educational resources and appears to impose the greater impact on the child's educational outcomes (Usaini & Abubakar, 2015).

Ahmar & Anwar (2013) in their analysis of gender and socioeconomic status on the academic achievement of High School students of Luck, a city in India, found out that male and female students from high socioeconomic status perform academically well than their peers from low socioeconomic status. This implies that parents with less prestigious occupation fail to provide adequate support for their children in their educational attainment, and results in poor academic performance or even dropout. In a research conducted by Faisal (2014) to find out the influence of parental socioeconomic status on their children's education in Jordan, he revealed that the relationship between parental occupation and parental involvement at home was moderate in some strategies. This shows that parents with prestigious occupations are more likely to identify their children's problem to give a possible solution. They also help them to do their homework by providing facilities necessary for learning development. It is possible as a prestigious occupation is connected with income level. High socioeconomic status parents provide necessary facilities regarding their children's education and understand their problems related to the adolescent period that affects their academic achievement (Usaini & Abubakar, 2015).

2.4.5. Inside School Factors

School connectedness is defined as "the belief held by students that whether adults in the school care about their learning and about them as individuals" (Blum, Libbey, Bishop, & Bishop, 2004). Students who know their teacher care about them and have been had clear and reasonable expectation, can get better score. This means supportive teacher plays a significant role in student's engagement in school. School's climate and culture (Fullan, 2001) and school connectedness or engagement (Blum, Libbey, Bishop, & Bishop, 2004) are two key factors for schools and its students' success.

A study by Gibb, Fergusson and Horwood (2008) have revealed that the pervasive theme on discourses of the origins of gender academic performance gap is that gender differences in academic performance are largely a perception of gender differences in classroom actions. Inside school factors as a major catalyst to gender academic performance differences associate male educational underperformance to schools learning strategies and assessment procedures that are best suited to females than to male students. In the classroom, girls are less likely to engage in risk-taking activities such as asking questions and providing answers than are boys. In support of this, Sadler and Sadler (cited in Streitmatter, 1997, p.18) found that "many girls are reluctant to risks in co-educational classrooms in part due to boys' domination". As Streitmatter (1997) pointed out, "students who are active participants in their own education tend to be higher achievers" (p. 18). Thus, without engaging in risk-taking activities in the classroom, it is not possible for girls to achieve their full academic potential in mathematics. Further, Research has shown that high-ability students perform best when associating with other high-ability peers, while lower-ability students benefit from interaction with students in the middle of the ability distribution (Burke & Sass, 2011).

According to Delamont (1999), the most commonly ways in which schooling is considered to be feminized include: educational institutions and classroom regimes that favour females; a lack of male teacher to act as academic role models for boys, a lack of toughness in discipline; a rejection of competition; and a bias towards feminism curriculum and teaching and learning materials. A study of Chung and Monroes (1998) on the effect of different information processing styles of female and male students on their learning outcome indicated that male students were hypothesis-confirming and female students were not.

Curriculum and teaching materials can also reinforce gender role lessons. Classroom interactions that follow gendered differentiated patterns (e.g. boys receiving more praise or being called on to answer more difficult questions) also serve to communicate different learning expectations for boys and girls (Brophy & Good, 1974). These gender-differentiated interaction patterns appear to be more pronounced in stereotypically male sex-typed subjects such as mathematics and science (Jones & Dindia, 2004), but can be moderated by classroom structures and environments (e.g. degree of competitiveness and teacher control). As high school teachers tend to use whole-class instruction and discussion, and boys are more likely to take an active role in these kinds of classroom settings, the emergence of gender differences in performance in favour of boys (or the narrowing of gender differences in performance favouring girls) may be related to a shift in teaching environments.

2.5. Views of Mathematics Tutors Towards Gender Differences and Their Performance in Mathematics

Foundational studies by Cooney (1985), Ernest (1989) and Thompson (1984) and have suggested that mathematics teachers' conceptions may play an important role in shaping their actions. Beliefs are thought of as implicit or explicit behavioral dispositions (Eynde, De Corte, & Verschaffel, 2002; Wilson & Cooney, 2003) that are inextricably intertwined with affect (DeBellis, & Goldin, 2006; Hannula, 2012; Zan, Brown, Evans, & Hannula, 2006) and attitudes (Di Martino & Zan, 2015; Leder & Forgasz, 2002). According to Copur-Gencturk, Cimpian, Lubienski, & Thacker, (2020), teachers' beliefs have important implications for students given that teachers' beliefs about mathematical ability;

i. can be subtle dispositions that potentially influence action;

ii. are related to but discernible from knowledge, attitudes, and emotion; and

iii. are relatively (but not ultimately) stable.

Further, prior studies have found that some elementary and middle school mathematics teachers (a) hold beliefs that mathematical ability is a fixed trait, and (b) rate male students' mathematical ability as greater than female students' ability. However, few studies have investigated potential relationships between teachers' general beliefs about mathematical ability and their gender-specific beliefs about mathematical ability, nor has research identified whether working with certain groups of students or possessing certain background characteristics is associated with such beliefs (Copur-Gencturk et al., 2020).

Fennema, Peterson, Carpenter, & Lubinski (1990) conducted a study in the United States that investigated gender differences in first-grade teachers' attributions of the success of students in their own classrooms. Thirty-eight teachers reported characteristics of their most and least successful boy and girl students in mathematics and were interviewed about whether they attributed the successes and failures of their students to the students' ability or effort. These attributions of selected students were also compared with the students' mathematics test scores. The authors found that teachers rated high-performing boys as more competitive, logical, enjoying mathematics more, being more independent, and volunteering answers more often than they did their top-performing girls.

Teachers have a large impact on students' performance through the amount of time teachers and students spend together during school. Since teachers often mark assignments and assessment student progress, it makes sense that the attitude and gender of teachers also have an influence on student performance (Chen, 2016). Findings show that male teachers are more likely to teach with a more aggressive, disciplinary approach towards boys while both female and male teachers tend to ignore the disruptive behaviour of boys more than that of girls if it's not aggressive (Dee, 2006).

In a study, Dee (2006) found that teacher gender significantly impacted academic performance. Girls perform better academically with female teachers while male students perform better with male teachers. However, the data that was analyzed originated in 1988, which may be less applicable after over 20 years. Later research using more current research found no gender interactions between student and teacher genders (Dee, 2006; Cantrell & Sudweeks, 2009).

In addition, students taught by male teachers had fairly constant test scores while students taught by female teachers saw improvements in their scores. Dee (2006) asserts that male teachers tend to be more supportive of male students but female teachers tend to be more supportive and expressive to all students and provide a more positive classroom overall than male teachers. On the other hand, Eccles and Jacobs (1986) suggested in a research that teacher and student interactions vary according to the sex of the student where male students receive more attention, instruction, and assistance compared to female classmates. Males and females are subjected to different learning atmospheres within the same classroom, even with the same teacher. According to Eccles and Jacobs (1986), this provides a possible explanation as to why female students are discriminated against in the class. As these negative experiences within the learning environment continue and possibly increase, female students' perceptions of academic abilities suffer, which can negatively influence opportunities in the future. Teachers may not intentionally treat females and male students different but they tend to passively reinforce gender stereotypes in the classroom (Eccles & Jacobs, 1987).

As future educators, we must strive to be "change agents", which is a term used by Kewley (2001). The term emphasizes the influential role that teachers can and do play in and outside the classroom. Such decisions can include seating arrangements, what to hang on the walls, how to solicit answers from students, and what examples to use during instructions. If we pay attention and be aware of what films to show and what readings to recommend, we can change these gender stereotypes that students bring into the classroom. Our beliefs can be reflected in how we praise, discipline, and respond to questions and issues arising around gender, race, sexuality, and other issues in society. There barriers like administration, faculty, fellow staff members, principals, and parents but teachers have autonomy to decide what to teach and how to teach it. Kewley (2001) gave an example of a group of teachers who went around the school and removed any material that had a mom in an apron and a dad with a briefcase. These small actions, such as taking down posters that reinforce gender norms, can create a welcoming and equal atmosphere for both genders.

Teachers can play a significant role in shaping students' attitudes towards learning, and in encouraging them to work to the best of their abilities, through the teaching strategies they use (Hipkins, 2012; Wigfield, Cambria and Eccles, 2012). Students who participated in PISA (Programme for International Student Assessment) 2012 were asked to think about the mathematics teacher who taught their most recent mathematics class and to report the frequency with which the following eight actions occur: the teacher asks questions that make students reflect on the problem; the teacher gives problems that require students to think for an extended time; the teacher asks students to decide, on their own, procedures for solving complex problems; the teacher presents problems in different contexts so that students know whether they have understood the concepts; the teacher helps students to learn from mistakes they have made; the teacher asks students to explain how they solved a problem; the teacher presents problems that require students to apply what they have learned in new contexts; and the teacher gives problems that can be solved in different ways (OECD, 2015).

2.6. Views of Pre-service Teachers Towards Gender Differences and Their Performance in Mathematics

It is widely claimed that, negative perceptions and myths of mathematics are widespread among the students, especially in the developed countries (Bosson-Amedenu, 2017). Sam (2002) claimed that many students are scared of mathematics and feel powerless in the presence of mathematical ideas. They regarded Mathematics as "difficult, cold, abstract, and in many cultures, largely masculine". Buxton, cited by Sam (2002) viewed mathematics as "fixed, immutable, external, intractable and uncreative" or "a timed test". Even scientists and engineers whose jobs are related to mathematics "often harbour an image of mathematics as a well-stocked warehouse from which to select ready-to-use formulae, theorems, and results to advance their own theories" (Bosson-Amedenu, 2017).

CHAPTER THREE

METHODOLOGY

3.0 Overview

This chapter provides information on the participants, the criteria for their inclusion in the study and how they were sampled. The researcher describes the research design and the instruments that were used for data collection. The chapter also presents the methods used to analyze the data. Lastly, the validity and reliability of the instruments used as well as the ethical issues that were followed in the process are also discussed.

3.1 Research Design

A descriptive survey was adopted for this study. Descriptive research design is used to discover new facts about people, events or activities, situation, or the frequency with which certain events or situations occur (Gliner and Morgan, 2009). This research design was selected because it provides an accurate portrayal or interpretation of the characteristics, for example behaviour, opinions, abilities, beliefs, and knowledge of a particular individual, situation or group. This design was chosen to meet the objectives of the study, namely;

1. To determine the differences between Enchi College of Education male and female pre-service teachers' performance in mathematics.
2. To examine gender related factors that influence pre-service teachers' performance in mathematics in Enchi College of Education.

3. To examine pre-service teachers' and their mathematics tutors' views about gender differences in pre-service teachers' performance in mathematics in Enchi College of Education.

The design was appropriate because it enabled the researcher to obtain the views of students and tutors about the gender differences in pre-service teachers' performance in mathematics and factors influencing it. Descriptive survey also enabled the researcher to obtain quantitative data with regards to gender differences in mathematics performance in the College. In using the descriptive research design, the researcher employed both qualitative and quantitative approach to collect the necessary data for this study. The qualitative data consisted of closed-ended information from the participants collected through questionnaires and the quantitative data consisted of the end of first semester examination scores.

3.2. Population

Population is the aggregate of all elements that show some common set of characteristics and that comprise the universe for the purpose of the research. The population parameters are typically numbers (unit) (Chakrapani, 2011). Also, a research population is a large well-defined collection of individuals or objects having similar characteristics. He further distinguished between two types of population as the targeted population and the accessible population. The targeted population which is also known as the theoretical population, refers to the group of individuals to which researchers are interested in generalizing the conclusion. Whilst the accessible population which is also known as the study population in research is one which the researchers can apply their conclusions (Castillo, 2009).

This study focused mainly on gender differences in pre-service teachers' performance in mathematics and related factors influencing it in Enchi College of Education in the Western North region of Ghana. The target population for this study was all 343 year-one (Level 100) students and 6 mathematics tutors in the selected college as shown in Table 3.1.

Table 3. 1: Population Distribution of Respondents

Category	Population			Percentage (%)	
	Male	Female	Total	Male	Female
Students	197	146	**343**	57.4	42.6
Tutors	6	0	**6**	100.0	0.0

However, the accessible population was 120 selected year-one students and 5 mathematics tutors from the College. The selection of the College, as well as the selected pre-service teachers and tutors was based largely on proximity, familiarity and accessibility of the subjects to the researcher.

3.2.1 Sampling Technique and Sample size

Generally, a researcher employs sampling strategies in order to generate statistics and generalize findings to a larger population. Sampling refers to the process of selecting individuals from a larger group of people and drawing conclusion that are "an accurate representation of how the larger group of people acts or what they believe" (Frankel & Wallen, 2006).

The sampling technique, therefore, used was purposive and simple-random sampling for the selection of the college and students respectively. This is because purposive sampling, according to Crossman (2018), is selected based on the characteristics of the population and very useful when a targeted sample needs to be reached quickly.

"A simple random sample is one in which each member of the population has an equal and independent chance of being included in the random sample. If the sample is large, this method is the best way to obtain a sample representative of the population" (Frankel & Wallen, 2006).

Table 3.2 presents the sample distribution for the study. Out of the 120 pre-service teachers sampled for the study, there were 60 males, representing 50% and 60 females, representing 50%. However, all mathematics tutors selected were males, since there was no female mathematics tutor in the college.

Table 3. 2: Sample Distribution of Respondents

Category	**Sample size**			**Percentage (%)**	
	Male	**Female**	**Total**	**Male**	**Female**
Students	60	60	**120**	50.0	50.0
Tutors	5	0	**5**	100.0	0.0

Table 3.3 shows the specialisms of the B.Ed. programme the respondents offer in the College, which are B.Ed. (JHS Option), B.Ed. (Primary Option), B.Ed. (Early Grade Option) and B.Ed. (French Option).

Table 3. 3: Course Distribution of Respondents

Course	Males	Females	Total	Percentage (%)
JHS	27	15	42	35.0
Primary	24	13	37	30.8
Early Grade	8	25	33	27.5
French	1	7	8	6.7
Total	**60**	**60**	**120**	**100**

The course with majority of respondents is JHS Education, 35.0%; 30.8% offer Primary Education, 27.5% offer Early Grade Education and 6.7% offer French Education.

3.3 Research Instruments

The research instruments used were a questionnaire and the end of semester examination.

The examination was administered under reasonably good conditions and by several examiners from the Department of Education, University of Ghana and Enchi College of Education. Thus, factors that tend to destroy the objectivity of an examination from its administration might have been eliminated to a great degree. By this, it was hoped that a more objective picture of the study would be obtained.

The questionnaire was preferred to other instruments because it was deemed to be the fastest mode of collecting large amount of data from the respondents. The questionnaire was also believed to guarantee confidentiality and anonymity of respondents since it was generally self-reporting, thereby, capable of producing more reliable responses. Also, the use of questionnaire was less expensive as compared to other forms of data collection techniques such as interviews and observation.

The purpose of the questionnaire was to enable the researcher to determine whether certain factors extremely affect one gender over the other and also to examine pre-service teachers and their mathematics tutors' views about gender differences in pre-service teachers' performance in mathematics in Enchi College of Education. Again, the questionnaire was to aid the researcher in providing recommendations for addressing gender-related disparities in mathematics education based on the findings. This could include suggestions for policy changes, curriculum development, teacher training programs, or support services tailored to address the specific needs of male and female pre-service teachers.

Both questionnaires for pre-service teachers and their tutors had an introductory part which comprised items relating to the demographic information of the respondents, and an assurance of confidentiality and anonymity attached to the responses of the respondents (See Appendices A, B, and C).

3.4. Validity of the Instruments

According to Frankel and Wallen (2006) validity is quality attributed to proposition or measure to the degree to which they conform to establish knowledge or truth. Also, validity is the accuracy and meaningfulness of inferences which are based on research results (Mugenda & Mugenda 1999; Kyavoa, 2017). For the School of Education and Leadership, University of Ghana to come out with end of semester examination, college tutors are invited to an item-setting conference where tutors are made to set standardized questions based on the course outline for the semester. After a number of questions are submitted to the team leader, another session is organised for the moderation of the items set to ensure content validity.

According to Dzakadzie (2017), content-related validity is important because it takes care of the requirements of the teaching curriculum, domain of importance and what people think should be taught and assessed.

The questionnaire items for the study were given out to the researcher's supervisor and colleagues from sister colleges, who were competent in research to check if the questionnaires captured the topic under investigation effectively. Feedback and suggestions from the aforementioned experts helped in checking double and confusing question and were also taken into account in the final questionnaire which was used for the data collection.

3.5. Reliability of the Instruments

Reliability is the degree of consistency of an instrument. That is reliability is the degree to which assessment results will be same when administered on different occasions (Creswell, 2012). The researcher employed test-retest approach to examine the reliability of the questionnaires. The questionnaires for the study were given out to the same respondents on two different occasions. In relation to this, Creswell (2012) asserted that the test-retest approach of measuring reliability involves administering the same instrument at two different times to the same participants at a sufficient time interval.

To reduce memory effects, there was increase in the period between the administration of the first questionnaire to respondents and the second set. This was done to avoid artificial reliability where respondents could respond to the questions in the way they remembered answering it the first time.

3.6. Data Collection Procedure

The world in some few months had been shaken by the deadliest COVID-19 pandemic. The severity of the pandemic forced governments to lock down their countries and cities and Ghana was no exception. In a televised state address on March 15, 2020, the government of Ghana banned all public gatherings and ordered the closure of all schools and universities until further notice. For this reason, the questionnaires were administered to respondents (tutors and pre-service teachers) online (Telegram platform) using Google Form.

The tutors and students for the study were contacted and an appropriate date for data collection was scheduled. During one of the researcher's online lessons, there was an opportunity to brief respondents about the purpose of the study and an appeal made to them to read all instructions carefully before responding to the items and could call for explanations if they were not clear of any item on the questionnaire. An assurance of anonymity was given to them as research ethics demand.

The questionnaires for college tutors and pre-service teachers were developed using Google Form. All questions to be answered were on the Google Form and sent to the general Telegram platform, where all year-one pre-service teachers and college tutors could be easily contacted. Pre-service teachers and their tutors were able to have access to the questionnaire through a Google link sent to the by the researcher through Telegram. Factors such as network accessibility and availability of pre-service teachers paved way for enough period for the submission of completed questionnaires.

The respondents (college tutors and pre-service teachers) completed and submitted their responses to the questionnaires either on the same day after administering them or on the specific day and time given to them to submit through online. The administration of questionnaires and its collection took one week to complete. In all a total of 120 pre-service teachers responded questionnaires and submitted their responses.

The data for the exams was obtained from the Academic Affairs Officer of the college, after a permission letter was addressed to him by the researcher. The data was in a form of raw-score (actual score in percentage obtained by pre-service teachers) and the accompanying grades. After the end of semester exams scores were released to the researcher, the scores and grades obtained by the participating pre-service teachers were recorded for analysis.

3.7 Questionnaire Return Rate

Questionnaire return rate, is the proportion of the questionnaires returned after they had been issued to the respondents (Adino, 2015). The researcher aimed at a sample of 5 tutors and 120 students. Thus, a total of 125 participants were targeted for the study.

The world in some few months have been shaken by the deadliest pandemic; COVID-19 and Ghana is no exception. For this reason, the researcher issued the questionnaires on the Telegram platform of tutors and students. The second semester lessons were taken online due to the COVID-19 pandemic. This enabled the researcher to have access to all the questionnaires administered online. Thus, it can be observed from Table 3.4 that all 5 tutors and 120 students completed and returned the questionnaires through Google forms. Therefore, there was a questionnaire return rate of 100%. This rate was deemed adequate for data analysis since they exceeded 85.0% return rate suggested by (Mugenda & Mugenda, 2003).

Table 3. 4: Questionnaire return rate

Respondent	Sample	Returned	Percentage (%)
Tutors	5	5	100
Students	120	120	100
Total	**125**	**125**	**100**

Source: Fieldwork, 2020

3.8. Data Analysis

The study used Statistical Package for Social Sciences (SPSS) to analyse the data. The data was analysed both qualitatively and quantitatively. Quantitative data (end of semester examination scores) were edited to eliminate inconsistencies, and summarized for easy classification in order to facilitate tabulation and interpretation.

The College in collaboration with University of Ghana, operate a combination of Continuous Assessment and End-of-Semester Examination for the final grading of pre-service teachers. The Continuous Assessment component consists of assignments, class quizzes and tests, and class project work. This component gives students the chance to demonstrate their abilities on a wider variety of learning tasks and a broader variety of work environments than is possible under formal examination conditions.

The University uses letter grades and corresponding numerical weightings which reflect the quality of performance. Total raw scores (combination of continuous assessment and end-of-semester examination) are converted according to the scheme in Table 3.5.

Table 3. 1: Interpretation of End-of-Semester Examination scores

Marks	Letter Grade	Interpretation
80 – 100	A	Outstanding
75 – 79	B+	Very Good
70 – 74	B	Good
65 – 69	C+	Fairly Good
60 – 64	C	Average
55 – 59	D+	Below Average
50 – 54	D	Marginal
0 – 49	E	Fail/Unsatisfactory

Source: Students' Handbook, 2005.

From Table 3.5, scores from 80% to 100% is interpreted as 'Outstanding' with grade A; scores from 75% to 79% is interpreted as 'Very Good' with grade B+; and scores from 70% to 74% is interpreted as 'Good' with grade B. Also, pre-service teachers' scores from 65% to 69% is graded C+ and interpreted as 'Fairly Good'; scores from 60% to 64% is graded C and interpreted as 'Average'; scores from 55% to 59% is interpreted as 'Below Average' and graded D+; scores from 50% to 54% is interpreted as 'Marginal' and graded D; and finally, scores below 50% is graded E and interpreted as 'Fail or Unsatisfactory'.

Descriptive statistics was used in describing the sample data in such a way as to portray the typical respondent and to reveal the general response pattern. Analysed data was presented in form of percentages, means, standard deviations and frequencies.

Closed-ended questions which elicited qualitative data was analyzed according to themes based on the research questions and the objectives and thereafter, inferences and conclusions were drawn.

3.9. Ethical Considerations

According to Resnik (2015), ethics are norms for conduct that distinguish between acceptable and unacceptable behavior. Again, Ethics are the norms or standards for conduct that distinguish between right and wrong and help to determine the difference between acceptable and unacceptable behaviors on the part of the researcher. Ethical consideration is, therefore, very important in research as the integrity, reliability and validity of the research findings rely heavily on adherence to the ethical principles underlying the research (Creswell, 2012) as cited by Mensah (2015).

Before the study commenced, both verbal and written permissions were sought for from the Vice Principal, the Academic Affairs Officer and the Gender, Equality and Social Inclusion (GESI) Unit for official approval.

Further, anonymity and confidentiality were maintained throughout the study. In this study, anonymity was ensured by not disclosing the participant's name on the questionnaire and confidentiality was also maintained by keeping the collected data confidential and not revealing the participant's responses to a third party. No identifying information was entered onto the questionnaires, and questionnaires were only sorted out after data collection.

CHAPTER FOUR

RESULTS AND DISCUSSIONS

4.0. Overview

The researcher adopted quantitative data to measure gender differences in pre-service teachers' performance in mathematics and factors influencing it in Enchi College of Education. The demographic characteristics of the respondents (students and tutors) are first presented. This is followed by the results of the study which were presented in four sections based on the research questions that guided the study. The findings are also discussed in the light of previous research findings and available literature, where applicable, in order to identify similarities and differences between this study and previous studies and literature.

4.1. Demographic Properties of Student Respondents

The demographic properties of the students considered in this study included gender, age, and the type of course they offer in the college. The sample size for the study was 120 students which consisted of 60 males and 60 females as presented in Table 4.1.

Table 4. 2: Gender Distribution of Student Respondents

	Gender	Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Male	60	50.0	50.0	50.0
	Female	60	50.0	50.0	100.0
	Total	**120**	**100.0**	**100.0**	

Source: Fieldwork, 2020

The results indicate that 50.0% of the respondents were males, whilst 50.0% were females as shown in Table 4.1. This was done in order to come out with balanced analyses. This buttresses the findings that gender imbalance should be understood through representativeness and statistical power. As an example, consider a study conducted at a small college of 1,000 students in which the distribution of gender groups at the college is quite imbalanced (e.g., 80% female and 20% male). Given that females may be more inclined to agree to participate in our research, we could easily end up with a sample of 100 students containing 85 females and 15 males (Dickinson, Adelson, & Owen, 2012).

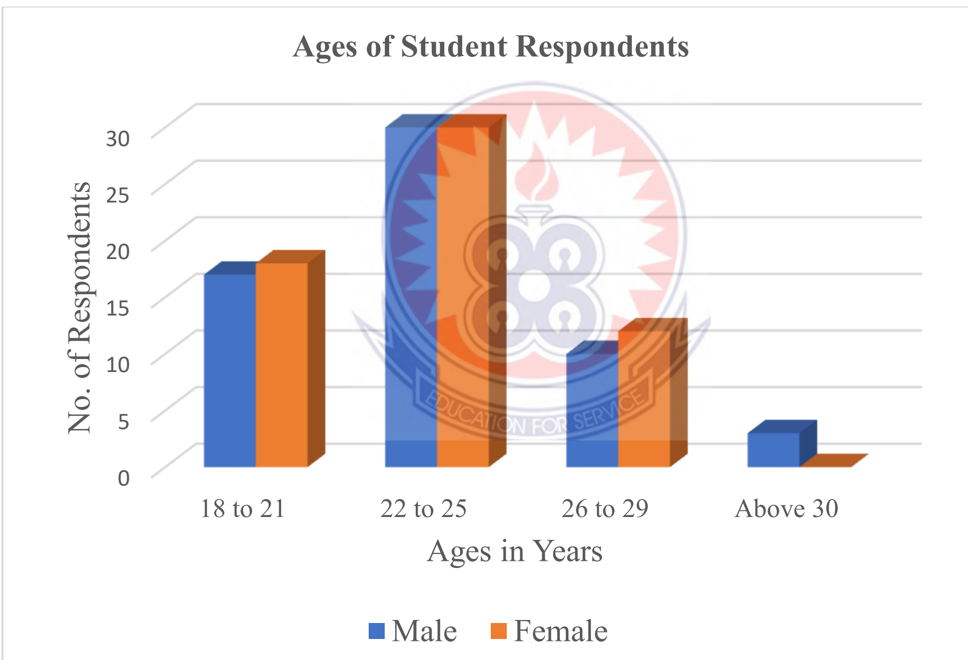

Figure 4. 1: Ages of student respondents at the time of completing the questionnaires

The respondents were asked how old they were as at the time of completing the questionnaires. Figure 4.1 depicts the respondents' ages. The respondents' ages ranged from 18 to 30 years and above with the majority of respondents (60 students) comprising of 30 males and 30 females falling within the age group of 22 to 25 years, representing 60%. This was followed by 35 respondents (17 males and 18 females) falling within the age group of 18 to 21 years, also representing 29.2%. In the age group of 26 to 29 years, there were 22 respondents (10 males and 12 females) representing 18.3% whereas the respondents within the age group of 30 years and above were only 3 (3 males), representing 2.5%.

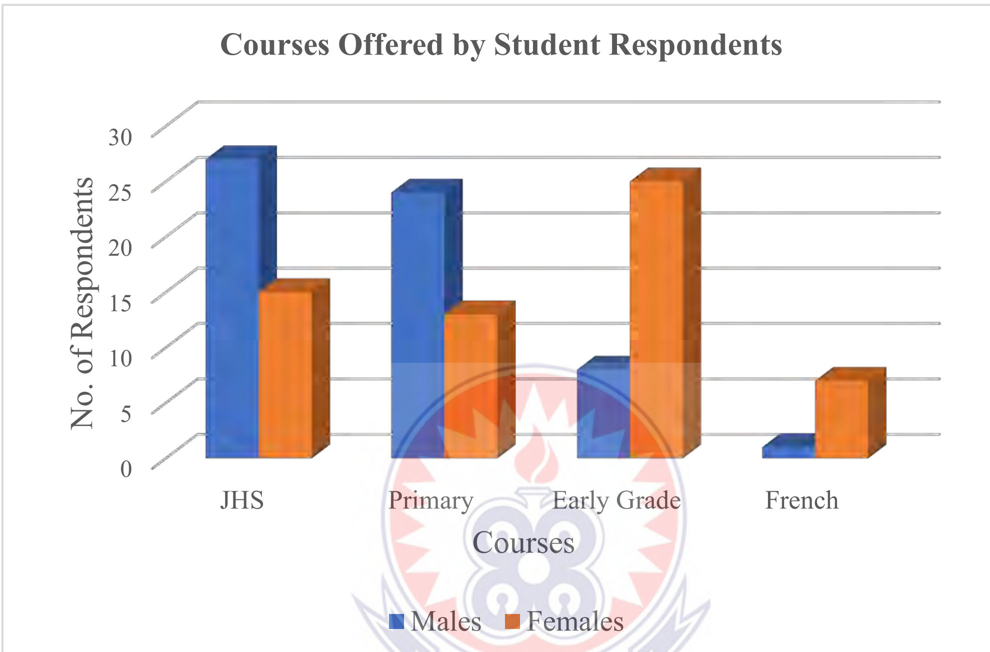

Figure 4. 2: Course distribution of student respondents

From Figure 4.2, it could be observed that 42 (27 males and 15 females) of the respondents representing 35.0% were offering JHS Education. 37 (24 males and 13 females) respondents representing 30.8% were offering Primary Education whiles 33 (8 males and 25 females) respondents representing 27.5% were offering Early Grade Education. The least respondents, 8 (1 male and 7 females) representing 6.7% were from the French Education class.

4.2 Demographic Characteristics of Tutor-Respondents

Five mathematics tutors were involved in the study. The demographic properties of the tutors considered in this study include the gender, highest qualification, status, as well as the number of years taught in the college, as presented in Tables 4.2, 4.3 and 4.4.

Table 4. 3: Gender distribution of tutor respondents

	Gender	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	Male	5	100.0	100.0	100.0

Source: Fieldwork, 2020

All five tutors who were selected were males representing 100%. This was because as at the time of the study, the Mathematics Department of Enchi College of Education had no female staff member.

Table 4. 4: Highest qualification of tutor respondents

Qualification	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
M.Phil./M.Ed/M.A	5	100.0	100.0	100.0

Source: Fieldwork, 2020

The tutors who responded were M.Phil. holders in the College, as at the time of the study. M.Phil. is the minimum requirement to become a college tutor, hence, all mathematics tutor respondents (5) representing 100%, in the College meet that requirement. According to Lee (2018), teacher quality is the most influential factor that determines student success. Again, if students are taught by a string of under qualified and underperforming teachers, it limits academic potential. However, highly qualified teachers are more likely to expand students' desires to learn and succeed (Lee, 2018).

Table 4. 5: Status of tutor respondents

	Status	*Frequency*	*Percent*	*Valid Percent*	*Cumulative Percent*
Valid	Tutor	5	100.0	100.0	100.0

Source: Fieldwork, 2020

Any qualification less than M.Phil. places a tutor at the status of Assistant Tutor. All tutor respondents (5) representing 100% had M.Phil. therefore, were at the status of a Tutor.

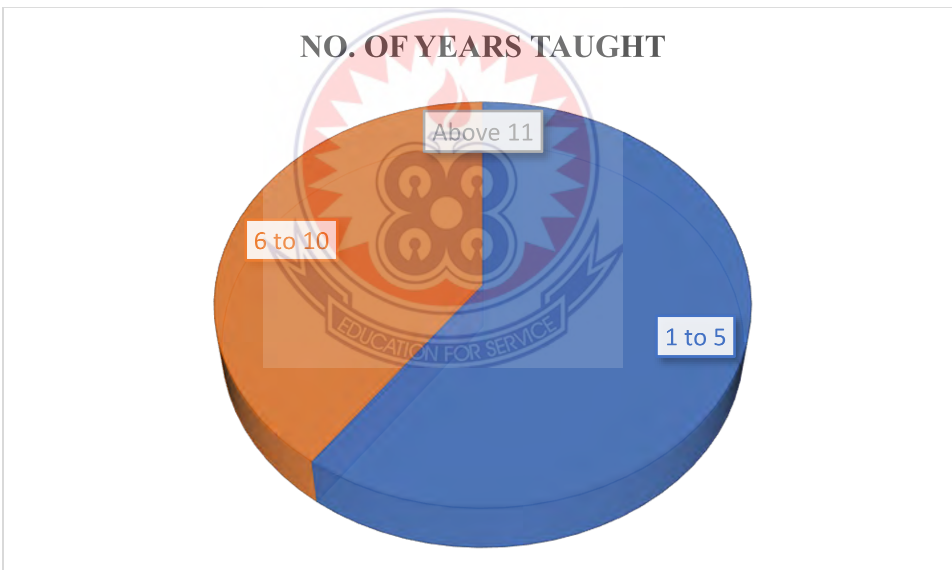

Figure 4. 3: A Pie Chart Showing Number of Years Taught in the College by Sampled Tutors

From Figure 4.3, it could be observed that 60% (3 out 5) of the tutors have taught mathematics in the college for at most 5 years. It was also evident that 2(40%) out of the 5 tutors have taught in the college for at least 11 years. None of the tutors have taught in the college for more than 10 years (11 years and above).

4.3. Research Question 1: How different is the performance in mathematics of male and female pre-service teachers in Enchi College of Education?

As a requirement for certification, at the end of each semester, pre-service teachers' examination results are released to the colleges for further analysis by the College's Academic Board. The scores of the sampled pre-service teachers were sorted from the general results. The index numbers of sampled pre-service teachers (both males and females) and the scores they obtained at the end of year-one-semester-one examination (see Appendix D).

The grades of the sampled pre-service teachers were sorted from the general results. Table 4.5, therefore, presents the number of pre-service teachers (both males and females) and the grades they obtained at the end of year-one-semester-one examination.

Table 4. 5: Frequency table for the end of semester grades of male and female in Mathematics

	Gender			
Grade	**Male**		**Female**	
	No.	%	No.	%
A	12	20.0	5	8.3
B+	9	15.0	4	6.7
B	12	20.0	7	11.7
C+	11	18.3	12	20
C	7	11.7	15	25
D+	6	10.0	9	15
D	3	5.0	6	10
E	0	0.0	2	3

From Table 4.5, 49 (40.8%) student teachers consisting of 33 (27.5%) males and 16 (13.3%) females obtained the 'best grades' (A, B+ and B). This indicates that 17 (14.2%) more males than females had the best grades. Further, a little over half (69) representing 57.5% consisting of 27 (22.5%) males and 42 (35%) females obtained 'satisfactory grade' (C+, C, D+ and D). However, 2 (1.7%) students were referred (obtained grade E) and they were all females.

The mean and standard deviation of scores obtained by pre-service teachers in the end of semester one examination is presented in Table 4.6.

Table 4.6: Group statistics of respondents

	Gender	**N**	**Mean**	**Std. Deviation**
Exam Score	Male	60	70.70	9.596
	Female	60	64.35	9.016

From Table 4.6, the male student teachers had a higher mean (70.70) than their female counterparts (64.35) and also recorded a standard deviation (9.60) in scores obtained than their female counterparts (9.02).

To establish whether the difference in the end-of-semester one examination scores of male and female pre-service teachers was statistically significant, an independent samples t-test was conducted to compare the performance of the pre-service teachers. The results from the independent samples t-test of the pre-service teachers' end-of-semester examination are illustrated in Table 4.7.

Table 4.7: Results of the Independent Samples t-test on scores obtained in Mathematics

Independent Samples Test										
		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	Df	Sig. (2-tailed)	Mean Diff.	Std. Error Diff.	95% Confidence Interval of the Difference Lower	Upper
Test Scores	Equal variances assumed	.859	.356	3.736	118	.000	6.350	1.700	2.984	9.716
	Equal variances not assumed			3.736	117.544	.000	6.350	1.700	2.984	9.716

Significance level 0.05

From Table 4.7, the significant value was 0.356 and the alpha level was 0.05 which means that the significant value was greater than the alpha level and this means that the column labelled equal variances assumed's t-value was chosen. Also, the significant (2-tailed) value was 0.000 which implies that it was less than the alpha level of 0.05.

4.4 Research Question 2: What gender related factors influence pre-service teachers' performance in mathematics in Enchi College of Education?

To examine whether anxiety had influence on pre-service teachers' performance in mathematics in Enchi College of Education, participants were made to respond to some statements on the questionnaire. The results of the responses from participants on the influence of anxiety on pre-service teachers' performance in mathematics are illustrated in Table 4.8.

Table 4. 8: Summary of responses by participants on the influence of Anxiety on pre-service teachers' performance in mathematics

1	*Mathematics makes me feel uncomfortable*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	9	15.0	21	35.0	6	10.0	17	28.3	7	11.7
Female	4	6.7	23	38.3	2	3.3	21	35.0	10	16.7
2	*I am always worried about being called on in mathematics class*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	10	16.7	23	38.3	6	10.0	16	26.7	5	8.3
Female	1	1.7	16	26.7	2	3.3	30	50.0	11	18.3
3	*I fear mathematics tests more than any other subject*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	14	23.3	16	26.7	4	6.7	18	30.0	8	13.3
Female	1	1.7	10	16.7	4	6.7	31	51.7	14	23.3

Results in Table 4.8 indicate that 57 (30 males and 27 females) out of the 120 respondents representing 47.5% disagreed to the statement '*Mathematics makes me feel uncomfortable*', while 55 (24 males and 31 females), representing 45% agreed to the statement. But 8(6 males and 2 females) were not sure whether they agreed or not. This result further reveals that many of the female respondents (51.7%) as compared to the male respondents (40.0%) were of the view that Mathematics makes them feel uncomfortable, hence, resulting in their poor performance. Similarly, from item two of Table 4.8, 41.7% of the respondents (33 males and 17 females) disagreed that *they are always worried about* *being called on in mathematics class*, whereas 51.7% (21 males and 41 females) agreed to the statement and 6.6% (6 males and 2 females) responded undecided. In view of these, responses from item two further indicate that majority of the female respondents (34.2%) agreed that they are always worried about being called on in mathematics class. Again, according to the responses on item three in Table 4.8, 41 respondents (30 males and 11 females) representing 34.2% disagreed that *they feared mathematics tests more than any other subject* whereas 70 respondents (26 males and 44 females) representing 58.3% agreed to the statement. This indicates that many female respondents (73.3%) than male respondents (43.3%) responded that they feared mathematics tests more than any other subject.

Also, to examine whether Socio-cultural Factors had influence on pre-service teachers' performance in mathematics in Enchi College of Education, participants were made to respond to some statements on the questionnaire. The results of the responses from participants on the influence of Socio-cultural Factors on pre-service teachers' performance in mathematics are illustrated in Table 4.9.

Table 4. 9: Summary of responses by participants on the influence of Socio-cultural Factors on pre-service teachers' performance in mathematics

1	*I have limited time to study due to other intervening activities that I undertake*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	11	18.3	14	23.3	9	15.5	17	28.3	9	15.0
Female	4	6.7	14	23.3	4	6.7	26	43.3	12	20.0
2	*Social interaction and discussion do not help me to learn and understand mathematics better*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	11	18.3	27	45.0	6	10.0	9	15.0	7	18.3
Female	9	15.0	12	20.0	12	20.0	16	26.7	11	18.3
3	*Tasks that are free from cultural biasness do not motivate me to learn mathematics*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	11	18.3	24	40.0	11	18.3	10	16.7	4	6.7
Female	4	6.7	34	56.7	9	15.0	11	18.3	2	3.3

According to the responses in Table 4.9, 43 (35.8%) respondents (25 males and 18 females) disagreed to the statement that '*they have limited time to study due to other intervening activities that they undertake*' while 64 (53.3%) respondents, comprising of 26 males and 38 females agreed to the statement, and 13 (10.8%) out of the 120 respondents responded neutral. Again, results from Item 2 in Table 4.9 indicate that 59 respondents (38 males and 21 females) representing 49.2% responded that they disagree that '*Social interaction and discussion do not help them to learn and understand mathematics better*'. However, 43 respondents (16 males and 27 females) representing 35.8% agreed to the statement while 18 (6 males and 12 females) representing 15.0% were neutral. Table 4.9 further reveals that the statement '*Tasks that are free from cultural biasness do not motivate me to learn mathematics*' was responded to as; 73 (60.8% – 35 males and 38 females) disagreed, 27 (22.5% – 14 males and 13 females) agreed and 20 (16.7% – 11 males and 9 females) were also undecided.

Likewise, to examine whether Self Concept/Self Confidence and Attitude had influence on pre-service teachers' performance in mathematics in Enchi College of Education, participants were made to respond to some statements on the questionnaire. The results of the responses from participants on the influence of Self Concept/Self Confidence and Attitude on pre-service teachers' performance in mathematics are illustrated in Table 4.10.

Table 4. 10: Summary of responses by participants on the influence of Self Concept/Self Confidence and Attitude on pre-service teachers' performance in mathematics

1	*I don't have enough self-confidence when it comes to mathematics*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	11	18.3	18	30.0	9	15.0	16	26.7	6	10.0
Female	3	5.0	11	18.3	12	20.0	21	35.0	13	21.7
2	*I am unhappy in Mathematics class than any other class*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	11	18.3	17	28.3	9	15.0	13	21.7	10	16.7
Female	5	8.3	10	16.7	4	6.7	25	41.6	16	26.7
3	*I don't have confidence when called upon to answer mathematics questions in class*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	9	15.0	17	28.3	6	10.0	20	33.3	8	13.3
Female	3	5.0	12	20.0	7	11.7	24	40.0	14	23.3

The responses to the statement '*I don't have enough self-confidence when it comes to mathematics*' in Table 4.10, reveal that 43 (29 males and 14 females) representing 35.8% disagreed while 56 (22 males and 34 females) representing 46.7% agreed and 21 (9 males and 12 females) representing 17.5% responded neutral. Similarly, the responses to the statement '*I am unhappy in Mathematics class than any other class*' in Table 4.10 indicate that 64 (23 males and 41 females) representing 53.3% agreed while 43 (28 males and 15 females) representing 35.8% disagreed and 13 (9 males and 4 females) representing 10.8% responded neutral. It is further indicated in Table 4.10 that 66 (55.0% – 28 males and 38 females) of the responses to the statement '*I don't have confidence in answering mathematics questions in class*' agreed whereas 41(34.2% – 26 males and 15 females) disagreed and 12(10.8% – 6 males and 7 females) responded neutral.

Similarly, in examining whether Economic factors had influence on pre-service teachers' performance in mathematics in Enchi College of Education, participants were made to respond to some statements on the questionnaire. The results of the responses from participants on the influence of Economic factors on pre-service teachers' performance in mathematics are illustrated in Table 4.11.

Table 4. 11: Summary of responses by participants on the influence of Economic Factors on pre-service teachers' performance in mathematics

1	*The occupation of my parents does not influence my interest and academic performance in mathematics*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	6	10.0	14	40.0	6	10.0	24	23.3	10	16.7
Female	7	11.7	11	18.3	3	5.0	21	30.0	18	30.0
2	*I don't have enough mathematics-related materials that help in understanding mathematics concepts*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	11	18.3	23	38.3	6	10.0	16	26.7	4	6.7
Female	18	30.0	25	41.7	3	5.0	13	21.7	1	1.7
3	*There is always inadequate financial support in aid of buying mathematics materials*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	12	20.0	16	26.7	4	6.7	18	30.0	10	16.7
Female	21	35.0	13	21.7	7	11.7	11	18.3	8	13.5

It is seen from Table 4.11 that 73 (34 males and 39 females) out of the 120 respondents representing 60.8% agreed to the statement '*The occupation of my parents does not influence my interest and academic performance in mathematics*', at the same time 38 (31.7%) respondents (20 males and 18 females) agreed to the same statement and 9 (6 males and 3 females) representing 7.5% responded neutral. Table 4.11 further illustrates that more than half of the respondents 77 (64.2%) consisting of 34 males and 43 females disagreed that '*they do not have enough mathematics-related materials that help in understanding mathematics concepts*'. However, 34 of the respondents (20 males and 14 females) depicting 28.3% agreed while 9 (6 males and 3 females) depicting 7.5% were not certain on their response. In addition, Table 4.11 shows that from the statement '*There is always inadequate financial support in aid of buying mathematics materials*', 62 (28 males and 34 females) representing 51.7% disagreed while 47 (28 males and 19 females) representing 39.2% agreed and 11 (4 males and 7 females) representing 9.2% were undecided.

Further, in examining whether Inside School factors had influence on pre-service teachers' performance in mathematics in Enchi College of Education, participants were made to respond to some statements on the questionnaire. The results of the responses from participants on the influence of Inside School factors on pre-service teachers' performance in mathematics are illustrated in Table 4.12.

Table 4. 12: Summary of responses by participants on the influence of Inside School factors on pre-service teachers' performance in mathematics

1	*My classmates do not encourage me to take mathematics at all levels*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	10	16.7	9	15.0	7	11.7	26	43.3	8	13.3
Female	9	15.0	12	20.0	2	3.3	28	46.7	9	15.0
2	*I am afraid to ask questions in mathematics class*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	11	18.3	21	35.0	3	5.0	16	26.7	9	15.0
Female	4	6.7	15	25.0	6	10.0	21	35.0	14	23.3

Responses in Table 4.12 illustrate that 40 (19 males and 21 females) out of the 120 respondents, representing 33.3% disagreed to the statement '*My classmates do not encourage me to take mathematics at all levels*'. However, 71 respondents (34 males and

37 females) representing 59.2% agreed and 9 respondents (7 males and 2 females) representing 7.5% were undecided. Table 4.12 further reveals that 51 respondents (32 males and 19 females) constituting 42.5% disagreed that '*they are afraid to ask questions in mathematics class*'. Even so, 60 (50.0%) respondents (25 males and 35 females) also agreed to the statement whereas 9 (7.5%) responded neutral.

4.5 Research Question 3: What are pre-service teachers' and their mathematics tutors' views about gender differences in pre-service teachers' performance in mathematics in Enchi College of Education?

In examining the views of mathematics tutors in Enchi College of Education about gender differences in pre-service teachers' performance in mathematics, the college tutors were made to respond to some statements on the questionnaire. The results of the responses from the tutors on mathematics tutors' views about gender differences in pre-service teachers' performance in mathematics in Enchi College of Education are illustrated in Table 4.13.

Table 4. 13: Views of mathematics tutors about gender differences in pre-service teachers' performance in mathematics in Enchi College of Education

1. *Most females in Enchi College of Education outperform males in mathematics*									
SD	**%**	**D**	**%**	**N**	**%**	**A**	**%**	**SA**	**%**
0	0.0	4	80.0	1	20.0	0	0.0	0	0.0
2. *Most males generally outperform females in mathematics in Enchi College of Education*									
SD	**%**	**D**	**%**	**N**	**%**	**A**	**%**	**SA**	**%**
0	0.0	0	0.0	0	0.0	4	80.0	1	20.0
3. *Males participate actively in mathematics lessons than females in Enchi College of Education*									
SD	**%**	**D**	**%**	**N**	**%**	**A**	**%**	**SA**	**%**
0	0.0	1	20.0	1	20.0	3	60.0	0	0.0
4. *Males are more confident about solving mathematical problems than females in Enchi College of Education*									
SD	**%**	**D**	**%**	**N**	**%**	**A**	**%**	**SA**	**%**
1	20.0	0	0.0	1	20.0	2	40.0	1	20.0
5. *Male students have more interest in mathematics as a subject than female students*									
SD	**%**	**D**	**%**	**N**	**%**	**A**	**%**	**SA**	**%**
0	0.0	0	0.0	1	20.0	3	60.0	1	20.0
6. *I encourage my students to work together with their classmates during lessons*									
SD	**%**	**D**	**%**	**N**	**%**	**A**	**%**	**SA**	**%**
0	0.0	0	0.0	0	0.0	0	0.0	5	100.0
7. *I make my students feel they have the ability to go on in mathematics*									
SD	**%**	**D**	**%**	**N**	**%**	**A**	**%**	**SA**	**%**
0	0.0	0	0.0	0	0.0	1	20.0	4	80.0
8. *Talking to my students about mathematics has usually been a problem*									
SD	**%**	**D**	**%**	**N**	**%**	**A**	**%**	**SA**	**%**
1	20.0	3	60.0	0	0.0	1	20.0	0	0.0

According to Table 4.13, 4 out of the 5 tutors representing 80% disagreed that *Most females in the college outperform males in mathematics* while only 1 tutor (20%) was neutral on the statement. Table 4.13 further reveals that all the tutors (5 out of 5) representing 100%

agreed that *Most males generally outperform females in mathematics in Enchi College of Education*.

Again, it can be observed from Table 4.13 that more than half of the tutors (3) constituting 60% agreed to the statement '*Males participate actively in mathematics lessons than females in Enchi College of Education* while 1 tutor each representing 20% responded disagree and neutral. Responses of tutors on *Males are more confident about solving mathematical problems than females in the college* in Table 4.13 depict that 4(80%) agreed and 1(20%) was neutral. Furthermore, all 5 tutors constituting 100% agreed that *they encourage their students to work together with their classmates during lessons*. Also, all 5 tutors constituting 100% agreed to the statement '*I make my students feel they have the ability to go on in mathematics*'. Lastly, while 4(80%) disagreed to the statement '*Talking to my students about math has usually been a problem*', only 1 tutor (10%) agreed that *talking to their students about mathematics has usually been a problem*.

Similarly, in examining the views of pre-service teachers in Enchi College of Education about gender differences in pre-service teachers' performance in mathematics, the participants were made to respond to some statements on the questionnaire. The results of the responses from the participants on mathematics tutors' views about gender differences in pre-service teachers' performance in mathematics in Enchi College of Education are illustrated in Table 4.14.

Table 4. 14: Views of pre-service teachers about gender differences in pre-service teachers' performance in mathematics in Enchi College of Education

1	*Most females in Enchi College of Education outperform males in mathematics*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	21	35.00	23	38.33	11	18.33	5	8.33	0	0.00
Female	32	53.33	19	31.67	5	8.33	4	6.67	0	0.00
2	*Most males generally outperform females in mathematics in Enchi College of Education*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	0	0.00	11	18.33	7	11.67	24	40.00	18	30.00
Female	4	6.67	6	10.00	9	15.00	22	36.67	19	31.67
3	*Males participate actively in mathematics lessons than females in Enchi College of Education*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	2	3.33	3	5.00	5	8.33	22	36.67	28	46.67
Female	6	10.00	2	3.33	9	15.00	27	45.00	16	26.67
4	*Males are more confident about solving mathematical problems than females in Enchi College of Education*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	5	8.33	9	15.00	6	10.00	23	38.33	17	28.33
Female	3	5.00	4	6.67	11	18.33	18	30.00	24	40.00
5	*Male students have more interest in mathematics as a subject than female students*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	3	5.00	7	11.67	4	6.67	25	41.67	21	35.00
Female	0	0.00	2	3.33	7	11.67	29	48.33	22	36.67
6	*My mathematics tutor encourages me to work together with my classmates during lessons*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	2	3.33	6	10.00	7	11.67	26	43.33	19	31.67
Female	3	5.00	10	16.67	11	18.33	21	35.00	15	25.00
7	*My mathematics tutor makes me feel I have the ability to go on in mathematics*									
	SD	%	**D**	%	**N**	%	**A**	%	**SA**	%
Male	8	13.33	13	21.67	5	8.33	23	38.33	11	18.33
Female	11	20.00	14	15.00	2	3.33	20	41.67	13	35.00

Results in Table 4.14 indicate that 95 (44 males and 51 females) out of the 120 respondents representing 79.17% disagreed to the statement '*Most females in Enchi College of Education outperform males in mathematics*', while only (5 males and 4 females), representing 7.50% agreed to the statement. But 16 (11 males and 5 females) representing 13.33% were not sure whether they agreed or not. Similarly, from Table 4.14, 17.50% of the respondents (11 males and 10 females) disagreed that '*Most males generally outperform females in mathematics in Enchi College of Education'*. However, 69.17% (42 males and 41 females) agreed to the statement and 13.33% (7 males and 9 females) responded undecided. According to the responses to item three in Table 4.14, 13 respondents (5 males and 8 females) representing 10.83% disagreed that '*Males participate actively in mathematics lessons than females in Enchi College of Education'* whereas 93 respondents (50 males and 43 females) representing 77.50% agreed to the statement and 14 respondents (5 males and 9 females) representing 11.67% were undecided.

Again, according to the responses to item 4 in Table 4.14, 21 (17.50%) respondents (14 males and 7 females) disagreed to the statement that '*Males are more confident about solving mathematical problems than females in Enchi College of Education*' while 82 (68.33%) respondents, comprising of 40 males and 42 females agreed to the statement, and 17 (14.17%) out of the 120 respondents responded neutral. Furthermore, results from Item 5 in Table 4.14 indicate that 12 respondents (10 males and 2 females) representing 10.00% responded that they disagree that '*Male students have more interest in mathematics as a subject than female students*. However, 97 respondents (46 males and 51 females) representing 80.83% agreed to the statement while 11 (4 males and 7 females) representing 9.17% were neutral. Moreover, Table 4.14 reveals that the statement '*My mathematics tutor encourages me to work together with my classmates during lessons*' was responded to as; 21 (17.50%; 8 males and 13 females) disagreed, 81 (67.50%; 45 males and 36 females) agreed and 18 (15.00%; 7 males and 11 females) were also undecided.

Additionally, results from Item 7 in Table 4.14 indicate that 46 respondents (21 males and 25 females) representing 38.33% responded that they disagree to the statement '*My mathematics tutor makes me feel I have the ability to go on in mathematics*'. However, 67 respondents (34 males and 33 females) representing 55.83% agreed to the statement while 7 (5 males and 2 females) representing 5.83% were neutral.

4.6. Discussion of Main Results

This section focuses on the individual research questions for the discussion. This was done to confirm or otherwise the various literatures reviewed under chapter two.

Research Question 1: How different is the performance in mathematics of male and female pre-service teachers in Enchi College of Education?

Analysis from Table 4.6 indicates that there was statistically significant difference in performance in mathematics of male and female pre-service teachers. The t-test conducted showed males (M = 70.70, SD = 9.596) do have higher level of performance in mathematics than females (M = 64.35, SD = 9.016); t (118) = 3.736, p = 0.000 (two-tailed), d = 0.05 in Enchi College of Education (See Table 4.7). It was therefore, evident from these results that male and female pre-service teachers had differences in mathematics performance, hence the hypothesis that "There is no statistically significant difference between Enchi College of Education male and female pre-service teachers' performance in mathematics" was rejected. This is in accordance with Janson (1996), Mullis' study (as cited in Tetteh, Wilmot & Ashong, 2018) revelation that male advantage in mathematics performance is a universal phenomenon. The results in this work, therefore, indicates that there is statistically significant difference in the mathematics performance of male and female pre-service teachers of Enchi College of Education.

Research Question 2: What gender related factors influence pre-service teachers' performance in mathematics in Enchi College of Education?

Anxiety often leads to avoidance of mathematics related activities and classes resulting in less experience with and exercise of mathematics leading to lower math performance. This assertion can be related to the responses of females from Table 4.8. Many females (31 – 51.7%) than males (24 – 40.0%) responded that mathematics makes them feel uncomfortable. Further, 41 (68.3%) females as against 21 (35.0%) males responded that they are always worried about being called on in mathematics class, and 18 (30.0%) more females than males also said they fear mathematics tests more than any other subject. This finding, therefore, confirms a study by Malinsky, Ross, Pannells, & McJunkin (2006) on mathematics anxiety in pre-service elementary school teachers, which revealed that the pre-service female teachers' mathematics anxiety level was higher than that of males. In other words, they claimed that there was a statistically significant difference in regard to mathematics anxiety between pre-service male and female teachers.

A similar study by Bowd and Brady (2003) with 357 final-year pre-service teachers at a small Canadian University found that pre-service female teachers had significantly greater mathematics anxiety than that of males. Many females feel extremely nervous when faced with a situation that requires them to do basic mathematics. This means that a person may feel anxious even though he or she knows that there is really no reason to feel anxious. Usually, people who have mathematics anxiety believe that they are bad at mathematics and because of this, they do not like mathematics. These feelings lead them to avoid situations in which they have to do mathematics.

In relation to Socio-Cultural factors, the responses in Table 4.9 reveal that 12 more females than males agreed that '*they have limited time to study due to other intervening activities that they undertake'* while 7 more males than females disagreed. Further, 11 more females than males agreed to the statement '*Social interaction and discussion do not help them to learn and understand mathematics better*' whereas 17 more males than females disagreed. However, 3 more females than males disagreed that '*Tasks that are free from cultural biasness do not motivate me to learn mathematics'* while 1 more male than female agreed. It further becomes evident that various experiences that females go through contribute heavily to their perceptions, beliefs and interest in Mathematics. Household chores, for example cooking, and washing, take up a lot of females' study time.

Accordingly, females may be disadvantaged by assuming the burden of doing chores in the home. As a result, little time would be reserved to the study of Mathematics, a subject that requires the dedication of a large amount of time. Hence, social-culture factors limit females' freedom of studying Mathematics. This view is in line with Gallagher (2001) who holds the view that boys and girls display different academic performance not because they differ in their physical, emotional and intellectual development but rather due to some social and cultural factors.

Responses in Table 4.10 reveal that 12 more females than males agreed that they do not have enough self-confidence when it comes to mathematics while 15 more males than females disagreed. Further 18 more females than males agreed to the statement 'I am unhappy in Mathematics class than any other class' whereas 13 more males than females disagreed. Again, 14 more females than males agreed that they have don't have confidence in answering mathematics questions in class while 11 more males than females disagreed.

These findings indicate that males and females exhibit very different levels of competence beliefs in the area of Mathematics. Thus, comparing the self-concept/self-confidence of male and female respondents, it is evident that males have higher self-perceptions of their math abilities than their female counterparts who often exhibit less positive attitudes toward mathematics and less interest in mathematics-related careers. This finding is also consistent with the findings of Midgley et al., (2001) who posited that past self-concept research focusing only on competence has indicated that in general boys tend to have higher competence beliefs than girls.

All students have certain level of socioeconomic status depending on their parents or guardian. Some students are from homes with good financial background which enables them to have access to the requisite educational resources which are necessary for their academic success. Other students from homes which do not provide adequate resources and support often end up in poor performance or dropout. However, most pre-service teachers in Enchi College of Education do not find themselves such category. This is evident from the responses of respondents in Table 4.11, where 5 (4.2%) more females than males responded that the occupation of their parents has no influence on their interest and academic performance in mathematics. Again, 5 (4.2%) more females than males agreed that they don’t have enough mathematics-related materials that help in understanding mathematics concepts. Additionally, 5 (4.2%) more females than males agreed that there is always inadequate financial support in aid of buying mathematics materials. It is quite obvious that very few (negligible) of the females in Enchi College of Education have been facing socioeconomic challenges as compared to their male colleagues. However, on the average, from the analysis of majority of the respondents, it asserted that socioeconomic factor has no significant influence on the performance of males and females in the Enchi College of Education in relation to Mathematics. This is in agreement with the findings of Usaini & Abubakar (2015) who found that, apparent socioeconomic status plays a significant role in providing adequate educational resources and appears to impose the greater impact on the child's educational outcomes.

Classroom inputs and processes contribute to student achievement. Thus, the quality of classroom learning environment is a significant determinant of pre-service teachers' Mathematics performance. Comparing the responses in Table 4.12, 3(2.5%) more females than males agreed that their classmates do not encourage them to take Mathematics at all levels and 10 (16.7%) more females than males also agreed that they are afraid to ask questions in Mathematics class respectively. These findings suggest that females are likely to be interrupted more often when they do speak and are imagined to have spoken more than they actually did by their male counterparts. This may be due to females being reluctant to volunteer, even when they are quite sure of an answer. Most females tend to forget that classroom inputs and processes contribute to student achievement. In support of this, Sadler and Sadler (cited in Streitmatter, 1997, p.18) found that many girls are reluctant to risks in co-educational classrooms in part due to boys' domination. Without engaging in risk-taking activities in the classroom, it is not possible for females to achieve their full academic potential in mathematics.

Research Question 3: What are pre-service teachers' and their mathematics tutors' views about gender differences in pre-service teachers' performance in mathematics in Enchi College of Education?

A central finding in Table 4.13 has to do with comparison of gender performance. It can be deduced from responses to items 1 and 2 that; males tend to be more active participants in mathematics lesson; they talk more and ask questions; they tend to dominate in group discussions as a result, they ignore females' ideas and requests, that females do not like to volunteer or ask questions due to fear of being incompetent in front of males. Similar to this finding is the finding of Fennema et al. (1990) who found that teachers rated high-performing boys as more competitive, logical, enjoying mathematics more, being more independent, and volunteering answers more often than they did their top-performing girls.

Furthermore, the sampled tutors seemed to hold more growth mind-sets, agreeing that males participate actively in mathematics lessons than females in the college (60%), males are more confident about solving mathematical problems than females in the college (60%) and male students have more interest in mathematics as a subject than female students (80%). These findings imply that in terms of overall performance male students were performing much better as compared to the females and this is evident from the end of semester exams score in Table 4.6 where the males had a mean of 70.70 against females' mean of 64.35. These findings match those of a study by Benbow & Stanley (1980) as cited by Sam (2015) which revealed that traditionally, males' academic performance was considered superior to that of females especially in male dominated subjects like mathematics and sciences because of higher levels of innate spatial ability.

Teachers can play a significant role in shaping students' attitudes towards learning, and in encouraging them to work to the best of their abilities. This is because students often learn more from teachers' actions and speech. Findings from Table 4.13 indicates that tutors expressed strong agreement with statements regarding mathematics requiring innate ability and motivation. Thus, all the tutors (100%) agreed that they encourage their students to work together with their classmates during lessons and they make their students feel they have the ability to go on in mathematics. Therefore, for a tutor, being able to interact with the student and display positive behavior such as asking questions, understanding their thoughts, showing interest and appreciation increases the students' motivation and success. This finding is in line with the finding in Frymier (1993) as cited by Ulug, Ozden & Eryilmaz (2011) where results of the study showed that teachers' nonverbal actions such as smiling, having a relaxed stance, various gestures and facial expressions come first in improving the learning experience for students whereas the topic of the class itself comes in second.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.0. Overview

This final chapter is represented in five sections. The first section contributes to an overall summary of the study followed by the summary of the major findings. Subsequent to these are the conclusions, recommendations and suggestions for future research.

5.1. Summary of the Study

The driving force of this study was to explore the gender differences in pre-service teachers' performance in mathematics and related factors influencing it in Enchi College of Education in the Western North of Ghana. Specifically, the study aimed at: determining the differences between Enchi College of Education male and female pre-service teachers' performance in mathematics; examining gender related factors that influence pre-service teachers' performance in mathematics in Enchi College of Education; and examining pre-service teachers' and their mathematics tutors' views about gender differences in pre-service teachers' performance in mathematics in Enchi College of Education.

Further, this study was guided by three research questions. Research Question 1 determined the differences between Enchi College of Education male and female pre-service teachers' performance in mathematics using the scores obtained in end of semester one exams – 2019/2020 academic year. Descriptive statistics (means, standard deviation, frequencies, and percentages), inferential statistics (independent t-test) were used to analyse the Research Question 1, to find out the mean performances of male and female participants.

Research Question 2 examined some gender related factors that influence pre-service teachers' performance in mathematics in Enchi College of Education. Questionnaires were used to analyse Research Question 2. Finally, Research Question 3 also examined pre-service teachers' and their mathematics tutors' views about gender differences in pre-service teachers' performance in mathematics. Questionnaires were used to analyse Research Question 3.

The study adopted the descriptive design with qualitative and quantitative approach of data collection. The population consisted of all 350 first year (Level 100) students in the college offering different courses (J.H.S. Education, Primary Education, Early Grade Education and French Education) and 6 mathematics tutors. The sampling technique used was purposive and simple-random sampling for the selection of pre-service teachers respectively. In all, 120 students and 5 tutors constituted the sample for the study.

5.2. Findings of the Study

The findings of the study are classified according to the research questions. They are presented under the three sub-headings in line with the research questions in this section.

Research Question 1: How different is the performance in mathematics of male and female pre-service teachers in Enchi College of Education?

The study proved that there was statistically significant different is the performance in mathematics of male and female pre-service teachers in Enchi College of Education The pre-service teachers' end of first semester (2019/2020) examination results revealed that male students outperformed female students in mathematics. This was evident in the hypothesis test where H_0: There is no statistically significant difference between Enchi

College of Education male and female pre-service teachers' performance in mathematics" was rejected. Again, it was revealed that male students performed better than females. The mean of (M=70.70) and (M=64.35) of the male and female students respectively showed that male students performed better than female students in the end of semester one Mathematics examination.

Research Question 2: What gender related factors influence pre-service teachers' performance in mathematics in Enchi College of Education?

The findings of this study revealed that there were disparities between male and female high mathematics anxiety. Thus, female pre-service teachers' level of Mathematics anxiety was very high as compared to their male counterparts in the college. Additionally, the findings showed that social-culture factors limited female pre-service teachers' freedom of studying Mathematics resulting in their loss of confidence and interest in Mathematics. The findings further showed that self-concept/confidence had a significant influence on pre-service teachers' performance in mathematics. The way pre-service teachers perceived themselves in relation to their mathematical abilities and their beliefs about their capacity to succeed in mathematical tasks had impact their actual performance. Thus, it was evident that males had higher self-perceptions of their math abilities than their female counterparts who often exhibited fewer positive attitudes toward mathematics and less interest in mathematics.

The researcher, again found that economic challenges among students in Enchi College of Education was insignificant. This is because, more than half of the respondents (73%) reside in the Western North region where cocoa farming and small-scale mining is predominant. This was evident from their responses to items in Table 4.11 where more than half of the respondents, 64.2% and 51.7% respectively disagreed that they do not have enough mathematics-related materials that helped in understanding mathematics concepts as well as financial support in aid of buying mathematics materials. Finally, the findings revealed that inside school factors play a significant role in shaping students' experiences and outcomes in mathematics. It was found that the quality of teaching, classroom environment, curriculum design, and other elements within the school setting influenced pre-service teachers’ engagement, understanding, and performance in mathematics.

Research Question 3: What are pre-service teachers’ and their mathematics tutors’ views about gender differences in pre-service teachers’ performance in mathematics in Enchi College of Education?

Mathematics tutors in Enchi College of Education held diverse views on gender and mathematics performance with some believing it is mainly suited for male students while others held the view that it was suitable for all learners irrespective of gender as it is evident in the findings. These views are informed mainly by the constant underperformance of female students in the subject. Tutors’ views were found to influence gender differences in performance in mathematics with the main effect being negative as the negative views could cause tutors to give more mathematical assistance to males, which would improve their knowledge of the subject content and overall performance while neglecting to offer the same assistance to female students. It was further found from the tutors that being able to interact with your students and display positive behaviour such as asking questions, understanding their thoughts, showing interest and appreciation, increases their level of motivation and interest in Mathematics which would enhance their performance.

5.3. Conclusion

There is statistically significant different is the performance in mathematics of male and female pre-service teachers in Enchi College of Education with males generally outperforming the female pre-service teachers. However, there were instances where some female pre-service teachers outperformed some pre-service teachers in the end of semester (2019/2020) exams. Further, based on the evidence presented in the data, it can be concluded that male and female pre-service teachers have different levels of self-concept/self-confidence and anxiety when it comes to learning Mathematics. The self-concept and anxiety of the students need to be improved because their self-concept and anxiety have a contribution to their performance. Additionally, the researcher also concludes that various student-related perspectives influence gender difference in performance with all the studied perspective positively favouring males' performance and not females.

However, in some cases (example, economics factors) the differences were not significant based on the variables in question as the findings showed. Students had access to materials that aid in the teaching and learning of Mathematics which could enhance their performance. Moreover, the researcher also concludes that in some instances school-related variables affect females' performance negatively while favouring positive performance among male pre-service teachers.

Lastly, the researcher concludes that tutors' views especially both inside and outside classroom have negative influence on females' performance and positive influence on males' performance in mathematics.

Therefore, although mathematics is not a favourite subject of all students, there are strategies tutors can employ to help reduce mathematics anxiety and foster positive mathematics dispositions in students through self-expression of varying oral and written forms. By confronting mathematics anxiety in students' early years, they may be more apt to engage with more advanced mathematics in their later years which can open up many possibilities that may have otherwise been limited to them in their lives.

5.4. Recommendations

Considering the findings and conclusions drawn from the study, the following recommendations have been made for college curriculum planners, policy makers, tutors and other stakeholders in education with reference to the teaching and learning of Mathematics in Colleges of Education in Ghana:

1. It is recommended that further training in gender sensitive techniques through workshops should be organized for tutors by the Gender, Equality and Social Inclusion Unit and the Quality Assurance Unit in collaboration with the College Management, to transform the negative attitudes and behaviours toward gender-related issues in classrooms.
2. Again, addressing inside school factors involves ongoing efforts to improve teaching practices, curriculum design, and the overall mathematics learning environment. A positive and supportive school setting contributes to students' mathematical success and fosters a lifelong appreciation for the subject.

3. The College need to identify specific school environment issues that the female students are finding problems with and that are negatively affecting their performance if these are to be effectively addressed.

4. In addition, on the causes of gender differences in Mathematics performance of students, tutors should adopt appropriate teaching and learning resources and materials to facilitate students' understanding as well as encouraging the students to put up their best during instructional process while College counsellors should orient the students, especially those with negative perception about the nature of Mathematics.

5. As the study revealed, tutors' opinions regarding mathematics and gender also have negative influence on gender differences in mathematics performance. Therefore, there should be a sensitization training for mathematics tutors by the Mathematics Unit in collaboration with GESI and the Quality Assurance Unit, in order to change the mentioned negative opinions they hold. Tutors found to discriminate on students based on gender while teaching should be called to order by the Academic Board of the College and the Quality Assurance Unit, in order to deter the development of negative opinions that have consistently influenced gender differences in mathematics performance.

5.5. Suggestions for Further Research

With reference to this research and its limitations, the following suggestions are proposed for further research:

1. The impact of environment on Mathematics performance of female pre-service teachers in the Colleges of Education.
2. The impact of home background on Mathematics performance of students in Colleges of Education.
3. The impact of classroom streaming on gender differences in Mathematics performance in co-educational schools.
4. Factors influencing Mathematics performance in single sex Colleges in Ghana.

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APPENDICES

APPENDIX A

QUESTIONNAIRE FOR PRE-SERVICE TEACHERS

UNIVERSITY OF EDUCATION, WINNEBA

DEPARTMENT OF MATHEMATICS EDUCATION

This questionnaire is designed to help the researcher to collect data on "Gender Differences in Pre-Service Teachers' Performance in Mathematics and Factors Influencing It: A Case Study of Enchi College of Education". This is purely for academic purpose thus; your responses and comments will be treated with absolute confidentiality. You are therefore kindly requested to provide sincere and objective responses to the questions. Your honest response to this questionnaire will make this study a success. Obviously, this is not a test and hence there is no wrong or right answer, so be sure not to omit any items.

INSTRUCTIONS

Please express the extent of your agreement with each statement by ticking the most appropriate box of each statement which corresponds most closely to your desired response. However, if you want to change your answer, please cross out and tick another box.

SECTION A: Demographic Information

Gender	☐ Male	☐ Female
Age Group	☐ 18 – 21	☐ 22 – 25
	☐ 26 – 29	☐ 30 and Above

Course ☐ Early Grade Education ☐ Primary Education

☐ JHS Education ☐ French Education

SECTION B: Gender Related Factors Influence Pre-Service Teachers' Performance in Mathematics in Enchi College of Education

Tick the most appropriate box of each statement.

S/N	Statement	SD	D	N	A	SA
1	Mathematics makes me feel uncomfortable.					
2	I am always worried about being called on in mathematics class.					
3	I fear mathematics tests more than any other subject.					
4	I have limited time to study due to other intervening activities that I undertake.					
5	Social interaction and discussion do not help me to learn and understand mathematics better.					
6	Tasks that are free from cultural biasness do not motivate me to learn mathematics.					
7	I don't have enough self-confidence when it comes to mathematics.					
8	I am unhappy in Mathematics class than any other class.					
9	I don't have confidence when called upon to answer mathematics questions in class.					
10	The occupation of my parents does not influence my interest and academic performance in mathematics.					
11	I don't have enough mathematics-related materials that help in understanding mathematics concepts.					
12	There is always inadequate financial support in aid of buying mathematics materials.					
13	My classmates do not encourage me to take mathematics at all levels.					
14	I am afraid to ask questions in mathematics class.					

APPENDIX B

QUESTIONNAIRE FOR TUTORS

UNIVERSITY OF EDUCATION, WINNEBA

DEPARTMENT OF MATHEMATICS EDUCATION

This questionnaire is designed to help the researcher to collect data on "Gender Differences in Pre-Service Teachers' Performance in Mathematics and Factors Influencing It: A Case Study of Enchi College of Education". This is purely for academic purpose thus; your responses and comments will be treated with absolute confidentiality. You are therefore kindly requested to provide sincere and objective responses to the questions. Your honest response to this questionnaire will make this study a success. Obviously, this is not a test and hence there is no wrong or right answer, so be sure not to omit any items.

INSTRUCTIONS

Please express the extent of your agreement with each statement by ticking the most appropriate box of each statement which corresponds most closely to your desired response. However, if you want to change your answer, please cross out and tick another box.

SECTION A: Demographic Information

Gender ☐ Male ☐ Female

Highest Qualification ☐ B.Ed/B.Sc/B.A ☐ M.Phil./M.Ed/M.A

☐ PhD

Status ☐ Tutor ☐ Assistant Tutor

Number of years taught in the college ☐ 1 – 5 ☐ 6 – 10 ☐ 11 and Above

SECTION B: Views of Mathematics Teachers on Gender Differences in Mathematics Performance

Tick the most appropriate box of each statement.

S/N	Statement	SD	D	N	A	SA
1	Most females in Enchi College of Education outperform males in mathematics.					
2	Most males generally outperform females in mathematics in Enchi College of Education					
3	Males participate actively in mathematics lessons than females in Enchi College of Education					
4	Males are more confident about solving mathematical problems than females in Enchi College of Education					
5	Male students have more interest in mathematics as a subject than female students					
6	I encourage my students to work together with their classmates during lessons.					
7	I make my students feel they have the ability to go on in mathematics					
8	Talking to my students about math has usually been a problem.					

APPENDIX C

QUESTIONNAIRE FOR PRE-SERVICE TEACHERS

UNIVERSITY OF EDUCATION, WINNEBA

DEPARTMENT OF MATHEMATICS EDUCATION

This questionnaire is designed to help the researcher to collect data on "Gender Differences in Pre-Service Teachers' Performance in Mathematics and Factors Influencing It: A Case Study of Enchi College of Education". This is purely for academic purpose thus; your responses and comments will be treated with absolute confidentiality. You are therefore kindly requested to provide sincere and objective responses to the questions. Your honest response to this questionnaire will make this study a success. Obviously, this is not a test and hence there is no wrong or right answer, so be sure not to omit any items.

INSTRUCTIONS

Please express the extent of your agreement with each statement by ticking the most appropriate box of each statement which corresponds most closely to your desired response. However, if you want to change your answer, please cross out and tick another box.

SECTION A: Demographic Information

Gender ☐ Male ☐ Female

Age Group ☐ 18 – 21 ☐ 22 – 25

☐ 26 – 29 ☐ 30 and Above

Course ☐ Early Grade Education ☐ Primary Education

☐ JHS Education ☐ French Education

SECTION B: Views of Pre-service Teachers on Gender Differences in Mathematics

Performance

Tick the most appropriate box of each statement.

S/N	Statement	SD	D	N	A	SA
1	Most females in Enchi College of Education outperform males in mathematics.					
2	Most males generally outperform females in mathematics in Enchi College of Education					
3	Males participate actively in mathematics lessons than females in Enchi College of Education					
4	Males are more confident about solving mathematical problems than females in Enchi College of Education					
5	Male students have more interest in mathematics as a subject than female students					
6	My mathematics tutor encourages me to work together with my classmates during lessons					
7	My mathematics tutor makes me feel I have the ability to go on in mathematics					

APPENDIX D

END OF SEMESTER EXAMINATION SCORES OF SAMPLED PRE-SERVICE TEACHERS

S/N	Ind. No.	Score	S/N	Ind. No.	Score	S/N	Ind. No.	Score
1	10848741	69	**41**	10858846	66	**81**	10858951	80
2	10858727	63	**42**	10858935	62	**82**	10858952	70
3	10858731	65	**43**	10858849	62	**83**	10858953	83
4	10858732	70	**44**	10858851	70	**84**	10858954	55
5	10858735	62	**45**	10858857	81	**85**	10858955	67
6	10858737	70	**46**	10858858	80	**86**	10858957	73
7	10858740	66	**47**	10858859	66	**87**	10858962	54
8	10858743	69	**48**	10858861	50	**88**	10858970	58
9	10858745	79	**49**	10858862	50	**89**	10858971	78
10	10858749	73	**50**	10858863	56	**90**	10858972	67
11	10858750	64	**51**	10858864	78	**91**	10858978	63
12	10858751	88	**52**	10858867	59	**92**	10858980	67
13	10858754	85	**53**	10858868	65	**93**	10858987	83
14	10858760	75	**54**	10858876	76	**94**	10858989	61
15	10858762	84	**55**	10858878	62	**95**	10858990	73
16	10858763	87	**56**	10858879	51	**96**	10858991	76
17	10858764	75	**57**	10858880	74	**97**	10858995	64
18	10859079	78	**58**	10858881	65	**98**	10859001	85
19	10858768	66	**59**	10858884	81	**99**	10859004	66
20	10858774	81	**60**	10858886	78	**100**	10859009	62
21	10858776	63	**61**	10858896	56	**101**	10859012	88
22	10858784	64	**62**	10858897	63	**102**	10859015	58
23	10858793	80	**63**	10858898	56	**103**	10859018	74

24	10858796	69	**64**	10858899	68	**104**	10859021	50
25	10858799	78	**65**	10858903	74	**105**	10859027	57
26	10858801	66	**66**	10858906	72	**106**	10859030	65
27	10858802	55	**67**	10858912	46	**107**	10859040	84
28	10858807	73	**68**	10858920	75	**108**	10859042	54
29	10858808	71	**69**	10858923	53	**109**	10859046	76
30	10858810	74	**70**	10858925	57	**110**	10859048	71
31	10858814	54	**71**	10858926	63	**111**	10859049	57
32	10858817	62	**72**	10858928	64	**112**	10859055	55
33	10858914	64	**73**	10858929	55	**113**	10859060	62
34	10858820	56	**74**	10858932	72	**114**	10859061	62
35	10858824	66	**75**	10858937	55	**115**	10859063	48
36	10858829	67	**76**	10858938	64	**116**	10859073	65
37	10858831	84	**77**	10858939	74	**117**	10859076	68
38	10858836	65	**78**	10858945	66	**118**	10859077	71
39	10858837	52	**79**	10858947	71	**119**	10859082	79
40	10858841	63	**80**	10858950	80	**120**	10858927	63