UNIVERSITY OF EDUCATION, WINNEBA

STUDENTS' PERCEPTIONS AND THEIR INTEREST IN MATHEMATICS: THE CASE OF SENIOR HIGH SCHOOLS IN YENDI MUNICIPALITY OF NORTHERN REGION

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DECLARATION

Student's Declaration

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

NAME OF STUDENT: ABDUL-JALIL ABUBAKARI

SIGNATURE……..

DATE……..

Supervisor's Declaration

I hereby declare that the presentation of this dissertation was done in accordance with the guidelines for supervision of dissertation laid down by the University of Education, Winneba.

NAME OF SUPERVISOR: DR. JONES APAWU

SIGNATURE……..

DATE……..

DEDICATION

This work is dedicated to my parents, Mr. Abdul-Rahman Abukari and Madam Alhassan Fatima (late) for their care and support throughout this work. I also dedicate this piece to my siblings for their support and finally to my lovely wife, madam Issahaku Jamila Chimsi for her care and support throughout this work.

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LIST OF ABBREVIATIONS

ACCT	Affective-Cognitive Consistency Theory
CRDD	Curriculum Research and Development Division
FA	Factor Analysis
GES	Ghana Education Service
HND	High National Diploma
HODs	Head of Departments
IBM	International Business Machines
ICT	Information and Communication Technology
JHS	Junior High School
JSS	Junior secondary school
KMO	Kaiser-Meyer-olkin
MAT	Mathematics Achievement Test
MOE	Ministry of Education
NaCCA	National Council for Curriculum and Assessment
SHS	Senior High School
SHTS	Senior High / Technical School
SSS	Senior Secondary school
SRS	Simple Random Sampling
SPSS	Statistical package For Social Sciences
UNESCO	United Nations Educational, Scientific and Cultural Organization
WAEC	West Africa Examination council
WASSCE	West Africa Senior School Certificate Examination

ABSTRACT

The purpose of the study was to investigate students' perception of mathematics and their interest in learning mathematics as well as the sources of their perceptions. The population for the study constitutes final year senior high school students in the Yendi municipality of the Northern Region of Ghana. The study employed a survey design of 100 sampled final year students from the senior high schools in the Yendi Municipality. The study used questionnaire and Mathematics Achievement Test (MAT) as instruments to collect data. MAT was used to collect quantitative data and the questionnaire was used for both qualitative and quantitative data. The study also used IBM SPSS (version 23) to analyse the quantitative data. The data was expressed in percentages, means and standard deviations obtained. In addition, factor analysis was conducted to determine factors that lead to student's perception of mathematics. Qualitative data was analysed thematically. The results showed that the students in Yendi municipality had high interest in learning mathematics, and they have some negative perceptions of mathematics. Amongst them include, mathematics is all about calculation, and mathematics activities include procedures that are devoid of real-life discovery and problem solving. The study found that students' performance in mathematic was affected by their perceptions of the subject. The study suggests that mathematics teachers adopt motivational strategies to increase students' interest levels in learning mathematics. Educational stakeholders should educate students about the relevance of mathematics in the society for them to develop positive perceptions which in turn can increase their performance in mathematics.

CHAPTER 1

INTRODUCTION

1.0 Overview

This chapter presents and discusses the background of the study. The problem, which necessitated this study, is also stated. The chapter further discussed the objective of the study, the research questions, and the significance of the study, delimitations, and limitations of the study. The chapter concludes with the organization of the study.

1.1 Background of the Study

The study of mathematics is important to the development of nations. Among them is the training of professionals capable of managing the country's finance and economy, development of science and technology by equipping students with uniquely powerful ways to describe, analyze and change the world and help develop in youth and adults an attitude of discovery, problem-solving and inductive and deductive reasoning (Bruce, 2016). Today, mathematics is seen as an engine for the development of all scientific disciplines. It is indirectly used in all facets of life. Mathematics plays a significant role in the life of an individual either private, social, or civil life (Anthony & Walshaw, 2009). This explains why students study mathematics at all levels of education. Considering the important nature of mathematics in our school curriculum, it will be suicidal for students to dislike it. Souza (2020) opined that a student's perception of mathematics is derived from their exposure to the subject matter.

The perception of students of Mathematics is crucial to stakeholders in education as they quest to find a lasting solution to the problem of poor performance and lack of interest in Mathematics. These perceptions of learners of Mathematics may be a result of experiences learners have gone through at their early stages in their educational life (Taylor & Graham 2007; Waugh & Su-Searle, 2014). Ali et al., (2013) pointed out that

the experiences learners go through in their academic life sum up to form factors that contribute to the disliking of Mathematics as a subject. It is high time educational policymakers and mathematics educators focus on the sources of students' perceptions of mathematics, how to correct the negative perceptions to boost their interest in mathematics, which is key to students' mathematics performance and achievement.

As suggested by Arthur et al., (2017), in their study of "Triangular law of students' mathematics interest in Ghana: A model with motivation and perception as predictors", Ghanaian students' interest in mathematics is significantly and positively predicted by their perception and motivation about mathematics. Again, students' perception of mathematics predicts their motivation to learn mathematics significantly. They concluded that improving students' motivation for studying mathematics and their perception of mathematics could improve student interest in mathematics. From their study, perception is the foundation of student motivation and student interest in mathematics, which are inevitable factors that influence student achievement in mathematics. In addition, Adae and Adyei (2018) in a study of high school students' attitudes towards the study of mathematics and their perceived teachers' teaching practices concludes that in maintaining positive attitudes of students towards the study of mathematics, mathematics teachers should integrate effective communication skills and good classroom management in their practices.

In Ghana, like in many other developing countries, mathematics education was keen even in the colonial era, a time when religious education was most considered in schools. Annabelle-Addo (1980) as cited by Serebour (2013) expounds on the colonial-era history of mathematics education, where arithmetic was taught as part of the curriculum to improve commercial activities. It is therefore not surprising that in Ghana, mathematics is considered a core subject in the basic and second cycle schools (Primary, Junior High

School, and Senior High School). Mathematics as a core subject is an integral part of the school placement system in Ghana. A student must have a pass in mathematics, which is a core subject for admission into Senior High Schools in Ghana. Consequently, a Ghanaian student is required to pass three core subjects, including mathematics, before they can gain admission to Colleges or any Tertiary institutions.

According to the CRDD (2012), mathematics education is considered as an essential area of learning and that everyone needs to develop mathematical concepts and skills to understand and play its role in society. Moreover, Serebour (2013) explains that the real reason for teaching mathematics is to ensure that all Ghanaian youth acquire the skills, ideas, attitudes, and mathematical values they need to succeed in their careers and their daily lives.

However, mathematics performance (achievement) has become a serious threat to the educational progress and advancement of students. This, in some cases, has been attributed to their perceptions of the subject in Ghana (WAEC, 2011). The poor performance of students in mathematics has been fundamental for Ghana and the world at large, as evidenced by national and international reports. For example, the performance of BECE students over the last 18 years has been very worrying. The West African Examination Council (WAEC) reports suggesting that over 50% of the entire students who sat for the examination failed in mathematics and declined to about a 40% point in 2000 to 2005 and 2006 to 2010 respectively. The poor performance is again evident in the school placement statistics. In 2008, for instance, out of the 338,292 candidates who took part in the BECE, only 210, 282 representing 62.16% qualified and placed into second cycle institutions. In the following year, 2009, 395,649 students sat for the exams, and only 198,642 of them accounting for 50.21% passed and ended up in second-cycle institutions. Ghana has continued to witness the poor performance of BECE candidates

in percentage wise thus 49.12% and 46.93% in 2010 and 2011 respectively (Okyere-Darko, 2011).

1.2 Statement of the Problem

One of the major objectives of educators is to make the classroom environment more stimulating to improve students' cognitive and affective outcomes (Tran, 2012; Sieberer-Nagler, 2016). Mathematics teachers' interest is to motivate students to apply mathematics to real-life situations. Despite the importance of the subject, students usually perceived it as boring, cold, difficult, abstract, and not practical (Ignacio et al., 2006; Mazana et'al., 2019). These negative perceptions held by students, if not reversed could impact negatively on their interest and subsequently, their attitudes and performance.

Students' negative attitude demonstrated in mathematics has been linked to their lack of motivation and interest as well as their negative perceptions towards the subject (Mensah et al., 2013; Arthur et al., 2017). According to research, SHS students, who negatively perceive mathematics, demonstrate different negative attitudes in expressing their dislike for the subject (Asante, 2012; Elçi, 2017; Adae & Adyei, 2018; Davadas & Lay, 2018; Mazana et al., 2019).

In Ghana, Students' performance (achievement) in Mathematics over the years has become a challenge to policymakers; the Ministry of Education and its allied agencies are making frantic efforts to curb the situation. The West African Examination Council (WAEC) report on mathematics in recent years has identified the challenge of poor performance of students in the Basic Education Certificate Examination (BECE), though, in some years, a minimal improvement was recorded. More emphatically, the Chief examiners report, WAEC (2011), on mathematics expressed concern about the poor performance of students and thus, suggested a change in attitude and perception towards the subject and in most cases students' approach to answering questions.

Even till date, there is dearth of knowledge on factors behind students' perceptions of mathematics, their interests in mathematics, attitudes toward mathematics and subsequently their performance in mathematics. As a result, this study seeks to investigate students' perceptions of mathematics, their interest in learning mathematics in the Yendi municipal of the Northern Region.

1.3 Purpose of the Study

The purpose of this study was to investigate students' perceptions of mathematics and their interest in learning mathematics as well as the factors that influences the student perceptions.

1.4 Objectives

The objectives of the study were to:

1. Assess students' level of interests in learning mathematics in Yendi Municipality.
2. Determine students' perceptions of Mathematics in Yendi Municipality.
3. Ascertain the factors that influence students' perceptions of Mathematics in Yendi Municipality.
4. Determine the relationship between students' perception of mathematics and their performance in mathematics in Yendi Municipality.

1.5 Research Questions

The following research questions guided the study:

1. What are students' level of interests in learning mathematics in Yendi municipality?
2. What are students' perceptions of mathematics in the Yendi municipality?
3. What factors influence students' perceptions of Mathematics in Yendi municipality?
4. What is the relationship between students' perceptions of mathematics and their performance in mathematics in Yendi Municipality?

1.6 Significance of the Study

This study was worth undertaking because students' negative attitudes they demonstrate toward mathematics due to their negative perceptions are so appalling that, frantic measures need to be taken to curb that attitude. Some of the negative attitudes include; dodging mathematics lessons in class, not submitting mathematics assignments for marking, feeling reluctant to contribute to mathematics lessons, unreasonable hatred of mathematics teachers and so many others. The consequences of these negative attitudes manifest in their performance in the end of school examination (WASSCE). The study is on, students' perceptions of mathematics, their interest in learning mathematics and subsequently their academic performance. It will serve as a whistle blow for stakeholders to address student perceptions and its effects on students' academic performance. Furthermore, the outcome of the study made recommendations that can change the perceptions of students, teachers, parents, and the public about mathematics. The study will have demystified mathematics of the unsubstantiated beliefs, which will at large, encouraged more people to pursue mathematics and mathematics-related programs at tertiary institutions. Finally, the finding of the study will serve as a foundation for further research work on student perceptions, interests, and attitudes towards mathematics.

1.7 Delimitations of the Study

This study was conducted to investigate students' perceptions and their interest in mathematics in the Yendi Municipality of the Northern region of Ghana. The study focused on only SHS final year students for the 2021/2022 academic year because they had enough experience in their schools than their counterparts in the first and second years. As such, the results from this study cannot be generalized beyond this group of students. The study was also confined to only the students' perceptions and interest in Mathematics.

1.8 Limitations of the Study

The study was affected by time constraints and participants' availability to take part in the study. The study was conducted at a time participants were taking their mock examination, in preparation for their final school examination. This made it difficult to get all participants together at a time.

1.9 Organization of the study

The thesis is organized into five (5) chapters. Chapter one (1) includes the general introduction such as the background of the study, statement of the problem, the objectives of the study, research questions, significance of the study, delimitations of the study, Limitations of the study, and organization of the study. Chapter two (2) contains the literature review, which spells out other works on the subject area. Chapter three (3) discussed the methodologies used for the study. Chapter four (4) looks at the presentation of the research findings and analysis. Chapter five (5) of the study includes a summary of key findings, recommendations, and conclusion.

CHAPTER 2

LITERATURE REVIEW

2.0 Overview

This chapter reviewed related literature relevant to this study. The chapter involves identifications, and analysis of documents with related information to the research problem. The chapter made explicit, the contributions of other researches on the subject matter as well as the gaps identified. The review was done under the following subheadings: theoretical framework, the conceptual framework of the study, the concept of perception, sources of students' perceptions of mathematics, Negative students' perceptions of mathematics, students' perceptions and interest in mathematics, students' perceptions, interest, and attitude towards mathematics, and students' perceptions, interest, attitudes and performance in mathematics.

2. 1 Theoretical Framework

Two theories, The Affective-Cognitive Consistency Theory by Rosenberg (1968), and the Self-Perception Theory by Daryl J. Bem, (1972) supported this study.

2.1.1 The Affective-Cognitive Consistency theory

The Affective-Cognitive Consistency Theory (ACCT) is a psychological theory that explains how individuals strive to maintain consistency between their emotions and their thoughts (Abelson, 1963). According to the theory, individuals experience discomfort or dissonance when they perceive a discrepancy between their emotions and their thoughts. In order to reduce this discomfort, individuals will attempt to change either their emotions or their thoughts to achieve consistency.

The ACCT has been used to explain a wide range of human behaviors, including attitudes, decision-making, and persuasion. For example, the theory suggests that individuals are more likely to change their attitudes when they perceive a discrepancy

between their attitudes and their behavior (Fazio & Zanna, 1978). This is known as the "attitude-behavior consistency principle" and suggests that individuals strive to maintain consistency between their attitudes and their behavior.

The ACCT has also been used to explain the role of emotions in decision-making. For example, a study by Lerner and Keltner (2000) found that individuals who experienced disgust were more likely to make risk-averse decisions. This supports the idea that individuals strive to maintain consistency between their emotions and their thoughts.

The ACCT has been used to explain the effectiveness of persuasive messages. According to the theory, persuasive messages are more effective when they are consistent with an individual's existing beliefs and emotions (Eagly & Chaiken, 1993). This suggests that individuals are more likely to be persuaded by messages that are consistent with their existing attitudes and emotions.

Overall, the Affective-Cognitive Consistency Theory has important implications for understanding human behavior. Its insights into how individuals strive to maintain consistency between their emotions and their thoughts have important implications for understanding attitudes, decision-making, and persuasion.

The ACCT has also been used to explain the role of cognitive dissonance in attitude change. According to the theory, when individuals experience cognitive dissonance, they will attempt to reduce it by changing one or more of their attitudes or beliefs (Festinger, 1957). For example, a study by Cooper and Fazio (1984) found that individuals were more likely to change their attitudes towards an issue when they were presented with information that was inconsistent with their existing beliefs. This supports the idea that individuals strive to maintain consistency between their attitudes and their thoughts.

Capuno et al., (2019) explain Affective-Cognitive Consistency theory (ACCT) that, the changes in the individual's affective component will produce changes in one's cognitive

component so that it will bring consistency between the two components. The students' feelings towards the subject will affect how they perform on the subject. A student with a negative perception and attitude towards mathematics will think they will not do well in mathematics. However, a student with a positive perception and attitude towards mathematics will be motivated to perform well because they think they are capable of achieving in the subject.

2.1.2 The Self-Perception theory

The Self-Perception theory was used collaboratively with the Affective-Cognitive Consistency theory. The concept of Self-Perception is based on the assumption that people are what they do (Bem, 1967). The theory was developed by Daryl J. Bem (1972) and has two assertions. The first assertion is that people become aware of their inner states, such as attitudes and beliefs, by assessing their behaviors and the circumstances under which these behaviors occur (Bem, 1972). The second assertion is that individuals who do not have a clue of their internal states are in the same position as external observers who have to rely on external clues of their behavior to deduce or infer their internal states (Bem, 1972). In short, people depend on their behaviors and the circumstances in which these behaviors occur, to infer their inner states such as beliefs and attitudes.

The self-perception theory has been used to explain a wide range of human behaviors, including academic achievement, motivation, and social influence. In terms of academic achievement, the self-perception theory has been used to explain how students develop their attitudes towards academic subjects. For example, a study by Wigfield and Eccles (1992) found that students' perceptions of their own competence in mathematics were related to their interest and achievement in the subject. This supports the idea that individuals infer their attitudes and beliefs based on their own behavior.

The self-perception theory also explains how individuals can change their attitudes and beliefs through their behavior. For example, if a student who previously had a negative attitude towards mathematics starts to perform well in the subject, they may start to develop a more positive attitude towards it. This is known as the self-perception theory's "over justification effect" (Bem, 1967). The over justification effect suggests that when individuals receive external rewards for performing a task that they already enjoy, they may start to attribute their behavior to the external reward rather than their own intrinsic motivation.

According to the self-perception theory, individuals infer their attitudes and beliefs based on their own behavior and the context in which it occurs (Bem, 1967). For example, if a student performs well in mathematics, they may infer that they are good at math and develop a positive attitude towards the subject. Conversely, if a student performs poorly in mathematics, they may infer that they are not good at mathematics and develop a negative attitude towards the subject.

It is based on the argument that individuals interpret their actions the same way they interpret others' actions and every individual's action is influenced by social surroundings and not influenced by one's free will (Bem, 1972). In other words, an individual's actions are interpreted by the way they interpret others and one's actions are most of the time influenced by others and not of one's own free will as they would expect (Capuno et al, 2019). Similarly, in the case of the students where most of them think mathematics is difficult, they tend to have the same feelings as others. Thus, whenever they do not understand the lessons in mathematics, they have the possibility of thinking that, they are not alone. Therefore, students justify their performance on the premise that most of their colleagues do not like mathematics because it is difficult and so they do. However, if the student feels the other way, then they would develop a positive attitude

towards the subject because they can justify why they like the subject. With this, willingness and the intrinsic motivation of the student to learn the subject, they can develop an interest in learning the subject.

2.2 Conceptual Framework

According to Al-hassan (2015), a conceptual framework is a model that allows the researcher to explore and study the relation nship among variables in a logical and prescribed fashion. It is a presentation or a model in which the researcher conceptualizes or represents the variables in the study graphically or diagrammatically. The diagram Figure 2.1 represents the structure or the pictorial view of the entire research study work. The conceptual framework as presented in Figure 2.1 illustrates how positive and negative student perceptions about mathematics can result in good and poor student performance in the WASSCE examination. Students' perceptions about mathematics originate from varied sources that span across their formal Junior High schools, home, the school, peers, and mathematics teachers' practices. Students' negative perceptions and beliefs about mathematics leave students with nothing but low interest in learning mathematics, which compels students to demonstrate negative attitudes leading to poor performance in mathematics. On the contrary, students with positive perceptions develop a high interest in mathematics lessons, and positive attitudes that result from their interest earn them good performance in their end-of-school examinations. This study, therefore, explores the genesis of students' lack of interest in mathematics, of which student perception is key. Students' attitudes relating to attendance to school, class participation, preparedness for mathematics classes, punctuality and regularity to mathematics class, skipping classes and coming to school unprepared without books, and homework, are negative attitudes that lead to poor performance in students' end-of-school examinations.

When students perform poorly in their WASSCE examination, the sources of their perceptions are confirmed. (i.e. Parents say mathematics is difficult, brothers and sisters in the house say mathematics is for boys, mathematics is for the nerds, etc.). Similarly, when they perform well in their end-of-school examination, (WASSCE), their sources of perceptions are confirmed. (ie mathematics is not difficult, with continuous practice; one can pass mathematics, hard work can make you pass mathematics, etc.). The diagram below is a cycle that represents the conceptual framework of the study.

Conceptual Framework

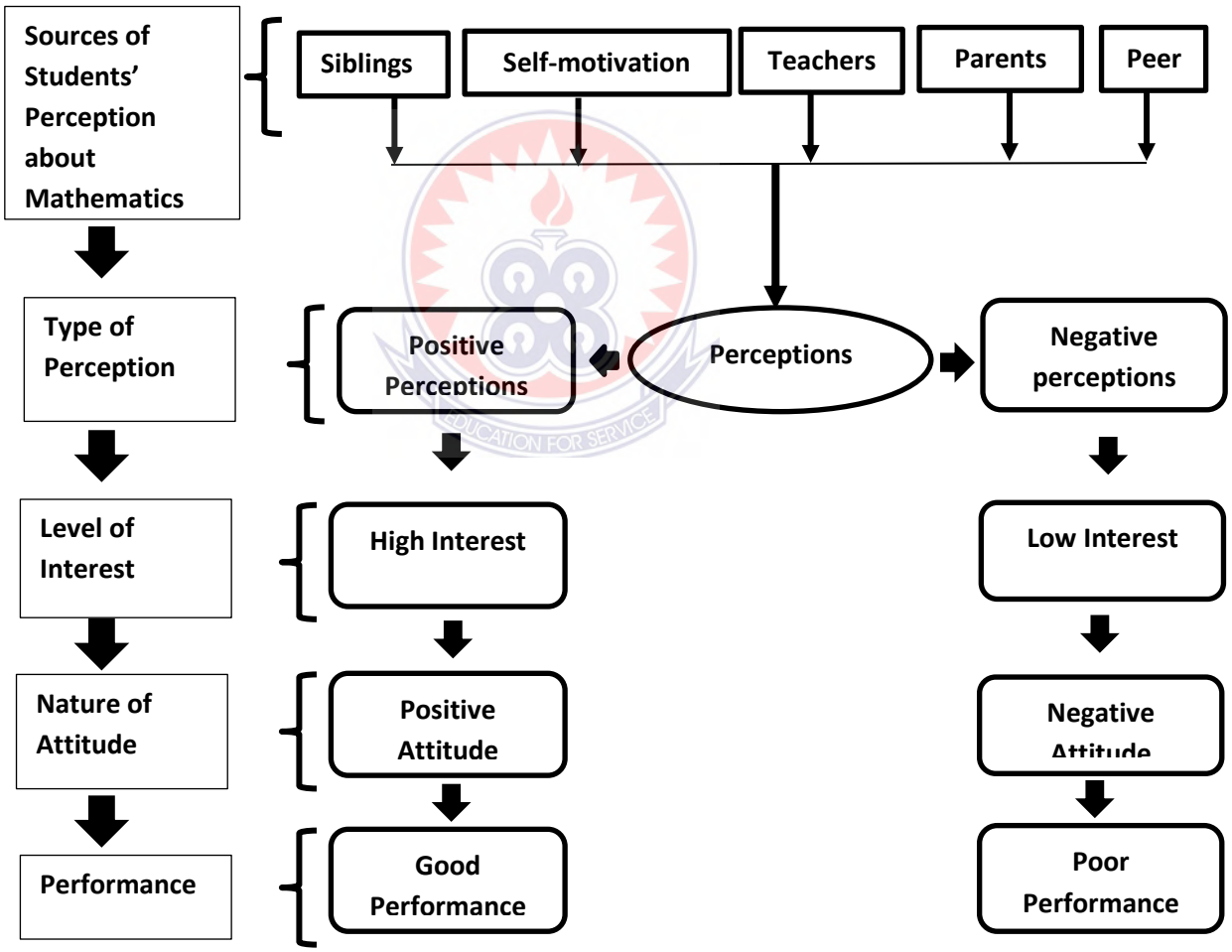

Figure 2.1: Conceptual Framework

2.3 The Concept of Perception

The term perception is said to have originated from a Latin word, "perciper", which means to perceive. Perception is defined as the process through which we select, organise and interpret information gathered by our senses in order to understand the world around us (Greenberg & Baro, 1999, p. 72). Perception has to do with the individual's feelings about, or appraisal of, a given object, thing or a person based on the individual's past and present experiences. Fazio and Williams (1986) see perception as those subjective experiences of objects or events that results from a stimulation of the individual's receptor organ. Akurugu (2010) states two dimensions to perception; the conscious recognition dimension and the instinctive dimension. Conscious recognition dimension of perception is the process by which an individual consciously recognizes and interprets issues in accordance with their understanding of the environment or the perceived object (Akurugu, 2010). It is believed to be the basis for a particular action or reaction towards a perceived person, object, activity or event. Instinctive dimension on the other hand, is the response or reaction of an individual towards the perceived object based on the individuals existing knowledge, sense, notion, impression and conception of the individual (Akurugu, 2010). It is in recognition of these dimensions that Fazio and Williams (1986) cited in Akurugu (1010) explained that perception about a given object, person, or event results from the stimulation of a person's receptor organ. According to them, this stimulation is encoded into a neural activity which in turn is relayed to the central nervous system for further processing. It is believed that the perceptual experience of an individual is a direct result of these neural processes. It must however be noted that perception may sometimes occur without necessarily being influenced by an external receptor stimulus, but rather, it may result from an evolutionary adaptation of an innate knowledge (Fazio & Williams, 1986; Akurugu, 2010). From the above revelations, the

perceptions of students about Mathematics as a subject of study at the Senior High School may either be innately determined or may be based on their past and present experiences with regards to the subject.

2.4 Students' Perceptions of Mathematics

Leder and Forgasz, (2002), as cited by Mutodi and Ngirande (2014) indicate that the constructs; beliefs and attitudes, images, views, perspectives, and opinions are not directly observable and have to be inferred, and because of their closeness, it is problematic to have a common definition of these notions. Perceptions and beliefs about mathematics originate from past experiences; comprising both cognitive and affective dimensions (Aguilar et al., 2012). They continued that, from a cognitive point of view, it relates to a person's knowledge, beliefs, and other cognitive representations while from the affective domain it relates to a person's attitudes, feelings, and emotions about mathematics. The term is also understood broadly by some researchers to include all visual, verbal representations, metaphorical images, associations, beliefs, attitudes, and feelings related to mathematics and mathematics learning experiences (Mutodi & Ngirande, 2014). Students' mathematics learning outcomes are strongly related to their beliefs and attitudes towards mathematics (Furinghetti & Pehkonen, 2000; Leder et al., 2002; Pehkonen, 2003).

Schoenfeld (1992) cited by Schoen and Pritchett (1998) stated several student beliefs and perceptions from the 1970s and the 1980s as:

1. There is always one correct way to solve any mathematics problem: usually the rule the teacher has most recently demonstrated to the class.

2. Ordinary students cannot understand mathematics; they are expected to memorize it and apply what they have learned mechanistically and without understanding.

3. Mathematics is a solitary activity, done by individuals in isolation.

4. Students who have understood the Mathematics they have studied will be able to solve any assigned problem in 5 minutes or less.

5. The mathematics learned in schools has little or nothing to do with the real world.

6. A formal proof is irrelevant to processes of discovery or invention.

7. Mathematical activities include procedures that are devoid of real life, discovery, and problem-solving.

Sam (2002) claims 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" (Ernest, 2015, p. 802). Aguilar, (2021) as cited by Sam (2002) viewed mathematics as "fixed, immutable, external, intractable and uncreative" or "a timed test" (p.115).

Educators attempt to explain this phenomenon through the widespread beliefs or mathematical myths that "learning mathematics is a question more of ability than effort" (McLeod, 1992, p. 575) or "there is an inherent natural ability for mathematics" (Fitz Simons et al., 1996, p. 768). Many people hold the view that mathematics is only for the clever ones, or only for those who have “inherited mathematical ability”. Another widely held belief is that mathematics is a male dominant subject. One other stereotyped image is that boys are better in mathematics than girls (Ernest, 2001). Crawford et al. (1993) found that majority of students perceived mathematics as “numbers, rules and formulae” (p. 213). For some students, awareness of mathematics involves simply the recall of facts and the use of formal procedures. These views were associated with what they calls a “surface approach” to learning mathematics, that is, “the reproduction of knowledge and procedures” (p. 212). The research revealed that many students relate mathematics mainly with computations and identify mathematics with arithmetic (Chand, et al., 2021). Doing mathematics is normally associated with calculations. It is widely maintained in

the literature that negative images and myths of mathematics are widespread among students. It is perceived by many students as an exclusive discipline (Buhagiar, 2013). Mathematics is also viewed as a static and objective discipline available for discovery by mathematicians in turn, to be transmitted by teachers and received by students (Mutodi & Ngirande, 2014).

Many students seem to concentrate on computations as the essence of mathematics. Many believe mathematical activity includes procedures that are divorced from real life, from discovery and problem-solving. The fact that mathematics is usually presented as a body of absolute truths that exist independently of the learners and are taught in a hierarchical, linear, and prescriptive fashion reinforces the view that mathematics is a difficult subject. There is also a claim that mathematics is only for the clever ones, or only for those who have inherited mathematical ability (Kimball & Smith, 2013). Being mathematically knowledgeable is often treated as an indicator of general intelligence, as evidenced by the widespread use of mathematics in entrance tests. This view causes many people to believe that learning mathematics is a question of ability rather than effort and that there is an inherent natural ability for mathematics.

These negative perceptions lead students to accept their lack of accomplishment in mathematics as a permanent state over which they have little control. When these perceptions are overlooked and seriousness is attached to the learning of mathematics, there will be a high achievement in mathematics performance.

The conceptions, attitudes, and expectations of the students regarding mathematics and mathematics teaching have been considered to be a very significant factor underlying their school experience and achievement (Borasi, 1990; Schoenfeld, 2008). These conceptions determine the way students approach mathematics tasks, in many cases leading them into non-productive paths. Students have been found to hold a strong

procedural and rule-oriented view of mathematics and to assume that mathematical questions should be quickly solvable in just a few steps, the goal just being to get the "right answers". For them, the role of the student is to receive mathematical knowledge and to be able to demonstrate so; the role of the teacher is to transmit this knowledge and to ascertain students acquired it (Borasi, 1990). Such conceptions may prevent the students from understanding that there are alternative strategies and approaches to many mathematical problems, different ways of defining concepts, and even different constructions due to different starting points. They may approach the tasks in the mathematical class with a very narrow frame of mind that keeps them from developing personal methods and building confidence in dealing with mathematical ideas.

Arthur et al., (2017) finds that when Ghanaian senior high school students have a good perception of mathematics and are motivated to learn mathematics, their interest in mathematics would improve significantly.

2.5 Sources of Students' Perceptions of Mathematics

The literature indicates widespread sources of student perception of mathematics (McLeod, 1989; Sam, 2002; Mutodi & Ngirande, 2014). Parents and significant others have a strong influence on students' beliefs and attitudes towards mathematics (McLeod, 1989). Parents, especially the educated ones, transfer their beliefs and thoughts about mathematics to their children in school forgetting that, the circumstances amidst their time of education are not the same as their wards'. Factors such as the professional qualification of teachers, the influence of technology in education, and government policies in education, just to mention a few, are different for the two generations. Thus, parents' perceptions of the mathematics they received at school may be quite different from what their wards are experiencing in school. According to Sam (2002), parents' views about mathematics have a strong effect on the way they teach their children. Thus,

their decision-making is affected. This often creates tension between the parents and teachers if they share contrasting views of mathematics.

Mutodi and Ngirande (2014), find that the origin of different student perceptions is the individual life histories that each student brings to mathematics learning. They added that these life histories influence the way the students position themselves in the classroom, the way they engage with mathematics, teachers, and peers, and the way they interpret mathematical experiences. Thus, teachers and peers of students also influence their perceptions of mathematics. Blazar and Kraft (2017) finds that teachers who are effective at improving test scores are often not equally effective in improving students' attitudes and behaviors.

2.6 Students' Interests in Mathematics

Interests are the awareness, desire, and attention of someone toward a certain object associated with them that is associated with strong feelings (Witherington, 1982; Ahmadi, 2003; Syah, 2011). Interest is a preference for an activity that is implemented through active participation (Slameto, 2010). Research indicates a distinction between individual interest, which is trait-like, and situational interest, which is interest sustained by the context (Hidi & Renninger, 2006). Research also indicates that situational interest precedes individual interest. Situational interest is dependent on the environment and may change from day to day while Individual interest is an individual difference construct and, consequently, is more stable than situational interest (Wininger et al., 2014). It is, therefore, appropriate to ask how often mathematics teachers' situational interest induced in the classroom contributes to the longer-term interest that an individual develops in mathematics. Mathematics is regarded as an important technical and natural science subject by engineering and science students; however, students do not have high interest in mathematics and its related field of studies (Matic, 2014). The lack of interest

in mathematics may be due to a lack of application in daily activities and workplaces although mathematics is the very basis for technological and industrial development in the world. Therefore, it is important to enhance interest because learning interest influences learning achievement (Djamarah, 2002). Frenzel et al. (2010), find that boys show higher mathematics interest than girls and the trend of interest decrease from lower levels of education to high levels of education. Some characteristics can be investigated if students have interests in learning mathematics (Tambunan, 2018), namely preferring and enjoying learning mathematics rather than other subjects, being active in either classroom or out-of-class activities, more interested in solving mathematics problems than other subjects, having great attention in mathematics.

To increase students' interest in learning, teachers can help to convey the purpose of learning by following the intellectual level of the students. Students' understanding of the learning objectives can generate interest in learning (Sanjaya, 2008), to explain the benefits of learning the subject matter, students' interest will increase if they know the benefits of mathematics (Marchis, 2011). Explaining the subject matter of mathematics needs to be done with a good approach, because many lessons are less successful due to the less good learning process (Al-agili et al., 2012; Sa'ad et al., 2014), teachers design better learning, because the design of learning has effects on the progress of student's achievement (Ariani & Mirdad, 2016).

Another important thing for students' interest in learning mathematics is that teachers must make students enjoy learning mathematics since pleasure is important in learning (Schukajlow, 2015), and there is a relationship between learning pleasure with learning achievement (Jalali & Heidari, 2016). There is a significant influence between the feeling of pleasure with interest in learning and affecting the achievement of learning mathematics (Laksono, 2016).

Motivation is important as far as interest in learning mathematics is concerned. Bugge and Wikan (2013) states that motivation greatly influences the improvement of students' learning outcomes. Uno (2012) states that motivation and learning are two inseparable things. Motivation indicators consist of determination, love, happiness, diligence, and eagerness in learning (Sardiman, 2011).

Teachers can improve students' learning motivation by making competition in the class because competition influences intrinsic motivation (Song et al., 2009), and to raise the awareness needed in the learning process so that students have their willingness to learn. Giving feedback, knowing the results, and giving the score can accumulate student-learning motivation (Sardiman, 2011). Giving appreciation in various forms, such as praise or reward is also important to improve motivation. Hamid (2006) states that a reward is a tool in education that can encourage students to do better. Awarding is a stimulus to students to strengthen a response (Arifin, 2011), significantly appreciating effects on student learning motivation and mathematics achievement (Ariyuza & Kusrini, 2014; Syahrul, 2017). (Arthur et al., 2017b) finds that, there is direct relationship between students' perceptions about mathematics and their interest in learning mathematics.

Dissou et al. (2014), in their study of "Statistical analysis of Ghanaian students' attitude and interest towards learning mathematics," reveals that teachers' motivation of students influences their interest in the subject. They also found teachers' methods of teaching and student access to textbooks as predictors of Ghanaian students' interest in mathematics. They indicated that gender and sex do not influence student interest in mathematics.

2.7 Students' Perceptions, Interests, and Attitudes toward Mathematics

According to Moenikia and Zahed-Babelan, (2010), attitude is defined as a mental set or disposition, readiness to respond, and the psychological basis of attitudes, their

permanence, learned nature, and evaluative character. In the context of mathematics, attitude should be viewed as a predisposition to respond favorably or unfavorably to mathematics (Moenikia & Zahed-Babela, 2010). Zelley et al. (2005) postulate that attitudes are generally positive or negative views about a person, place, thing, or event which are often referred to as the attitude object. Attitudes develop and change with time (Rubinstein, 1986). According to the Multicomponent model of Attitude (Eagly & Chaiken, 1993), attitudes are influenced by three components (Mohammed & Waheed, 2011). They are cognitive (beliefs, thoughts, attributes), affective (feelings, emotions) and behavioral information (past events, experiences) (Maio & Haddock, 2010).

Literature indicates that students' attitude toward mathematics is influenced by several factors. These factors can be categorized into three distinctive groups. Firstly, factors associated with the students themselves. Some of these factors include students' mathematical achievement scores (Köğce et al., 2009), anxiety toward mathematics, students' self-efficacy and self-concept, extrinsic motivation (Tahar et al., 2010), and experiences in high school (Bobis & Cusworth, 1994; Klein, 2004). Secondly, the factors that are associated with the school, teacher, and teaching. Some of these factors that influence attitudes are teaching materials used by the teacher, teachers' classroom management, teachers' content knowledge, and personality, teaching topics with real-life enriched examples, and other students' opinions about mathematics courses (Yilmaz et at., 2010). Teaching methods, reinforcement (Papanastasiou, 2000), receiving private tuition (Köğce et al, 2009), teachers' beliefs towards mathematics (Cater & Norwood, 1997) and teachers' attitude toward mathematics (Karp, 1991; Ford, 1994) are all factors that influence attitude of a student in class. Thirdly, factors from the home environment and society also affect students' attitudes towards mathematics. Factors such as the educational background of parents, occupation of parents (Köğce et al, 2009), and

parental expectations (Tobias, 1993) play a critical role in influencing students' attitudes toward mathematics. Due to these several factors, students have a different attitude towards mathematics. More often, the public image of mathematics is labeling it as a difficult, cold, abstract, theoretical, and ultra-rational subject (Ernest, 2004). However, some studies show that students have relatively positive attitudes toward mathematics (Fan et al., 2005; Tezer & Karasel, 2010; Yilmaz et al., 2010). Sometimes, Mathematics is also considered a very important and largely masculine subject (Ernest, 2004). Several studies give evidence that compared to boys, girls lack confidence in doing mathematical sums and viewed mathematics as a male domain (Hyde et al., 1990; Odell & Schumacher, 1998; Meelissen & Luyten, 2008). The study explored student-related perceptual factors, school, teacher, and teaching-related perceptual factors as well as home environment-related perceptual factors that influence student attitude and interest in mathematics.

Addae annd Agyei (2018) finds that to maintain a positive student attitude toward mathematics, effective communication and classroom management skills are key in mathematics teachers' instructional practices.

2.8 Students' Perceptions and Performance in Mathematics

An examination is described by Fagbamiye (1998) as a tool for measuring and judging the standard of education in any country. Uduh (2009) defined examination as the process of finding out how much of the objectives of specific tasks a learner has learned. Examinations could be internally or externally conducted. Internal examinations are usually developed and administered by schools using teacher-made tests. These could be conducted weekly, termly, or end of the school year. External examinations are developed and administered by public examination bodies. The West African Examination Council (WAEC) is an international examination body that organizes and administers the West African Senior School Certificate Examination (WASSCE). Ajayi

and Osalusi (2013) opined that the mass failure of students in public examinations could be traced to several factors that can be categorized into the domains of parents, students, teachers, schools, government, and society. They added that parents play significant roles in the education of their children and wards. Apart from the fact they pay school fees and other levies, they buy textbooks, uniforms, and other materials required by their children and wards. In addition to this, they are expected to supervise their academic work and give them good moral training. They are also expected to visit schools from time to time to find out how their children and wards are behaving intending to take corrective measures where and when necessary. However, the failure of parents to play these roles could negatively affect the academic performance of the students.

The importance of teachers in the educational attainment of the students cannot be overemphasized. The quantity and quality of instructional delivery by the teacher will, to a large extent, determine the academic performance of the students. Various causes of poor academic performance of students which are attributed to the teachers include absenteeism, inability to complete the syllabi and less interest in children's understanding of lessons (Etsey, 2005), and poor methods of teaching (Asikhia, 2010).

Considerable literature shows that students are responsible for their poor academic performance. Bakare (1994) and, Aremu and Sokan (2003) found out that the students' factors of poor academic performance were poor study habits and negative perceptions about mathematics. Other studies (Salami, 2004; Etsey, 2005; Karande & Kulkarni, 2005; Ong et al., 2010; Ajayi & Ekundayo, 2010) have shown that students' lack of interest coupled with ill perceptions can lead to poor academic performance of students. Chua and Mosha (2015), as cited by Abreh et al. (2018), also argue that performance at the secondary education level is said to be contingent on some related and interrelated factors. Two of these factors that stand out in the current literature according to Chua and

Mosha (2015) are those relating to the student factors (interest and perception) , the curriculum and, the teacher and teaching factors. The curriculum is known to direct the teaching, learning, and assessment practices that should go on in schools. Mainly, aspects such as the syllabus and textbooks influence educational attainment (Dembélé & Lefoka, 2007; Pridmore, 2007; United Nations Educational, Scientific and Cultural Organization [UNESCO], 2016). In addition, the scope, balance, and relevance of the curriculum influence what stakeholders do with the curriculum as well as its ability to achieve the intended outcome.

Studies have also shown a linkage between attitude and pereception, and success in mathematics (Moenikia & Zahed-Babelan, 2010; Lipnevich et al., 2011; Lubienski et al., 2012). A positive attitude toward mathematics is key to develeoping a positive perception in the lead to improve performance in mathematics (Chiesi & Primi, 2009; Bilican et al., 2011; Lipnevich et al., 2011; Marchis, 2011; Singh & Imam, 2013). Students, in general, tend to dislike mathematics more than other subjects (Poffenberger & Norton, 1959). However, Mathematics is a compulsory subject in pre-tertiary schools in Ghana and students must pass it to move to the next level of education.

2.9 Students' Interest and their Achievement in Mathematics

According to research, students' interest in mathematics is positively correlated with their performance. A study by Ainley, Hidi, and Berndorff (2002) found that students who showed more interest in mathematics achieved higher scores on mathematics assessment.

A study by Hidi and Renninger (2006), as cited in Fastrich and Murayama (2020), found the relationship between interest and performance in mathematics to be very complex. Their research, which utilized structural equation modeling, found that interest alone did not have a direct effect on achievement when controlling for prior knowledge. However,

they observed that achievement influenced interest, even when controlling for prior interest.

Overall, fostering students' interest in mathematics can contribute to improved performance by enhancing motivation, engagement, effort, and positive attitudes towards the subject. It is important to note that while interest can positively impact performance, it is not the sole determinant. Other factors such as instructional quality, teaching methods, curriculum, and individual differences also play a role in students' performance in mathematics.

Stakeholders in education can support students' interest by providing engaging and relevant mathematics experiences, creating a positive learning environment, and highlighting the real-world applications of mathematics (Fastrich & Murayama, 2020).

2.10 Chapter Summary

The chapter contains a review of literature related to this study. The review of the literature revealed the Affective–Cognitive Consistency Theory and the Self-Perception Theory as the bases for which the study is wealth undertaken. From the conceptual framework of the study, it was necessary the chapter discuss the concept of perception, causes of student perception of mathematics, students' negative perceptions of mathematics, student perceptions and their interest in mathematics. The chapter also reviewed student interest in mathematics and their attitude towards mathematics, students' attitudes towards mathematics and their performance in mathematics. This chapter also provided some of the research gaps the study identified from the literature.

CHAPTER 3

METHODOLOGY

3.0 Overview

This chapter describes the research methodology. Specifically, it describes the study approach, research paradigm, study design, the target population, the sample and sampling procedure, data collection instrumentations, validity, and reliability of the instruments, data collection procedure, data analysis, and ethical considerations.

3.1 Research Approach

Clark et al., (2021) cites qualitative and quantitative research as two broad cluster of research approaches that engulfs several research designs. Quantitative research validates phenomena by collecting and presenting numerical and quantifiable data (Poedjia, 2021) whilst qualitative research is an approach that allows the researcher to examine people's experiences in detailed (Hennink et al, 2020). An integration of these two broad approaches (qualitative and quantitative) results in the mixed method approach. The combination allows researchers to triangulate data from multiple sources, integrates findings and draw inferences using both qualitative and quantitative approaches in a single study (Fetters, 2016). This study employed a mixed method approach.

Because of the integrated nature of the mixed method approach design, Creswell and Clark (2011) came up with key principles that researchers can consider to help navigate this process. The first is to determine whether that mixed methods approach is fixed and/or emergent. The approach employed in this study can be classified as the Fixed mixed methods design since the use of quantitative and qualitative methods was predetermined and planned from the very start of the research process, and the procedures were implemented as planned. Another point, perhaps the most important decision, which defines the mixed method approach used in a study, is to look at the different ways the qualitative and quantitative strands of the study relate to each other. A strand is a

component of a study that encompasses the basic process of conducting quantitative or qualitative research: posing a question, collecting data, analyzing data, and interpreting results based on that data (Shannon-baker, 2016). Therefore, the specific major mixed methods design used was the concurrent triangulation design, using quantitative and qualitative data collection methods and statistical analyses to obtain corroboratory results.

3.2 Research Design

Mouton (2001) described research design as the research plan with which the study would be conducted. It provides a clear explanation of the facts concerning the sample, the variables to be studied, selected measurement instruments, ways of gathering data, and data scrutiny.

The research design used was a descriptive survey. Vanderstoep and Johnson (2008), argue that a descriptive survey provides the advantage of sampling a large group of randomly selected people to measure their attitudes and behavior. Fraenkel and Wallen (2009) also stated that a descriptive survey gives information on the current status of the situation under study, and defines the nature of the situation as it occurs at the time of the study. It is a research method where large numbers of people answer questions about aspects of their opinion or their behaviors (Baron 1998). Rea and Parker (1997, p. 342) have stated that "…the foremost advantage of the sample survey technique is the ability to generalize about an entire population by drawing inferences based on data drawn from a small portion of that population." A descriptive survey usually describes and offers an understanding of phenomena mostly with simple descriptive statistics and is most valuable when an area of study is fairly new (Macmillan & Schumacher, 2014). According to Rea and Parker (1997), surveys are cost-effective; they allow for a swift

glimpse of the whole population, secrecy to the individual surveyed, and plenty of time for completion.

The purpose of this study was to examine students' perceptions and interest in mathematics with sample from SHSs in Yendi Municipality of Northern Ghana. The researcher wanted to understand the best predictors with regard to students' perceptions, interest, and performance in mathematics. Due to this, a descriptive survey was use to provide information useful to the solution of the problem. The descriptive survey design fits well with this study because the researcher intended to provide basic descriptive statistics to aid in the understanding of students' perceptions of mathematics, their interest and performance in mathematics.

3.3 Target Population

A population refers to an "abstract idea of a large group of many cases from which a researcher draws a sample and to which results from a sample are generalize" (Neuman, 2006, p. 224). The population is the total of all the cases that meet the definition of the unit of analysis of a study (White 2005). A population is seen as a collection of objects, events, or individuals having some common characteristics that the researcher is interested in studying (Salifu, 2017). The target population for this study was final year students of public Senior High Schools in the Yendi municipality of the Northern Region of Ghana. There are three (3) SHSs in the Yendi municipality. Out of the three SHSs, two are public SHS. These two schools use the same mathematics syllabus and textbooks provided by the Ministry of Education (MOE) except the third SHS, which is a remedial SHS. The target population for the study was only final year students in the two public SHS. The study focused on the final year students because they have covered enough topics under the syllabus and were deemed the appropriate group of students suitable for the study. The accessible population at the time of conducting the study consist of final

year SHS students within Yendi municipality comprised of 1,003 of which 601 were males and 402 were females.

3.4 Sample and Sampling Techniques

According to White (2005), sampling is the process of selecting samples (units/elements) from a sample frame for a study. Sampling has to do with extracting or "getting a representative sample from a large population, such that the researcher can study the smaller group and produce accurate generalizations about the larger group" (Neuman, 2006, p. 219). Sampling is the procedure a researcher employs to select people, places, or things to study (Flick, 2014). The quality of a sample determines the quality of the research findings in large measure. Sampling and selection of a site is to a large extent influenced by the strategy of enquiry used by the researcher (Creswell, 2009).

A sampling technique can either be probabilistic or non-probabilistic. Karwa (2019) refers to probability sampling as randomization implying that the targeted population sample has a known, equal, fair and a non-zero chance of being selected, (Brown, 2007), thus ensuring equity between prospective research participants. Probability sampling is referred to as random sampling or representative sampling. Simple random sampling (SRS), systematic sampling, stratified sampling, cluster sampling, stage or multi-stage sampling are some examples of probability sampling techniques. The advantage of using random sampling is the liberty from human judgement, bias and subjectivity (Taherdoost, 2016). Non probability sampling, according to Neuman (2006), is a sampling technique that does not necessarily strives for representativeness, but rather, participants are selected based on their "relevance to the research topic" (p. 220). Some types of non-probability sampling technique identified include, quota sampling, purposive sampling, convenient/accidental/haphazard/availability sampling, snowball,

deviant case, sequential and theoretical sampling (White, 2005; Neuman, 2006; Williams, 2006 Creswell, 2014).

In this study, the researcher randomly sampled 100 final year students for the descriptive survey. This number represents 9.97% of the accessible population. The choice of 10% of the accessible population was based on Krejcie and Morgan's (1970) and Dornyei's (2007) assertion that around 10% of a study population gives an adequate representativeness of the population. The researcher employed a simple random sampling technique to avoid biasness and give participants an equal chance to be selected. The whole population list was made accessible to the researcher. The students were numbered and a simple random selection was conducted using a computer-generated random list. Students whose assigned numbers were in the randomly generated list were selected to be part of the study.

These 100 students sampled consisted of forty-five percent (45%) male students and fifty-five percent (55%) female students. Out of the 100 students sampled, 91 of them returned the first instrument (questionnaire) administered. The data is presented in table 3.1 below.

Table 3.1: Sample size of Participants

S/N	School	Male	Female	Total
1.	School A	22	28	50
2.	School B	15	26	41
	Total	37	54	91

3.5 Data Collection Instrument

Two instruments were used to gather data for this study. These were a structured questionnaire and a Mathematics Achievement Test (MAT) to access their basic mathematics knowledge.

3.5.1 The Questionnaire

The questionnaire (Appendix A) consists of closed-ended and open-ended questions to obtain the information required to answer the research questions. A questionnaire is widely used as a very useful instrument for collecting survey information, and providing a structured outline and can be administered without the presence of the researcher if participants can read and write. Again, it is often comparatively straightforward to analyze (Cohen et al., 2007). The questionnaire consisted of 37 items in four sections; section A, B, C, and D. Section A consist of the demographic information of the participants. The section seeks to collect information on student gender, age, and program of study.

Section B of the questionnaire sought to obtain information on student s' perception of mathematics which answers research question two. Most of the items were adapted from Schoenfeld (1992) and modified to suit participants understanding. The questionnaire statement ranged from students' perception of difficulty to their level of understanding mathematics. The section consisted of 10 negative perceptions of mathematics for participants to respond with the Likert scale. The Likert scale contained five-point Likert-type items: strongly agree (SA), Agree (A), Neutral (N), Disagree (D), and strongly disagree (SD).

Section C of the questionnaire sought to obtain information on the factors that influence students' perception of mathematics as a subject. These questionnaire items sought to collect information on factors that influence participants' perceptions of mathematics. This section was made up of 15 items. The Likert scale was used for this section and consisted of five-point Likert-type items: strongly agree (SA), Agree (A), Neutral (N), Disagree (D), and strongly disagree (SD).

Section D of the questionnaire, was the final section consisting of 8 open and closed-ended questions. This section sought information on participants' interest in mathematics.

3.5.2 The Mathematics Achievement Test

The second instrument was the mathematics Achievement test (MAT) (Appendix B). This consists of objective questions from three basic topics in the SHS core mathematics syllabus. Real number system, Algebraic expressions, and Linear equations and inequalities. This was selected to assess students' basic knowledge and understanding of the fundamentals of mathematics. The test consists of 10 questions for respondents to attempt all 10 questions. The first three questions were Algebraic expression questions, the next four questions were real Number system questions and the last three were linear Equations and Inequalities questions. It was scored out of 10 points.

3.6 Pilot Testing the Instruments

A pilot test, according to Polit and Hungler (1995), is a small-scale version or trial done by the investigator in preparation for the major study. In this study, the student questionnaire and the student MAT were pilot tested with thirty 30 SHS three students from one of the Senior High Schools within the target population, to establish internal consistency and reliability. The reason for the chosen SHS for the pilot test was convenience and the possession of similar features to the other school. Also, students' demographic characteristics were similar because they were of the same year group as the sampled population. The researcher pilot–tested the instruments to ascertain their reliability and validity to the research questions. All students in the school offer mathematics as a core subject and have treated the Real number system, Algebraic expressions, and Linear equations and inequalities as part of the first-year's syllabus. However, participants were assured of confidentiality, and the instruments were

responded to anonymously with no identifying information. They were given one hour outside instructional hours to provide their responses individually after which all instruments were received.

3.7 Validity of the test

Validity refers to whether a test truthfully does what it is constructed to do (Taale & Ngman-Wara, 2003). A test is valid if its results are appropriated and useful for making decisions and judgments about an aspect of students' achievement (Gronlund & Linn, 1990). For face validity, two experienced teachers who had taught mathematics for over five years in the municipal validated the MAT items. They checked the test items to ensure they were within the content of the topics taught. The questionnaire was also validated by the supervisor and other colleagues who have researched in the area. The content validity of the test items was examined by the researcher based on the application level of the students in the mathematics syllabus for Senior High Schools in Ghana (CRDD, 2008). According to Taale and Ngman-Wara (2003), content validity is most appropriately considered in connection with achievement testing. According to Salifu, (2017) an achievement test has content validity if it represents faithfully the objectives of a given instructional sequence and reflects the emphasis accorded to those objectives as the instruction was carried out. In other words, it is the degree or the extent to which the test items adequately cover the subject matter or the part of the curriculum covered during instruction.

3.8 Reliability of the instruments

Joppe (2000) defines reliability as the extent to which results are consistent over time and if the results of a study can be reproduced under the same methodology, then the research instrument is considered to be reliable. The reliability of a test refers to how well it provides a consistent set of results across similar test situations, periods, and

examiners (Taale & Ngman-Wara, 2003). In other words, it is the consistency with which a test measures whatever it measures from one measurement to another, over and over again, over time. Also, Reliability concerns the degree to which an experiment, test, or any measuring procedure yields the same results on repeated trials (Patton, 2002). Data from the pilot test was used to determine the reliability of the research instruments. Item analysis was at this point carried out to identify items whose removal would enhance the internal consistency of the questionnaire. In particular, an attempt was made to improve the internal consistency by removing items with low item correlations (i.e. correlations between a certain item and the rest of the items excluding that item). Items meeting any of the following criteria were deleted: correlation coefficient between an item and the total score less than 0.30 and if internal consistency (Cronbach α) of the whole scale was high after deleting the item. The items of the questionnaire resulted in a Cronbach alpha reliability coefficient of 0.6. The instruments were therefore accepted as reliable by the researcher based on the purpose and objectives of this study

3.9 Data Collection Procedure

In conducting a study, Creswell (2005) advises researchers to seek and obtain permission from the authorities in charge of the site of the study because it involves prolonged and extensive data collection. In line with this, an introductory letter was obtained from the Department of Mathematics Education at the University of Education, Winneba. This letter (Appendix C) introduced the researcher and provided details of the study. This letter was used with an application for consent letter (Appendix D) to obtain permission from the Yendi Municipal Education Office. The permit granted by Yendi Municipal Director of Education (Appendix E) was used to gain approval from Heads of the Senior High Schools.

After permission was granted, the researcher first arranged with the Heads of Departments (HODs) of mathematics on convenient days and time to administer the instruments. The next point of contact was with the sampled participants to inform them of the impending administration of the questionnaire. The researcher guided the participants from each school on how to correctly respond to the instrument objectively, with the support of the HODs. The instruments were administered outside instructional hours and each school had its sessions on different days.

The questionnaires were personally administered to students by the researcher. They agreed to complete them and submit them the same day. Participants adhered to the agreed time and presented the completed questionnaire at the end of the day. This was done to ensure high coverage, completion, and return rate. The completion and return rate was 91%. Participants were encouraged to respond to the MAT individually as the researcher personally administered it. The participants responded to the questions and submitted their responses the same day. It was administered to participants when they submitted their questionnaires. Participants adhered to the time and rules for the Mathematics Achievement Test (MAT). This was done to ensure high coverage, fairness, and competition.

3.10 Data Analysis

The data was analyzed using both quantitative and qualitative research methods, which is in line with modern trends in social and educational research. According to Creswell (2003), merging both quantitative and qualitative research methods develop a deeper understanding of social and educational processes. The data was categorized, structured, and organized for easy analysis. According to Marshall and Rossman (1995), qualitative data analyses require categorization, structuring, and making meaning out of the collected data. IBM SPSS (version 23) was used to compute and analyze the data using

descriptive statistics and inferential statistics to describe quantitative data obtained. The qualitative data was analysed thematically. Positive Likert rating scale statements was ranked in the following descending order to determine student perceptions of mathematics:

SA	A	N	D	SD
5	4	3	2	1

Where; SA - Strongly Agree; A - Agree; N - Neutral; D - Disagree; SD - Strongly Disagree;

Factor analyses was done to identify factors that influence students' perceptions of mathematics. After the factors were identified, reliability analysis was carried out. Reliability test informs how accurate measurement made on the factors. This section of the questionnaire consisted of 10 negative perceptions of mathematics for participants to respond with the Likert scale (Choi et al., 2001). The reliability level of Cronbach's Alpha value was determined.

3.11 Ethical Considerations

According to Neuman (2006, p. 129), "ethics is what is or is not legitimate to do or what a 'moral' research procedure involves". Isaac Newton is famously credited with the saying, "If I have seen a little further, it is by standing on the shoulders of giants." "Giants" can be understood as a metaphorical term, referring to the vast volume of published research and the scholarly works in general. The following ethical issues were considered:

3.11.1 Permission

A written permission was sought to carry out the study from the Yendi municipal director of education and the headmasters of the selected Senior High Schools in the municipality.

3.11.2 Informed consent

All the participants in the study were given written forms describing the research objectives and procedures to append their signatures as evidence of consent to participate in the study. The researcher also explained the risks and time involved in participating in the study. Participants were also informed of their right to participate or not to participate in the study. Finally, the participants were also informed of their rights to withdraw or discontinue participating in the study at any time they feel they were no longer interested in participating in the study, without any fear.

3.11.3 Voluntary participation

Neuman (2006) stated that people must not be coerced into participating in a research study, but rather, they must be given the free will to participate or do otherwise. The researcher gave participants enough time to freely/voluntarily participate in the study or do otherwise after the details of the study were communicated to them.

3.11.4 Anonymity

Neuman (2006) emphasized that participants in a study must remain nameless and unknown. The data should not identify any participant with a given response. Participants' responses were represented by alphabetical letters and not their names or any form of identity that could led to any form of traces to them.

3.11.5 Confidentiality

According to Neuman (2006), confidentiality is a situation in which the researcher keeps the information provided by the respondent secret from public view so that there are no

traces whatsoever that will lead to the identification of the individual. The researcher assured participants that any information that may embarrass them or endanger their friends and relations would not be disclosed to the public.

3.11.6 No harm to participants

Neuman (2006) also added that researchers must strive to ensure that participants in their studies do not suffer any form of harm (physical, psychological, or emotional) as a result of participating in their studies. The researcher therefore considered the needs and concerns of the participants in the research process, and took oversight responsibility in administering the instrument. Participants were assured that their general well-being is a top priority throughout the study. Hence, the researcher did everything possible to protect them from any form of harm as long as participating in the study is a concern.

3.11.7 No deception of subjects

Mack et al (2011), defines deception, as a deliberate misrepresentation of facts to make another person (subjects) believe in what is not true. Throughout the study, the researcher maintained an open, honest, dignifying, frank, objective, focused, and professionally relate with the respondents. After introduction, the researcher made it clear to the respondents that the study was meant for academic purpose.

CHAPTER 4

RESULTS AND DISCUSSION

4.0 Overview

The study sought to find out students' perceptions and interest towards mathematics. With participants from the Yendi Municipal, Northern region. Results from the data collected for the four research questions are analysed, the findings of the study and further discussions are presented in this chapter.

The following objectives were used to achieve the purpose of the study:

1. To assess students' level of interests in mathematics in Tamale Metropolis
2. To determine students' perceptions of Mathematics in the Metropolis
3. To ascertain the factors that influence students' perceptions of Mathematics in the Metropolis
4. To assess the extent teachers can minimize students' negative perceptions about mathematics in the Metropolis

4.1 Biographic Data of Participants

Section A of the questionnaire, was designed to collect data on participants bio-data. It consists of four questions on participants' schools, age, gender, and the program been offered. The responses were analysed descriptively and presented in Table 4.1.

Table 4.1: Biographic Data of Participants

Demographics	Category	Frequency	Percentage (%)
Name of Schools	School A	50	54.9
	School B	41	45.1
	Total	**91**	**100**
Age range	16-18 years	38	41.8
	19 and above years	53	58.2
	Total	**91**	**100**
Gender	Male	37	40.7
	Female	54	59.3
	Total	**91**	**100**
Program of study	General Science	14	15.4
	General Arts	40	44.0
	Visual Arts	03	3.3
	Home Economics	08	8.8
	Agricultural Science	26	28.6
	Total	**91**	**100**

4.1.1 Age Range of Participants

The age of participants was necessary to ensure that their ages correspond with their level of education (SHS 3). Participants' ages ranged from 16 - 18 and above 19 years. 38 of the participants, representing 41.8% were between the ages of 16-18 years and 53 participants representing 58.2% of the participants were above 19 years. This shows that a good number of them were matured and could reason well to respond to the questions. The data is presented in Table 4.1.

4.1.2 Gender Distribution of Participants

The selection of participants was not gender bias as it has good number of both sexes. Out of the 91 participants, 37 of them representing 40.7% were males 54 representing 59.3% of participants were females. The data is presented in Table 4.1.

4.1.3 Distribution of Programs Offered by Participants

The participants were sampled across five different programs from the two schools. Thus, General Science, General Arts, Visual Arts, Home Economics and Agricultural Science. 14 of the participants representing 15.4% were from the General Science class, 40 participants representing 44.0% were from the General Arts, 3 of the participants representing 3.3% from the Visual Arts, 8 of the participants, representing 8.8% were from the Home Economics class and 26 of the participants representing 28.6% were from the Agricultural Science class. The data is presented in Table 4.1.

4.2 Analysis of Findings Related to Research Questions

Research question 1: What are students' level of interests in learning mathematics in the Yendi municipality?

To access students' level of interest in learning mathematics, section D of the questionnaire, consisting of open and closed-ended questions to allow participants express their opinions clearly was used. This section was used to collect qualitative data. The first question posed to participants in this section was "Do you like mathematics as a subject?" Out of the 91 participants, 62 of them said they like mathematics and 21 said they do not like mathematics as a subject. Though 8 of the participants representing 9% of them were undecided on this question, 68% and 23% of the participants respectively like and dislike mathematics as shown in Figure 4.1. The 23% participants who dislike mathematics were made to justify their reasoning. Some of their justifications are presented below:

mathematics is confusing and difficult to understand

there are no juicy career opportunities in mathematics except teaching

I prefer reading subject than working subject

mathematics has no benefit to humanity and no impact in our daily lives

Every topic involve calculation

It involves a lot of calculations which makes it difficult to comprehend

It's difficult to understand

Mixture of numbers and variables are confusing

No matter how hard I try, I always forget the procedure used.

I cannot understand it no matter how I try.

The formulas are difficult

It's difficult to do the calculations in mathematics

It involves a lot of workings

Variables and negative numbers are confusing

Understanding mathematics is difficult

I can't do calculations

It's all about calculations

I finds it difficult to understand whenever they taught me

Their responses revealed that they have low interest in mathematics with some negative perceptions of mathematics associated with them. However, these students represent a proportion of the 23% of the participants who responded to the question.

On the contrary, a proportion of the 68% of participants who like mathematics presented the following justifications:

I understand mathematics easier than reading to understand any other subject

It's interesting and fulfilling if you work correctly

It's the only subject one can learn without memorizing it

Reading subjects make me sleep

It's easy and understanding to me

It helps to train the brain and activate it faster

I understand mathematics better than any other subject

Mathematics is the only subject that makes me happy

I like calculation subjects

It's about facts and easy to understand

It does not involve memorization of concepts

It's easy to understand

It's easy to understand if you follow the procedure

It's part of our daily activities

I can understand mathematics easily

It's about calculation which is easy to understand

I understands it and can solve mathematical problems

Its an interesting subject that needs understanding of the basics

It involves every life activities

It makes one to think

The responses here indicates that most students in this category have positive perceptions of mathematics with high interest in mathematics and are willing to learn mathematics.

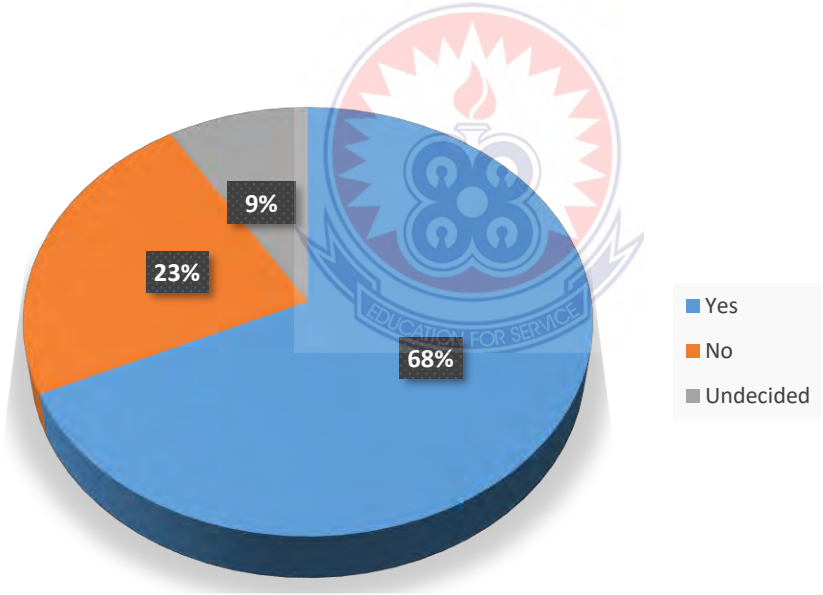

Figure 4.1: Distribution of participants' interest in learning mathematics (Like or Dislike of mathematics)

The second question posed to participants to assess their interest in learning mathematics was, "Have you ever intentionally missed your mathematics lesson?" 28 of the participants representing 30.77% responded in affirmation and 63 of them, representing 69.23% said no as shown in Figure 4.2.

Figure 4.2: Distribution of participants' interest in learning mathematics

(Intentionally missing lessons)

Justifications given by the 28 participants for deliberately not attending mathematics lessons were analysed and categorized as:

Its boring and confusing

I was feeling sleepy

It was afternoon lesson and I was boring and feeling sleepy

Its difficult to understand and contains a lot of calculations

The teacher direct questions to individual students, and I am not always able to answer my questions so I absent myself

Our teacher asked us to come with calculators and I wasn't having one so I stayed away

The teacher was going to cane me

I wasn't feeling well

I didn't like that topic

The mathematics teacher was going to cane me for scoring zero in class test

I was late to school

I didn't want the teacher to disgrace me for not answering his question correct.

I was afraid of the teacher's mental punishment

Student responses here showed negative attitude and lack of interest in mathematics. These were sample responses of 30.77% of the participants who have intentionally missed their mathematics lessons, whilst 69.23% of the participants have never intentionally missed their mathematics lessons.

Another question that was posed to participants to assess their interest in mathematics was "Do you always participate in mathematics activities in class?" Out of the 91 participants, 62 of them representing 68.13% of them responded yes and 29 of the participants representing 31.87% of them responded no as shown in Figure 4.3. The 29 participants who responded no to the question justifications were analysed and categorized as;

Mathematics involve a lot of calculations

They don't have passion for mathematics

They prefer reading subjects than working subjects

Mathematics is difficult, and boring

Mathematics has no benefit to humanity and no impact in their daily lives.

The responses given by the 31.87% of the participants for not participating in mathematics activities in class also shows they have negative perceptions of mathematics, and were not interested in mathematics. Though they were just 31.87% of the participants, the remaining 68.13 were actively participating in mathematics lessons in class, indicating their positive perceptions and interest in mathematics.

Figure 4.3: Distribution of participants' interest in learning mathematics (Classroom participation)

To further investigate students' interest level in learning mathematics, participants were asked to rate their interest in mathematics on a scale of 1-10. A rating of 1- 4 showed low interest, 5-7 showed moderate interest and a rating of above 7 indicated high interest. The distribution of the rating is shown in the Table 4.2.

Table 4.2: Students interest rating

Interest level	Interest rating	Frequency	Percentage
Low	1	0	0
	2	1	1.1
	3	7	7.7
	4	17	18.7
Moderate	5	2	2.2
	6	1	1.1
	7	17	18.7
High	8	3	3.3
	9	29	31.9
	10	14	15.4
	Total	**91**	**100.0**

From the Table 4.2, 25 out of the 91 students rated their interest from 1-4. This consist of 27.5% percentage of the entire participants. 20 students representing 22% of the participants moderately rated their interest for mathematics. Majority of the participants, 46 representing 50.6% them, indicated they have high interest in mathematics. Generally, the rating suggests participants had high interest levels for mathematics. A further descriptive analysis of the participants' ratings was carried out and the results presented in the Table 4.3.

Table 4.3: Descriptive statistics on mathematics interest ratings

	N	Minimum	Maximum	Mean	Standard deviation
Interest rating	91	2.00	10.00	7.15	2.45

The descriptive in Table 4.3 show an average interest rating of 7.15 with a standard deviation of 2.45. This average rating falls above a rating of 7.0, which indicates participants, had a high interest level. The minimum rating was 2.00 and the maximum rating was 10.00.

Research question 2: What are students' perceptions of mathematics in the Yendi municipality?

To answer, the question "What are students' perceptions about mathematics in the Yendi municipality? A set of negative perceptions of mathematics as adapted from literature were posed to participants to rank using five-point Likert scale and the data is analysed in Table 4.4.

Table 4.4: Participants Perceptions of Mathematics

Statement	Strongly Agreed Frequency (%)	Agreed Frequency (%)	Neutral Frequency (%)	Disagreed Frequency (%)	Strongly Disagreed Frequency (%)	Mean	Standard deviation
Mathematics is difficult, cold and abstract	14 (15.4)	27 (29.7)	10 (10.9)	19 (20.9)	21 (23.1)	3.0659	1.43606
Learning mathematics is a question more of ability than effort	15 (16.5)	27 (29.7)	9 (9.8)	25 (27.5)	15 (16.5)	3.1099	1.46402
Mathematics is only for the clever ones or only for those who have inherited mathematical ability	12 (13.2)	6 (6.6)	6 (6.5)	29 (31.9)	38 (41.8)	2.2637	1.39710
Mathematics is a male dominant subject	3 (3.3)	9 (9.9)	7 (7.6)	31 (34.1)	41 (45.1)	1.9769	1.10786
The mathematics learned in schools has little or nothing to do with the real world	13 (14.3)	11 (12.1)	6 (6.6)	24 (26.4)	37 (40.7)	2.4176	1.39894

Mathematics problems have one and only one right answer	27 (29.7)	18 (19.8)	9 (9.9)	20 (22.0)	17 (18.7)	3.6703	1.26860
There is always one correct way to solve any mathematics problem: usually the rule the teacher has most recently demonstrated to the class	12 (13.2)	21 (23.1)	5 (5.5)	23 (25.3)	30 (33.0)	2.4022	1.52912
Ordinary students cannot understand mathematics; they can memorize it and apply what they have learned mathematically and without understanding	18 (19.8)	17 (18.7)	14 (15.4)	21 (23.1)	21 (23.1)	2.9780	1.38225
Mathematics is all about calculation	27 (29.7)	36 (39.6)	4 (4.4)	11 (12.1)	13 (14.3)	3.8242	1.12719
Mathematical activities include procedures that are devoid of real life, discovery and problem-solving	37 (40.7)	25 (27.5)	7 (7.7)	12 (13.2)	10 (11.0)	3.6176	1.34623

The results in Table 4.4 revealed that, when you consider the perception "Mathematics is difficult, cold and abstract", 15.4% and 29.7% of the participants strongly agreed and agreed respectively to it, with 45.1% generally agreed to that. On the other hand, 23.1% and 20.9% disagreed and strongly disagreed respectively to that perception. In general, 44.0% of the participants disagreed with that perception. However, 10.9% of the participants were undecided on this perception. This produced a mean of 3.0659 and a standard deviation of 1.43606.

The results also revealed that, with "Learning mathematics is a question more of ability than effort" as perception, 16.5% and 29.7% strongly agreed and agreed respectively with 46.2% generally agreed to that perception. 16.5% and 27.5% disagreed and strongly disagreed respectively with that perception and a total of, 44.0% generally disagreed. 9.8% of the participants were neutral to this perception. This perception also produced a mean value of 3.1099 which is marginally pulled towards agreeing to the perception. This is similar to findings of Mutodi and Ngirande (2014). where student perceived mathematics as a more of ability than effort.

Considering "Mathematics is only for the clever ones or those who inherited mathematical ability", as a perception, 13.2% and 6.6% of the participants respectively strongly agreed and agreed to it, with 19.8%, generally agreeing. A large number of the participants 41.8% and 31.9% respectively disagreed and strongly disagreed to that, with 73.7% of the participants generally disagreed to that perception. 6.5% of the participants were undecided on this perception. This also produced an average of 2.2637 and a standard deviation of 1.39710, which suggests participants' responses cluster around disagreeing to this perception. This perception was ranked as the second least, agreed perception about mathematics. This is contrary to Mutodi and Ngirande (2014), who

states that mathematics is only for the clever ones, or only for those who have inherited mathematical ability.

Also, with "Mathematics is a male dominated subject" as a perception, just a few of the participants, 3.3% and 9.9% strongly agreed and agreed respectively to that perception, with 13.2% generally agreed to that perception. In contrast, 45.1% and 34.1% of the participants disagreed and strongly disagreed to that, with a total of 79.2% generally disagreed to that perception. However, 7.6% of the participants were undecided on this perception. This perception produced a mean of 1.9761, which suggests participants' generally disagreed to it. It is interesting to note that this was ranked as the least agreed perception. This is again contrary to Mutodi and Ngirande (2014)'s findings that mathematics is a male dominated subject.

Another perception that was strongly disagreed to was "The mathematics learned at school has little or nothing to do with the real world". 14.3% and 12.1% respectively strongly agreed and agreed to that, with 26.4% generally agreed to that perception. 40.7% and 26.4% of the participants disagreed and strongly disagreed respectively to this perception, with 67.1% generally disagreed. 6.5% of the participants were neutral on this perception. This also produced a mean of 2.4176 and standard deviation of 1.39894 which indicates participants generally disagreed to this perception.

"Mathematics problems have one and only one right answer" as a perception, 29.7% and 19.8% of participants respectively strongly agreed and agreed to it, with 49.5% generally agreeing to it. 18.7% and 22.0% of participants disagreed and strongly disagreed respectively to it, with 40.7% of participants generally disagreed with this perception. 9.8% of the participants were undecided on this. This was the third most agreed perception about mathematics.

With “There is always one correct way to solve any mathematics problem: usually the rule the teacher has recently demonstrated to the class”, 13.2% and 23.1% of participants strongly agreed and agreed respectively, with 36.3% of participants generally agreed to this perception. A good number of the participants 25.3% and 33.0% respectively disagreed and strongly disagreed to it, with 58.3% generally disagreed. 5.4% of the participants were neutral on this perception. This perception also produced a mean of 2.4022 and a standard deviation of 1.52912. This suggests participants generally disagreed to this perception.

“Ordinary students cannot understand mathematics; they can memorize it and apply what they have learned mathematically and without understanding”. 19.8% and 18.7% of participants strongly agreed and agreed respectively, with 38.5% generally agreed to this perception. 23.1% and 23.1% of participants disagreed and strongly disagreed respectively, with 46.2% generally disagreed. However, 7.6% of the participants were neutral. This results in the table above shows this perception has an average of 2.9780 and a standard deviation of 1.38225.

However, with “Mathematics is all about calculation”, most of the participants, 29.7% and 39.6% strongly agreed and agreed respectively, with 69.3% of them generally agreed. On the same perception, 14.3% and 12.1% of the participants disagreed and strongly disagreed respectively, with 26.4% of them generally disagreed. 4.3% of the participants were neutral to this perception. This perception was ranked as the most agreed perception with a mean of 3.8242. This finding is similar to the research findings that many students relate mathematics mainly with computations (Iddo & Ginsburg, 1994). Many students tend to identify mathematics with arithmetic. Doing mathematics is normally associated with calculations.

Similar result was obtained on "Mathematics activities include procedures that are devoid of real-life discovery and problem solving". 40.7% and 27.5% of participants strongly agreed and agreed respectively, with 68.2% of them generally agreed. 11.0% and 13.2% of the participants disagreed and strongly disagreed respectively, with 24.2% of them generally disagreed to this perception. 7.6% of the participants were undecided on this perception. It was the second most agreed perception among participants.

Research question 3: What are the factors that influence students' perceptions of Mathematics in the Municipal?

To investigate the sources of students' perceptions of mathematics, the table below was the results of the analysis of the data gathered. Participants' responses as to the variable stated is applied to the participant were discussed as shown in Table 4.5.

Table 4.5: Factors influencing Student Perceptions of Mathematics

Statement	Strongly Agreed	Agreed	Neutral	Disagreed	Strongly Disagreed
	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)	Frequency (%)
My parents cautioned me about the difficult nature of mathematics	8 (8.8)	12 (13.2)	8 (8.8)	31 (34.1)	32 (35.2)
My senior brothers/sisters cautioned me about the difficulty of mathematics	12 (13.2)	18 (19.8)	6 (6.6)	31 (34.1)	24 (26.4)
Seeing my siblings struggling in passing mathematics informed me that I will not be good at mathematics	10 (11.0)	8 (8.8)	5 (5.5)	29 (31.9)	39 (42.9)
My performance in mathematics was influenced by my basic school mathematics teacher	23 (25.3)	28 (30.8)	11 (12.1)	18 (19.8)	11 (12.1)
Mathematics teacher classroom teaching practices influenced my perception about mathematics	24 (26.4)	31 (34.1)	9 (9.9)	17 (18.7)	10 (11.0)
The attitude of the mathematics teacher in class influences my perception about mathematics	24 (26.4)	21 (23.1)	10 (11.0)	18 (19.8)	18 (19.8)
Mathematics teachers present the subject as a difficult one	12 (13.2)	14 (15.4)	7 (7.7)	16 (17.6)	42 (46.2)

Mathematics teacher using cane during lessons made me dislike mathematics	25 (27.5)	18 (19.8)	6 (6.6)	14 (15.4)	28 (30.8)
My JHS mathematics teacher advised me to be serious with mathematics in the SHS	40 (44.0)	17 (18.7)	8 (8.8)	16 (17.6)	10 (11.0)
My experience at the primary school influenced my perception about mathematics	31 (34.1)	26 (28.6)	9 (9.9)	15 (16.5)	10 (11.0)
My friends in class say mathematics is difficult	20 (22.0)	26 (28.6)	12 (13.2)	16 (17.6)	17 (18.7)
My BECE mathematics grade informed me that I am not good at mathematics	16 (17.6)	31 (34.1)	10 (11.0)	16 (17.6)	18 (19.8)
My first mathematics class at SHS influenced my perception about mathematics	19 (20.9)	21 (23.1)	12 (13.2)	23 (25.3)	16 (17.6)
My experience at the JHS influence my perception about mathematics	24 (26.4)	29 (31.9)	8 (8.8)	14 (15.4)	16 (17.6)
My school seniors cautioned me about the difficulty of mathematics	20 (22.0)	24 (26.4)	8 (8.8)	20 (22.0)	19 (20.9)

From Table 4.5, the first factor "My parents cautioned me about the difficult nature of mathematics", 8.8% of participants strongly accepted that, they have experience it and 13.2% agreed they experienced it. Generally, 22.0% of the participants agreed to that factor. 34.1% and 35.2% of the participants disagreed and strongly disagreed respectively to this factor, with 69.3% generally disagreed to this factor. However, 8.7% of the participants were neutral to this factor.

Another factor that was generally disagreed was "My senior brothers/sisters cautioned me about the difficulty of mathematics". 13.2% and 19.8% strongly agreed and agreed respectively to this factor, meaning 33.0% of the participants generally agreed to this factor. 34.1% and 26.4% of the participants disagreed and strongly disagreed respectively to this factor, thus 60.5% of the participants generally agreed to have experienced this factor. However, 6.5% of the participants were undecided on this factor.

A factor that was least experienced by the participants was "Seeing my siblings struggling in passing mathematics informed me that I will not be good at mathematics". 11.0% and 8.8% of the participants strongly agreed and agreed respectively, with 19.8% of the participants generally agreed to this factor. 31.9% and 42.9% disagreed and strongly disagreed to have experienced this factor with 74.8% generally disagreed to have experienced it. Notwithstanding, 5.4% of the participants were undecided on this factor.

When "My performance in mathematics was influenced by my basic school mathematics teacher" was considered, 25.3% and 30.8% of the participants strongly agreed and agreed respectively with 56.1% generally agreed to this factor. 19.8% and 12.1% of the participants disagreed and strongly disagreed respective to this factor with 31.9% generally disagreed. 12.0% of the participants were neutral on this.

Another factor that most of the students agreed to have influenced their perceptions about mathematics was "Mathematics teacher classroom teaching practices influenced

my perception about mathematics". 26.4% and 34.1% strongly agreed and agreed respectively to this factor, with 60.5% generally agreeing to this factor. Notwithstanding, 18.7% and 11.0% of the participants respectively disagreed and strongly disagreed to this factor influencing their perception. 9.8% of the students were undecided on this factor. This factor was the second most influential factor to the sources of participants' perceptions about mathematics.

"The attitude of the mathematics teacher in class influences my perception about mathematics", was also considered as an influential factor to students' perceptions about mathematics. 26.4% and 23.1% of the participants strongly agreed and agreed respectively. Generally, 49.5% of the participants agreed to this factor. 19.8% of the participants disagreed and strongly disagreed respectively to this factor, with 39.6% of the participants generally disagreed to this factor. However, 10.9% of the participants were undecided on this factor.

When "Mathematics teachers present the subject as a difficult one", was considered, 13.2% and 15.4% of the participants strongly agreed and agreed respectively, with 28.6% generally agreed to this factor. 17.6% and 46.2% of the participants disagreed and strongly disagreed respectively to this factor with 63.8% generally disagreed. 7.6% of the participants were however undecided.

Furthermore, "Mathematics teacher using cane during lessons made me dislike mathematics", was another factor that was considered. 27.5% and 19.8% of the participants strongly agreed and agreed respectively. 47.3% of the participants generally agreed to this factor. On the other hand, 15.4% and 30.8% of the participants disagreed and strongly disagreed to this factor, with 46.2% generally disagreed. However, 6.5% of the participants were undecided on this factor.

"My JHS mathematics teacher advised me to be serious with mathematics in the SHS', was ranked the first influential factor of participants' perceptions of mathematics. 44.0% and 18.7% of the participants strongly agreed and agreed respectively with 62. 7% of them generally agreed to this factor. Notwithstanding, 17.6% and 18.7% of the participants disagreed and strongly disagreed to this factor, with 28.6% of the participants generally disagreed, and 8.7% of the participants were neutral on this factor.

Another influential factor that was ranked first and same as the previous factor was "My experience at the primary school influenced my perception about mathematics". 34.1% and 28.6% of the participants strongly agreed and agreed respectively to, with 62.7% generally agreed to this factor. However, 16.5% and 11.0% of the participants disagreed and strongly disagreed respectively to the factor, with 27.5% generally disagreed. 9.8% of the participants were undecided on this factor. These two factors that was ranked most influential factors are concerned with the participants' experience at the JHS. This is similar to the findings of Mutodi and Ngirande (2014), the origin of different student perceptions is the individual life histories that each student brings to mathematics learning. They added that these life histories influence the way the students position themselves in the classroom, the way they engage with mathematics, teachers, and peers, and the way they interpret mathematical experiences.

"My friends in class say mathematics is difficult". 22.0% and 28.6% of the participants strongly agreed and agreed respectively to this factor, with 50.6% of the participants generally agreed to this factor. 17.6% and 18.7% of the participants disagreed and strongly disagreed respectively, with 36.3% of them generally disagreed. However, 13.2% of the participants were undecided on this factor.

"My BECE mathematics grade informed me that I am not good at mathematics". 17.6% and 34.1% of the participants strongly agreed and agreed respectively with 51.7%

generally agreed to this factor. However, 17.6% and 19.8% of the participants disagreed and strongly disagreed respectively to this factor, with 37.4% generally disagreed to this factor. 10.9% of the participants were undecided on this factor.

"My first mathematics class at SHS influenced my perception about mathematics". 20.9% and 23.1% of the participants strongly agreed and agreed respectively to this factor, with 44.0% generally agreed. 25.3% and 17.6% of the participants disagreed and strongly disagreed respectively, with 42.9% generally disagreed. 13.1% of the participants were neutral on this factor.

" My experience at the JHS influence my perception about mathematics". 26.4% and 31.9% of the participants strongly agreed and agreed respectively with 58.3% generally agreeing to this factor. 15.4% and 17.6% of the participants respectively disagreed and strongly disagreed with 33.0% generally disagreed to this factor. However, 8.7% of the participants were undecided. This factor was ranked as the third most influential factor of participants' perceptions about mathematics.

"My school seniors cautioned me about the difficulty of mathematics". 22.0% and 26.4% of the participants strongly agreed and agreed to this factor, with 48.4% of the participants generally agreed to this factor. 22.0% and 20.9% of the participants disagreed and strongly disagreed to this factor, with 42.9% generally disagreed to this factor. 8.7% of the participants were undecided on this perception.

Factor analysis

The factors as described above were subjected to factor analysis to find out which of these factor that affects students' perceptions of mathematics. Factor analysis has been employed over years to reduce large variables into less and contributing factors. Table 4.6 indicates the value of KMO and Bartlett's Test. From Table 4.6, the value of KMO obtained was 0.612 (> 0.5), which was greater than (>) 0.5. The hypotheses used to test

Bartlett's Test were H0: There is no correlation between variables and H1: There is correlation between variables. The p-value obtained is 0.000 (<0.05); which was less than a predetermined value α = 0.05, therefore H0 was not accepted and there was a relationship between variables. The result indicates that the data was adequate to be analyzed using factor analysis (DeCoster, 2012).

Table 4.6: KMO and Bartlett's Test

KMO and Bartlett's Test	
Kaiser-Meyer-Olkin Measure of Sampling_Adequacy	.612
Bartlett's Test of Sphericity Approx. Chi-Square	288.384
df	90
Sig.	.000

According to Table 4.6, 15 components were first identified before extraction using factor analysis. After extraction was done, six factors were considered as the factors based on eigenvalues greater than 1, where the eigenvalues were; FA1 = 2.903, FA2 = 2.041, FA3 = 1.635, FA4 = 1.258, FA5 = 1.198 and FA6 = 1.054. This was observed in the scree plot in Figure. 4.4.

After extraction was done, it was found that the total cumulative variances for these six factors were 67.268%. A total of 19.357 % was explained by FA1, 13.606 % was explained by FA2 and each of 10.900 %, 8.389 %, 7.988 % and 7.028 % were explained by FA3, FA4, FA5 and FA6 after extraction.

In addition, rotation was used to ease the interpretation of the data and to optimize the structure of the six factors. Similar to the extraction method, the eigenvalues must be greater than 1 as shown in table 4.7. The variance for the first factor (FA1) reduced from 19.357 % to 16.008 % that was by 3.349 %. Also, the second factor (FA2) reduced from

13.606 % to 12.433 % that was by 1.173%. However, the variances of the other four factors were increased about 1.092 % (FA3), 0.995 % (FA4), 1.070 % (FA5) and 1.365 % (FA6). These confirmed that FA1 was more correlated to the dependent variable compared to other factors.

Table 4.7: Total Variance Explained

Total Variance Explained

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	2.903	19.357	19.357	2.401	16.008	16.008
2.	2.041	13.606	32.963	1.865	12.433	28.441
3.	1.635	10.900	43.863	1.799	11.992	40.434
4.	1.258	8.389	52.252	1.408	9.384	49.817
5.	1.198	7.988	60.240	1.359	9.058	58.875
6.	1.054	7.028	67.268	1.259	8.393	67.268
7.	.926	6.171	73.439			
8.	.807	5.381	78.821			
9.	.678	4.520	83.341			
10.	.608	4.051	87.393			
11.	.502	3.350	90.743			
12.	.406	2.710	93.453			
13.	.396	2.639	96.092			
14.	.327	2.180	98.272			
15	.259	1.728	100.00			

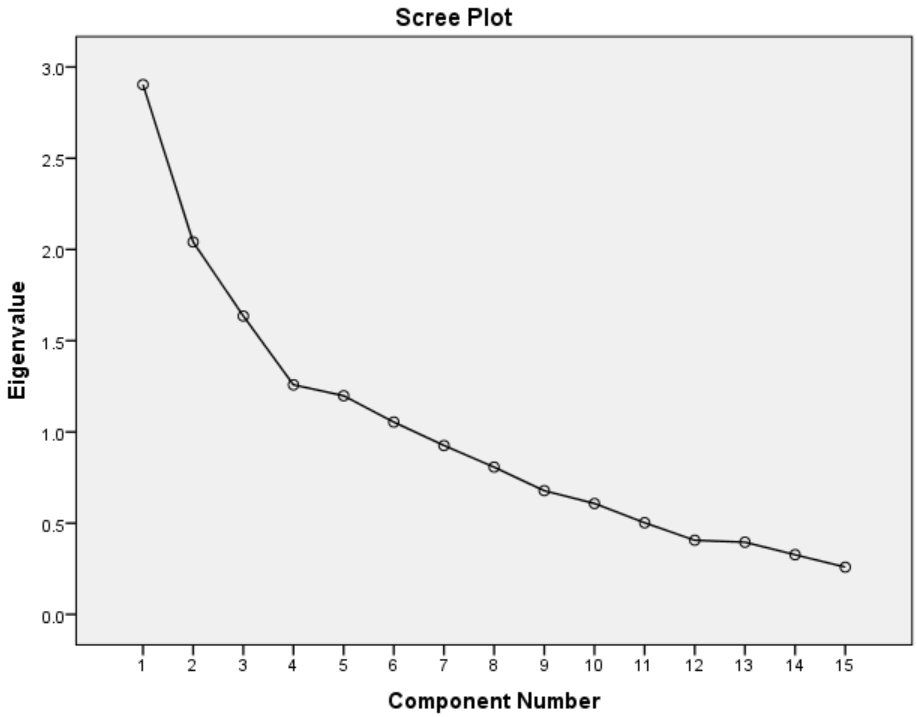

Figure 4.4: Scree plot of the factor component against eigenvalue

Results from Table 4.8, FA1 is a major contributor that contains variables, V6 (0.866), V5 (0.795), V10 (0.528), V4 (0.494), V14 (0.460). V11 (0.350) and the second highest contributor is FA2 which contains items V9 (0.689), V12 (0.644), V15 (0.581) and V11 (0.508). The third contributor is FA3 that consists of items V1 (0.873) and V2 (0.866). The fourth contributors FA4 includes the items of V3 (0.839) and V15 (0.488). The fifth contributors FA5 includes the items of V8 (0.865) and V7 (0.504). The last contributor is FA6 which contains components of V13 (0.903), V14 (0.383) and V10 (0.343).

Table 4.8: Rotated Component Matrix

Component	1	2	3	4	5	6
V6. The attitude of the mathematics teacher in class influenced my perception about mathematics	0.866					
V5. Mathematics teacher classroom teaching practices influenced my perception about mathematics	0.795					
V10. My experience at the primary school influences my perception about mathematics	0.582					
V4 My performance in mathematics was influenced by my basic school mathematics teacher	0.494					
V14. My experience at the JHS influence my perception about mathematics	0.460					
V11. My friends in class say mathematics is difficult	0.350					
V9. My JHS mathematics teacher advised me to be serious with mathematics in the SHS		0.689				
V12 My B.E.C.E mathematics grade informed me that I am not good at mathematics		0.644				
V15. My school seniors cautioned me about the difficulty of mathematics		0.581				
V11. My friends in class say mathematics is difficult		0.508				
V1. My parents cautioned me about the difficult nature of mathematics			0.873			

V2. My senior brothers/sisters cautioned me about the difficulty of mathematics	0.866			
V3. Seeing my siblings struggling in passing mathematics informed me that I will not be good at mathematics		0.839		
V15. My school seniors cautioned me about the difficulty of mathematics		0.488		
V8. Mathematics teacher using cane during lessons made me dislike mathematics			0.548	
V7. Mathematics teachers present the subject as a difficult one			0.510	
V13. My first mathematics class at the SHS influenced my perception about mathematics.				0.903
V14. My experience at the JHS influence my perception about mathematics				0.383
V10. My experience at the primary school influences my perception about mathematics				0.343

According to Figure. 4. 5, all of the components that have been classified into six factors can represent the factors that influences students' perceptions of mathematics. From Figure. 4. 5, mathematics teachers' attitude in class can be identified as the major factor (FA1) and corroborate with similar studies and observations made by Blazar and Kraft (2017). The students' past experiences with mathematics teachers were also identifies as major factors, (FA2) and (FA5) that influence students' perceptions about mathematics. The students' previous experiences with mathematics teachers and their instructional

methods and counselling processes influence students' perceptions. This is in line with the findings of Mutodi and Ngirande (2014).

Parents influence on their wards' perceptions about mathematics was highly rated (Table 4.8) and observed as the third factor (FA3). Similar results were obtained by McLeod (1989) and Sam (2002). The peers of students, both at school and home was also observed to have a great influence on students' perceptions. It was major factor in (FA4) and (FA6). This is not different from the findings of McLeod, (1989), Sam, (2002) and Mutodi and Ngirande, (2014).

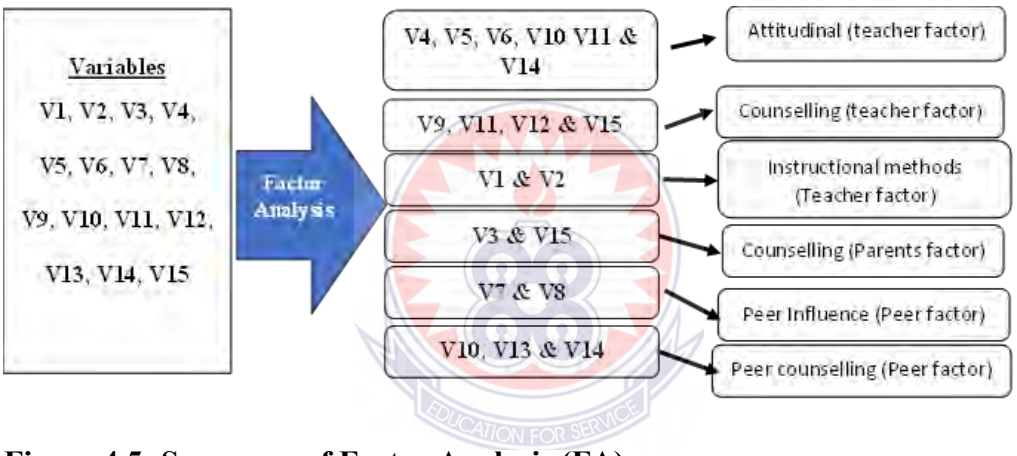

Figure 4.5: Summary of Factor Analysis (FA)

After the factors were identified, the reliability analysis was carried out. The Cronbach's Alpha value shows how accurate and precise the measurement made on the factors were. According to the results in the Table 4.9, all the Cronbach's Alpha values are acceptable. This is supported by Choi et al., 2001, where the value of each factor should be ≥ 0.530 to prove that the factor can be said to have internal consistency reliability and the factor with correlation coefficient <0.4 will be removed.

Table 4.9: Cronbach's Alpha value

Factor	Cronbach's Alpha	Internal Consistency
Attitudinal (teacher)	0.658	Good
Counselling (teacher)	0.648	Good
Method of delivery	0.643	Good
Counselling (parent)	0.532	Medium
Peer Influence	0.542	Medium
Peer counselling	0.565	Medium

Research question 4: What is the relationship between students' perception of mathematics and their performance in mathematics?

This research question sought to determine the relationship between students' performance and their perception about mathematics. To answer this question, participants performance and negative perception rating was explored. A correlation analysis was run between these two variables to determine if a relationship exist between them.

Table 4.10: Descriptive Statistics of Mathematics Achievement Test

	N	Minimum	Maximum	Mean	Standard deviation
MAT	91	2.00	10.00	6.25	3.15

Participants' scores in the mathematics achievement test were recorded and analyzed. The table above shows the descriptive statistics of the scores. From the table, the mean score was 6.25 with a standard deviation of 3.15. The minimum score was 2.0 and the maximum was 10.0. Generally, the scores in the mathematics achievement test were encouraging which reflects in the mean value above the pass mark of 5.

Participants' general average perception was rated and the descriptive statistics of the ratings are presented in Table 4.11.

Table 4.11: Descriptive Statistics of participants' negative perception rating

	N	Minimum	Maximum	Mean	Standard deviation
Negative Perception Rating	91	1.80	4.70	4.1626	0.66209

From Table 4.11, the average participant perception rating was 4.1626 which suggests participants responses generally agreed to the perceptions given them. Since these given perceptions were negatively held perceptions about mathematics, the high mean of 4.1626 indicates that participants generally agreed to these negative perceptions. A low standard deviation of 0.66209 indicates participants average perception rating was clustered around the mean value.

To determine the relationship between the students' perceptions and their performance in mathematics, a correlation analysis between the participants' perception and the participants score in the Mathematics Achievement Test (MAT) as shown in Table 4.12.

Table 4.12: Correlation between Participants' Perceptions of Mathematics and Mathematics Achievement Test (MAT)

		Mathematics Achievement Test	SP
Mathematics Achievement Test	Pearson Correlation	1	-0.616**
	Sig. (2-tailed)		.002
	N	91	91
Students' Perception	Pearson Correlation	-0.616**	1
	Sig. (2-tailed)	.002	
	N	91	91

From the Table 4.12, it could be found that the result of the co-efficient of Pearson product moment between the two variables was -0.616. This coefficient signals a negative correlation suggesting that there exists a relationship between students' perceptions and students' performance. A high but negative correlation value of -0.616 indicates that there is a strong relationship between the two variables. This means as participants' negative perception rating decreases, there is a strong tendency of an increase in performance. This finding is consistent with Marchis (2011) and Singh and Imam (2013) who also found that student's perception influenced their academic performance.

4.3 Discussion of Findings

The current study used the Affective Cognitive Consistency Theory and the Self Perception Theory as springboards and theoretical framework. The two theories explained how individuals' feelings affects their behaviors and attitudes and consequently how individuals' behaviors and attitudes are influenced by others.

Participants provided information concerning their age, gender and programs they offer in school. Participants' ages were 16 years or more indicating they were matured and could respond meaningfully to the questions. The researcher was gender sensitive as 40.7% and 59.3% of the sample were respectively used for females and males. The participants were selected from five different programs from the two schools without emphasis on any program. This indicates that, the study did not exclude or prioritize any program over another.

Research question one sought to find students level of interest in mathematics. From the findings on the first open-ended question of the questionnaire, the justifications given by a sample of the 23% of participants who do not like mathematics showed they were not interested in mathematics and were associated with some negative perception of mathematics. On the contrary, a sample from the 68% of participants, justifying why they like mathematics indicates that, they have positive attitudes and perceptions towards mathematics and were interested and willing to learn mathematics.

Findings on students' responses to the second open-ended question of section D of the questionnaire reveal that 30.77% of the participants have ever intentional missed their mathematics lessons. Their justifications showed that they have negative attitudes towards mathematics and were not interested in mathematics, whilst 69.23% of the participants have never intentionally missed their mathematics lessons. These 69.23% are assume to have positive attitudes toward mathematics and are interested in learning mathematics.

With regard to the third open-ended question of the section D of the questionnaire, justifications given by the 31.87% of the participants for not participating in mathematics activities in class indicate their negative perceptions of mathematics and their lack of

interest in mathematics. Compared with the 68.13% who always participate in mathematics activities in class, means most of the students are interested in mathematics. Finally, when participants were asked to rank their interest in mathematics, as question four of section D of the questionnaire, the results shows that 50.6% and 22.0% of participants had high and moderate interest levels in mathematics respectively with 27.5% showing low interest in mathematics. The results also show an average interest rating of 7.15 which falls within the rate of high interest level. Generally, the results indicate students have high interest in mathematics. This finding is however inconsistent with the study by Matic (2014) which found that students do not have high interest in mathematics and its related subjects.

With regards to students' perceptions of mathematics. A list of ten negative perceptions were presented to participants to tick if they agreed to them or not. The results showed an overall average perception rating of 4.1626 which suggest students in generally agrees to and hold to these negative perceptions about mathematics. Three different perceptions out of the ten were identified to have high percentage of acceptance from the participants, indicating participants' possession. "Mathematics problems have one and only one right answer", "Mathematics is all about calculation" and "Mathematics activities include procedures that are devoid of real discovery and problem solving" with general acceptance percentages 49.5%, 69.3% and 68.4% respectively. It is also evident that "Mathematics is all about calculation" was the most commonly held perception among participants. Conversely, the perception that was least held by participants was "Mathematics is a male dominant subject" with 13.2% of participants agreeing and 79.2% generally disagreeing. This finding does not support that of Arthur et al., (2017) which asserts that Ghanaian students have positive perceptions about mathematics.

However, the findings support Schoenfeld (1992) which finds students to hold all these negative perceptions about mathematics.

Research question three sought to identify factors that influence students' perceptions about mathematics. The results shows that students' perceptions of mathematics were influenced by teacher, parent and peer factors. The results of the quantitative data analysis indicates that two factors were most influential to their mathematics perceptions "My JHS mathematics teacher counselling on mathematics at the SHS level" and "My experience at the primary school influence my perception of mathematics" with 62.7% of participants generally agreeing to each factor. This was followed by "Mathematics teacher classroom teaching practices influenced my perception about mathematics" with 60.5% of participants agreeing and "My experience at the JHS influence my perception of mathematics" with 58.3% of the participants agreeing to this factor. Participants agreement to these four factors is an indication that students form their perceptions of mathematics at the early stages of their education making it difficult to be changed at the senior secondary school and tertiary levels. The same factors were contained in the six factors from the factor analysis. The six factors obtained from the factor analysis are;

- Teachers' attitude in class
- Teachers' counselling
- Teachers' method of delivery
- Parental counselling
- Peer counselling
- Peer influence

The six factors were further subjected to reliability analysis with acceptable Cronbach's alpha values. This is consistent with the findings of Sam (2002), Blazar and Kraft (2017) who found that parents, teachers and peers influence students mathematics perceptions.

With research question four, the descriptive statistics on MAT 10/10 and 2/10 as the maximum and minimum scores respectively with a mean score of 6.25 and standard deviation of 3.15. The mean indicates that participants' performance was generally good. The standard deviation shows that scores were not clustered around the mean. The descriptive statistics on participants' negative perception rating indicate a mean of 4.1626 and a standard deviation of 0.66209. The mean shows that most participants agreed to the negative perceptions of mathematics as the rating was from 5-1 representing strongly agreed, agreed, neutral, disagreed and strongly disagreed respectively. The standard deviation shows other values were clustered around the mean.

The results of the correlation analysis between MAT and negative perception rating shows a strong negative correlation between negative perceptions of mathematics and MAT. This suggests that as negative perception of students increase, there is the tendency of a decrease in mathematics performance. This finding is consistent with research by Singh and Imam (2013).

CHAPTER 5

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Overview

This chapter summarizes key findings of the study on students' perceptions of mathematics and the effect of their perceptions on their interest, attitude and performance in mathematics; the case of senior high schools in the Yendi municipality of Northern region of Ghana. On the basis of this, conclusion is drawn from the objectives of the studies. The chapter ends with recommendations on the key findings of the study.

5.1 Summary of the Study

The purpose of the study was to investigate students' perception of mathematics, and their interest in learning mathematics as well as the factors that influences their perceptions. The population for the study constituted two SHS final year students from Yendi municipality. The sample for the study was 100 final year students sampled from SHS in the Yendi municipality. The study adopted two research instruments amidst a survey design. The instruments were questionnaire and mathematics achievement test. The questionnaire was used to answer research question1, 2 and 3. The mathematics achievement test supported the questionnaire result and answered research question 4. To answer research question one, section D of the questionnaire was analyzed. Participants' responses to open ended questions were thematically discussed and the rating of their interest in mathematics was categorized and analyzed with SPSS. Research question two and three were analysed by Likert scale ranking with SPSS and subsequently conducting correlational analysis. Also, factor analysis was conducted to assess the factors that influence student perceptions of mathematics. The research question four was answered by analyzing the perception of the participants and their

performance in the MAT. A correlation analysis was conducted to determine the relationship between these two variables.

The study showed that students had high interest levels in mathematics but perceived mathematics to be all about calculations. Also, generally students showed positive interest in mathematics which was evident in the mathematics achievement test. However, common factors that influence students' perceptions were teacher's guidance and methodology. In addition, there was a strong inverse relationship between students' perceptions of mathematics and their performance in the subject.

5.2 Summary of key Findings

The findings evolved from this study are summarized below with their respective research questions.

1. The first research question sought to find out students' level of interest in learning mathematics in Yendi municipality. From the analysis of the data, it was evident that most students in the Yendi municipality have high interest levels in mathematics and are willing to learn mathematics and excel with some challenges.
2. The data as analysed for research question two showed the following findings on students' perceptions of mathematics. Students were asked to rank perceptions on a Likert scale. The results show that, "Mathematics is all about calculations" was the most common perception. This was followed by "Mathematics activities include procedures that are devoid of real-life discovery and problem solving" and "Mathematics problems have one and only one right answer". In general, the findings from the perception rating showed students had negative perceptions about mathematics.

3. With regards to research question three, teachers' attitude, teachers' counselling, teachers' instructional methods, parental counselling, peer influence and peer counselling were identified to be the factors that influence students' perceptions about mathematics. Teachers' attitude was the most influential factor of student perception of mathematics.
4. Students' perceptions about mathematics had a strong relationship with student's performance in mathematics. This suggests that students with negative perceptions in mathematics has a high tendency of performing low in mathematics.

5.3 Conclusion

Base on the findings of the study, it concludes that there is a strong inverse relationship between students' perceptions and their performance in mathematic in Yendi municipal. Most students in the Yendi municipal have the following negative perception of mathematics: "Mathematics is all about calculations, Mathematics activities include procedures that are devoid of real-life discovery and problem solving, Mathematics problems have one and only one right answer". These perceptions in most instances are influenced by home, school and teacher factors. Mathematics teachers' attitude, counselling and instructional methods, parental counselling, and peer influence were the factors identified to influence students' perceptions of mathematics. However, the study also concludes that students in Yendi municipal still have high interest in mathematics.

5.4 Recommendations

This study investigates student interest level in mathematics, their perceptions of mathematics and factors that influenced their perceptions. Based on the findings of the study, the following recommendations were made:

The study finds that, students have high interest in mathematics and as such, recommends that teachers encourage and motivate students to sustain their interest in mathematics. Teachers can motivate learners by rewarding positive attitudes of learners in class.

Students' negative perceptions of mathematics can be minimized by mathematics teachers when they incorporate real life application of concepts in their lessons. In addition, mathematics teachers can minimize students' negative perceptions of mathematics when they strive to use the appropriate Teacher learner materials (TLMs) in their lessons. Furthermore, when mathematics teachers use multimedia in their lessons, it makes mathematics interesting and thus minimize students' negative perceptions of mathematics.

The study finds that students' perceptions are influenced by home, school and teacher factors. As a result, the study recommends educational stakeholders within these key aspects to ensure free flow of communication to minimize the negative perceptions held by students. Talks and workshops can be organized to highlight the positives of mathematics in the society.

As a result of the relationship between students' perceptions and mathematics performance, educational stakeholders should expose learners to the relevance and importance of mathematics to create a positive perception about the subject in the minds of the learner.

5.5 Suggestion for Future Research

There have been many studies on the perception, interest and performance of students in mathematics over the years. It is suggested that future studies should assess and evaluate the progress of the studies over a long period. In addition, future studies could be undertaken to assess the progress of students as they move from the junior high school to senior high school and the tertiary. There is also the need for further studies to consider

evidence-based practices such as teachers' communication skills and methodology during lessons in a mathematics classroom. Future studies can be expanded to look at the effectiveness of the approaches on students' strengths and abilities to meet educational demands. It could be possible that future works could consider peer influence as a sole factor and conduct a longitudinal survey study to ascertain its immediate and long-term effect on students' choice of career.

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APPENDICES

APPENDIX A

QUESTIONNAIRE FOR PARTICIPANTS

UNIVERSITY OF EDUCATION, WINNEBA

FACULTY OF SCIENCE

DEPARTMENT OF MATHEMATICS EDUCATION

My name is Abubakari Abdul-Jalil, a student of University of Education, Winneba. I am doing this schoolwork to ascertain Students' perceptions and their interest in mathematics: the case of selected senior high schools (SHS) in Tamale Metropolis of Northern Region". This questionnaire is for academic purposes only as part of a requirement for the award of a Masters of philosophy degree, hence your participation is highly required. All the answers you will give will be between you and me and will not be seen by anyone. If I ask any question you don't want to answer, just tell me and I will go on to the next question. However, I hope you will participate fully in this school assignment since your views are important.

Thanks for your co-operation.

Section A. Background information of the Participant

Q#	Question	Responds	Code
	Section A: Socio-demographics		
1	School code		
2	What is your age (in years)?	15 years 16 – 18 years 19 years and above	
3	What is your gender?	0. Male 1.Female	
4	What is your programme of study?	1.General Science 2.General Arts 3.Visual Art 4.Home Economics	

		5.Agricultural Science 7. Business 8. Technical Science	

Section B: Students' perceptions about Mathematics

Instruction: Please indicate the extent to which you agree or disagree with each of the statement in the table below

KEY: Strongly Agree=SA, Agree=A, Uncertain=N, Disagree=D, Strongly disagree=SD.

	Statement	**SA**	**A**	**N**	**D**	**SD**
5	Mathematics is difficult, cold and abstract.					
6	Learning Mathematics is a question more of ability than effort					
7	Mathematics is only for the clever ones or only for those who have inherited mathematical ability.					
8	Mathematics is a male dominant subject.					
9	The mathematics learned in schools has little or nothing to do with the real world.					
10	Mathematics problems have one and only one right answer.					

11	There is always one correct way to solve any mathematics problem: usually the rule the teacher has most recently demonstrated to the class.					
12	Ordinary students cannot understand mathematics; they can memorize it and apply what they have learned mechanistically and without understanding.					
13	Mathematics is all about calculation					
14	Mathematical activities include procedures that are devoid of real life, discovery and problem-solving.					

Section C: Factors behind students' perceptions about Mathematics

Instruction: Please indicate the extent to which you agree or disagree with each of the statement in the table below

KEY: Strongly Agree=SA, Agree=A, Uncertain=N, Disagree=D, Strongly disagree=SD.

	Family centered	**SA**	**A**	**N**	**D**	**SD**
15	My parents cautioned me about the difficult nature of mathematics					
16	My senior brothers/sisters cautioned me about the difficulty of mathematics					

17	Seeing my siblings struggling in passing mathematics informed me that I will not be good at mathematics					
	Teacher centered	**SA**	**A**	**N**	**D**	**SD**
18	My performance in mathematics was influenced by my basic school mathematics teacher					
19	Mathematics teacher classroom teaching practices influenced my perception about mathematics					
20	The attitude of the mathematics teacher in class influenced my perception about mathematics					
21	Mathematics teachers present the subject as a difficult one					
22	Mathematics teacher using cane during lessons made me dislike mathematics					
23	My JHS mathematics teacher advised me to be serious with mathematics in the SHS					
	Past experience	**SA**	**A**	**N**	**D**	**SD**
24	My experience at the primary school influences my perception about mathematics					
25	Advice from my SHS seniors influence my perception about mathematics					

26	My friends in class say mathematics is difficult					
27	My B.E.C.E mathematics grade informed me that I am not good at mathematics					
28	My first mathematics class at the SHS influenced my perception about mathematics.					
29	My experience at the JHS influence my perception about mathematics					
30	My school seniors cautioned me about the difficulty of mathematics					

Section D: Student Interest in Mathematics

31. Do you like mathematics as a subject? YES/NO
32. Explain your answer in question 31.
33. Have you ever intentionally missed your mathematics lessons? YES/NO
34. If your answer to question 34 is yes, kindly explain why.
35. Do you always participate in mathematics activities in class? YES/NO
36. Do you have interest in learning mathematics and will like to read mathematics related program at the tertiary level? YES/NO
37. Kindly explain your answer in question 36.
38. Rate your interest level in mathematics on a scale of 0-10 where 10 means highly interested in mathematics and 0 means not interested in mathematics.

Scale	Frequency
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

APPENDIX B

MATHEMATICS ACHIEVEMENT TEST

ANSWER ALL QUESTIONS FROM THIS SECTION

Each question is followed by four options lettered A to D. Find the correct option for each question and circle the letter that corresponds with your answer. Give only one answer to each question

For which value of x is y not defined in the relation, $y = \frac{2x-5}{3x+2}$?

A $x = \frac{5}{2}$ B. $x = \frac{2}{3}$

C. $x = -\frac{5}{2}$ D. $x = -\frac{2}{3}$

If p, q, r and s are all positive and, $= \sqrt{q^2 - \frac{r^2}{S^2}}$, make s the subject of the relation.

A. $s = \frac{r}{q^2-p^2}$ B. $s = \frac{r}{p^2-q^2}$

C. $s = \frac{r}{\sqrt{q^2-p^2}}$ D. $s = \frac{\sqrt{p^2-q^2}}{r}$

Simplify $\frac{3\frac{1}{4}-1\frac{3}{5}}{4\frac{2}{5}}$ expressing your answer in decimal.

A. 0.125 B. 0.375

C. 0.625 D. 0.5

Rewrite $\frac{0.000867}{842}$ in standard form

A. $\frac{8.67\times10^{4}}{8.00\times10^{-2}}$ B. $\frac{8.67\times10^{-4}}{8.00\times10^{-2}}$

C. $\frac{8.67\times10^{-4}}{8.42\times10^{2}}$ D. $\frac{8.00\times10^{-4}}{8.00\times10^{2}}$

Write $1.\overline{67}$ as a common fraction.

A. $\frac{167}{99}$ B. $\frac{166}{99}$

C. $\frac{165}{99}$ D. $\frac{166}{100}$

Which of the following is described by $\{x: -4 < x < 3\}$ where x is an integer?

A. {0, 1, 2} B. {-3, -2, -1}

C. {-3, -2, -1, 0, 1, 2} D. {-3, -2, -1, 0, 1, 2, 3}

If Q = {1, 3, 5, 7, 9, 11}, which of the following adequately defines Q?

A. The set of odd numbers B. The set of odd numbers less than 11

C. The set of odd numbers less than 13 D. The set of even numbers less than 12

Which of the following is/are rational?

I. P = $\{2, \sqrt{3}, 5\}$ II. Q = $\{7, \frac{1}{6}, \sqrt{9}\}$ III. R = $\{-3 \leq x \leq 8\}$

A. I only B. II only

C.III only D. II and III only

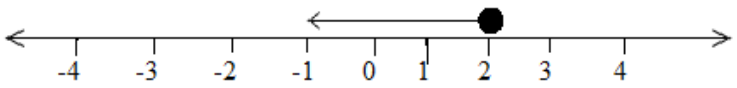
Find the truth set of the inequality, $2y + 3 < 4y - 3$.

A. $\{y: y < 3\}$ B. $\{y: y < 0\}$

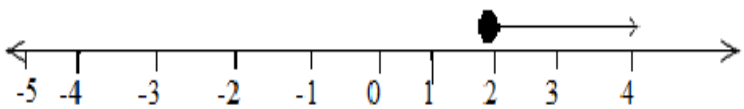
C. $\{y: y > 3\}$ D. $\{y: y > 1\}$

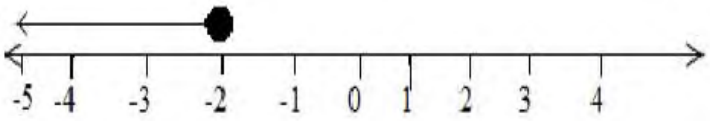
Which of the following number lines illustrates the solution set of $3x + 5 \geq -1$

A.

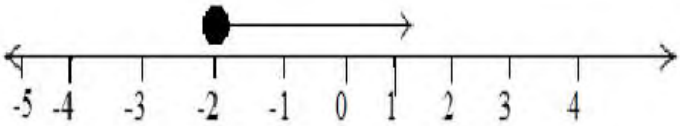


B.





C.



D.

APPENDIX C

INTRODUCTORY LETTER

UNIVERSITY OF EDUCATION, WINNEBA

DEPARTMENT OF MATHEMATICS EDUCATION

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

21 /12/2020

TO WHOM IT MAY CONCERN

Dear Sir /Madam,

LETTER OF INTRODUCTION: ABUBAKARI ABDUL-JALIL (200014031)

I write to introduce to you the bearer of this letter, Mr. Abubakari Abdul-Jalil a postgraduate student in the University of Education, Winneba. He is reading for Master of Philosophy degree in Mathematics Education and as part of the requirements of the programme, he is undertaking a research titled – ***Students' perceptions about mathematics and the effects of their perceptions on their interest in mathematics: The case study of three (3) Senior High Schools (SHS) in Tamale Metropolis of Northern Region***.

He needs to gather information to be analysed for the said research and he has chosen to do so in your institution. I would be grateful if he is given the needed assistance to carry out this exercise.

Thank you.

Yours faithfully,

UNIVERSITY OF EDUCATION, WINNEBA
SIGN
DATE
DEPARTMENT OF MATHEMATICS EDUCATION

Dr. Joseph I. Nyala
Graduate Coordinator

APPENDIX D

APPLICATION FOR MUNICIPAL EDUCATION DIRECTOR'S CONSENT

YENDI MUNICIPAL EDUCATION DIRECTORATE

Abubakari Abdul-Jalil
Post Office Box 945 TL
Tamale.
5th July, 2021.

The Municipal Director,
Ghana Education Service,
Post Office Box 6 E/R,
Tamale.

Dear Sir,

INFORMED CONSENT

I would be very grateful if you could grant me permission to conduct research titled " Students' Perceptions and Their Interest in Mathematics: The Case of Senior High Schools in Yendi Municipal of Northern Region" in fulfilment of the requirements for the award of Master of Philosophy in Mathematics Education from the Faculty of Science, Department of Mathematics Education at the University of Education, Winneba. The researcher is assuring you the strictest confidentiality and anonymity. Therefore, no school or individual shall be identified in this study and at the same time schools' academic activities shall not be disrupted by this study. Participants will be allowed to withdraw at any time without penalty or victimization and will be protected from any form of abuse. The outcome of this study will be communicated to the Metropolitan Education Directorate.

I hope my request would be granted.

Thank You.

Yours faithfully,
…….
Abubakari Abdul-Jalil
(Student Researcher)
Student ID: 200014031
0548431931/0205332990