UNIVERSITY OF CAPE COAST

RELATIONSHIP BETWEEN SHS STUDENTS' ATTITUDE, MOTIVATION, ANXIETY, AND ACHIEVEMENT IN THE STUDY OF ELECTIVE MATHEMATICS

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BY

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Thesis submitted to the Department of Mathematics and ICT Education, Faculty of Science and Technology Education, University of Cape Coast, in partial fulfillment of the requirements for the award of Master of Philosophy degree in Mathematics Education

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DECLARATION

Candidate's Declaration

I hereby declare that this thesis is the result of my own original research and that no part of it has been presented for another degree in this University or elsewhere.

Candidate's Signature..... Date.....

Name: John Kudjo Azila

Supervisor's Declaration

I hereby declare that the preparation and presentation of the thesis were supervised in accordance with the guidelines on supervision of thesis laid down by the University of Cape Coast.

Supervisor's signature..... Date.....

Name: Prof. Ernest Kofi Davis

ABSTRACT

The purpose of the study was to analyze the relationship between SHS students' attitude, motivation, anxiety, and achievement towards the study of elective mathematics. The sample consisted of all public grade B mixed SHS 2 students doing Elective Mathematics, selected from five (5) SHSs in three municipalities, drawn from five programmes namely, General Arts, Science, Agricultural Science, Business and Technical. In all, nine hundred and sixty-seven (967) students participated in the study (595 males and 372 females). The purposive sampling technique was used to select the participants. The research designs used were descriptive survey and inferential statistical method. The tools used were achievement test and a questionnaire. The instruments were pre - tested and the construct validity was established using Cronbach alpha. The Cronbach alpha coefficients of the instruments were 0.795 for attitude, 0.791 for motivation and 0.767 for anxiety, which established the internal consistency of the instrument. The statistical tools used to analyse the research questions were Pearson's Product Moment Correlation and Standard Multiple Regression. Attitude, motivation and anxiety therefore, had positive significant effects on achievement. The results revealed that there were strong positive significant correlations between the achievement and each of the affective variables used. There were positive high significant correlations between each pair of affective variables. It is therefore, recommended that elective mathematics teachers and parents check attitude and motivation of the students effectively to enable them develop much desire, interest and the right attitude towards the study of elective mathematics. This will help reduce elective mathematics anxiety level among the students.

KEY WORDS

Achievement test

Attitude towards mathematics

Effective Motivation

Mathematical achievement of the students

Mathematics Anxiety

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DEDICATION

To my beloved wife, Agartha Azila, and our child, Christabel Winner Dorgbefu-Azila.

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CHAPTER ONE

INTRODUCTION

This chapter is the introductory section of the study, it is on the general background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, hypotheses, significance of the study, limitation, delimitations of the study and the organizational plan of the study.

Background to the Study

The development of a nation is dependent on the learning of mathematics in many ways. One, professionals are trained to acquire mathematical knowledge to manage the country's finances and economy. Two, a nation's development of science and technology is established through the training of learners to change the world by knowing how to describe and analyze ways exclusively. This helps to develop in the youth and in the adults an attitude of self-centered problem solving skills, (Bruce, 2016). Githua and Mwangi (2003), stated that it is not easy for any person to live a well-meaning life in any part of the world without mathematics. For instance, mathematics is described as the 'queen of the Sciences'. This means that mathematics should be taken seriously from the early stage of schooling.

In both academic success and efficient functioning in everyday life, skills acquired through the learning of mathematics have long been known as very vital (Carey, Hill, Devine & Szu, 2017). In the study of mathematics, some essential skills such as truth, uniformity, and psychological discipline are

trained. These knowledges acquired help the trainees to make decision to solve everyday life problems effectively. There is an awareness globally about the importance of mathematical knowledge and the expression of worry about under-achievement in mathematics from Basic to tertiary for decades (Eng, Li, & Julaihi, 2010). The mathematics achievement of students from the Basic to the tertiary is still a problem to address (Wahid, Yusof, & Razak, 2014).

In view of its importance many countries, developed and developing alike have made mathematics a compulsory subject up to the secondary school level. For instance, Ghana, Germany, Britain, Canada, Japan, and many more have made mathematics compulsory up to the upper secondary general and vocational education levels (Hodgen, Küchemann, Brown, & Coe, 2008).

According to Anamuah-Mensah, Mereku, & Ghartey-Ampiah, (2008), the application of science, mathematics and technology help in improving productivity and create wealth of a country. Thus, it is very important for every nation to train her citizens to acquire the requisite knowledge in science, mathematics and technology.

Several fields in tertiary, need the applications of mathematical knowledge to fulfil their goals. Some of these disciplines include technical fields, engineering, economics, finance, agriculture, pharmaceuticals, and health science (Nicholas, Poladian, Mack, & Wilson, 2015). Social sciences Universities make use of more applications of a knowledge in mathematics. These universities make it a must that their students take a course in Mathematics. This helps the students at the end to acquire vital knowledge in mathematics. Regrettably, students are dropping out of the universities because of mathematics related courses they have to take. The mathematics as

a course has been identified as a very important blockage for university students (Gradwohl & Eichler, 2018). The study of mathematics is a serious problem mostly in non-scientific university programs, where more than 30% of the students fail in mathematics easily (Awaludin, Razak, Azliana & Selamat, 2015).

In Ghana, all students study Core and Elective Mathematics. While the Core Mathematics is studied by all students, the Elective Mathematics is studied by Science, some Business, some General Arts, some Agriculture and some Technical students. In most cases the elective Mathematics serves as a basis for pursuing those subjects at the tertiary level.

However, many students see Mathematics as very complex subject. This is because Mathematics contains numerous formulae to be memorized, arithmetic calculations, algebraic equations, and geometrical proofs that the students have to master before they can pass easily hence, students' fears in the subject (Delice, Ertekin, Aydın, & Dilmaç, 2009).

Generally, many learners around the world fail mathematics as a subject. Mathematics educators have associated this to poor attitudes of the learners towards the subject. This poor attitude as a factor has contributed to low achievement in mathematics. For instance, in America, research shows that students poorly perform in mathematics. This makes them to have a view about the subject as unfavourable (Hamilton, Mahera, Matenge & Machumu, 2010).

Ogilvy (2015) in a survey reported that more than 50% of USA students have low confidence and ability when it comes to performing calculations in mathematics. Also, Sixty-three percent (63%) of Americans

say even working on simple operations in mathematics such as estimating distances or weight, they had some difficulty solving it.

Furner (2000) revealed that two out of every three Americans dislike mathematics. This group of Americans suffer from mathematics anxiety. Learning mathematics with negative mathematics anxiety and engaging in mathematical activities with negative mathematics anxiety are almost familiar and emotional. Researchers and educators have tried to deal with this mathematics anxiety for many years whether it is an emotion or an attitude (Jackson & Leffingwell 1999).

> *The teaching and learning methods and students' cultural backgrounds influence students' performance in mathematics. Teaching methods like lecture method, discussion method, and type of homework assignments offered to students are used. Learning methods such as group discussions when solving problems and individual works as provided by the teacher or as in textbooks are also used. The relationship between teachers and students, the way students are punished, and homework assignments given to the students also influence students' performances in mathematics, Isack (2015, p. 10).*

One branch of mathematics that is considered a requirement for many advance studies is the Elective Mathematics or further mathematics. Like core mathematics, Senior High School students' achievements in Elective Mathematics are not encouraging as many students continue to fail in the subject (Amanyi, Owuba & Adjabui, 2013). Amanyi et al described the achievement of students in elective mathematics in the West African Senior School Certificate Examinations (WASSCE) in recent years as progressing at a decreasing rate.

In Nigeria, the report of West African Examinations Council (WAEC) from 2001 to 2005 showed that 44.97%, 60.23%, 66.61%, 77.67% and 73.92% of the candidates passed at grade E in Elective Mathematics during the period. This represented average failure of 65% every year within the period. Though, some of the candidates passed, only one out of ten had at least grade C. The percentage that passed did not meet the societal expectations. Many factors could be attributed to this unfortunate situation, (Amanyi et al, 2013). According to them, various reasons for the low performance in elective mathematics may include:

- Teachers without a professional specialization training in the subject teach the subject.
- The competence of students offering the subject.
- Parents and school authorities choose programmes for students without taking into consideration their mathematical background and capabilities.
- Too many topics to be covered in elective mathematics syllabus.
- Ratio of a teacher to many students which makes it difficult for a teacher to pay attention to every student.
- The students with social and psychological problems who need to be given special attention.
- Negative attitudes shown by students towards elective mathematics.

Several decades ago, researchers had tried to determine the factors that affect individuals' achievement in mathematics among the students at various levels of education. The interaction of many variables in education affects number of topics covered (Papanastasiou, 2000). The factors associated

> *with mathematics performance are varied and complex in nature. This has caused many authors to research into the factors.*

Kushwaha (2014), revealed that Mathematics achievement has several research works on it. In these works, the variables were studied together. The researchers based their studies on a few number of these factors such as psychological variables.

Very central to the discourse on poor performance in mathematics is the extent to which affective variables such as motivation, attitude and anxiety affect students' performance in mathematics. Aiken (1970, p. 551, 1976, p. 293) as well carried out studies which showed that affective variables such as personality, anxiety, motivation, interest, to mention but a few, to some extent influence students' mathematics learning and their achievements in mathematics.

Other researchers as well found some variables that make students to experience mathematics as easy or difficulty when learning and achieving in mathematics as courses. They include math self-efficacy, math anxiety, motivation, and attitudes towards math (Cretchley, 2008, Haycock & Steen, 2002; Pajares & Miller, 1995).

Amanyi, Owuba, and Adjabui (2015, p. 249), found out that:

> *Intelligence has no relation with the growth of achievement over the years but motivation and learning strategies are predictors of learning growth.*

Lamb and Fullarton **(**2002), found out three factors affecting mathematics teaching and learning. They include personal, home factors and classroom and school related factors. The personal factor -- deciding to like or dislike

mathematics. Classroom factors -- conducive or unconducive environment for study. School related factors -- sufficient or insufficient Teaching Learning Materials and qualified or unqualified teachers. These factors also apply in the learning, teaching and achievement in elective mathematics.

Though there is existing literature on factors affecting students' performance in mathematics, Ghanaians still worried about the continuous poor achievement in mathematics in recent years. This poses a challenge to the researcher to delve into the affective factors which possibly influence students' performance in Elective Mathematics.

Statement of the Problem

The attitude of students determines their ability to learn and achieve in mathematics. Researchers for many years are therefore, interested in finding out how attitude relates to mathematics performance of students (Aiken, 1970).

Many learners around the world find it difficult to pass in Mathematics as subject. For this reason, mathematics educators have identified poor attitudes towards mathematics as a contributing factor to low achievement. The public is not comfortable as the students continue to perform poorly in mathematics (Hamilton, Mahera, Mateng'e & Machumu, 2010).

WAEC (2019) reported that between 2007 to 2017 averagely, almost half (45.23%) of Elective Mathematics candidates failed every year by scoring E8 and F9 as shown in (Table 1) below.

Table 1: Percentage of Candidates Who Scored E8 – F9 (Failed) From 2007 – 2017.

2007	2008	2009	2011	2012	2013	2014	2015	2016	2017
50.20%	52.47%	52.21%	21.60%	14.92%	38.63%	69.17%	65.51%	33.08%	54.46%

WAEC IT Department, 2014, (as cited in Abotowuro, 2015, page 3), showed WASSCE results in Elective Mathematics from 2007 – 2014, indicating the percentage of candidates who scored D7 – F9 (failed).

Table 2: Percentage of Candidates Who Scored D7 – F9 (Failed) From 2007 – 2014.

2007	2008	2009	2011	2012	2013	2014
63.5%	64.3%	64.3%	31.9%	24.8%	53.0%	79.5%

The table indicates that averagely, about 55% of Elective Mathematics candidates scored from D7 to F9, since most public tertiary institutions accept C6 as the least grade. "These results call for further research into other factors preventing students from passing in Elective mathematics examinations. This further research will help the Ghanaians to plan strategies to guide the students learning for future improvement in the pass rates in Elective mathematics.

As cited in Isack (2015, p. 3), In Tanzania, Mathematics is a general subject for both basic second cycle education students. Though mathematics is general subject, students' performances in it had been low from 2004 to 2012 in Certificate of Secondary Education Examinations (CSEE). Many candidates could not pass mathematics examinations with minimum grades needed. The examination results from 2004 to 2012 were very bad" as showed in the table below:

Table 3: Percentage of students who failed from 2004–2012 in mathematics in Tanzania Certificate of Secondary Education Examinations (CSEE)

2004	2005	2006	2007	2008	2009	2010	2011	2012
70%	77%	76%	60.3%	42.5%	27.5%	49.6%	46.4%	60.5%

Averagely, the table shows that 56.64% of the national form four students failed to pass mathematics in Tanzania Certificate of Secondary Education Examinations (CSEE) from 2004 to 2012.

Performance in Mathematics had been researched extensively but only a few of such researches were specifically on Elective mathematics. The few ones are concerned with gender differences (Baah-Korang, 2015), the impact of Elective Mathematics on specific courses (Yussif, 2015). These researchers have found a plethora of factors that influence achievement of students in mathematics. Among them are school environment, students and home, quality teaching and methods of teaching as well as student learning strategies (Csikszentmihalyi & Nakamura, 1989; Csikszentmihalyi, Rathunde & Whallen, 1993).

An area that is receiving much attention with regards to achievement in elective mathematics is the effect of anxiety, motivation and attitude on performance of students (Borasi, 1990).

Also, according to Arthur, Boadi, and Oduro, (2014,), when students understand the reason why they have to learn mathematics and they put in an effort and succeed, they get motivated to learn it the more. This is when they based their success in mathematics on the much effort they made. On the other

hand, when they make maximum attempt and fail, they based their failure in mathematics on the confusion and difficult nature of the concept to learn. Such students will not be having the right interest and motivation to study mathematics. When it happens this way, it is the responsibility of mathematics teachers to intervene to help the unmotivated and uninterested students to understand the learning materials. Teachers should teach students to both understand why they are learning mathematics and how they can learn it on their own. This will lead to increase students' motivation and interest towards the study of elective mathematics.

Relatedly, according to Sam (1999), at times, students get confused when learning mathematics because of misunderstanding of rules and concepts. Some students like mathematics and enjoy challenging problem solving in mathematics. These students full of motivation and interest in mathematics often choose mathematics programmes in their colleges of study. Some also dislike mathematics. The students who dislike it even get scared of a simple mathematics. They feel mathematics is an uneasy subject and often try to avoid programmes involving mathematics in their tertiary level of education.

When students get to know that elective mathematics as important and interesting for the future, they develop positive attitudes towards it to understand it. Similarly, when students do not see the reason why they should study elective mathematics, they develop negative attitudes towards it. This at times happens when they continue to have a low score elective mathematics, they describe it as a boring subject. The students develop more positive mathematical interest and attitudes towards elective mathematics if they

directly involve in problem solving activities in a conducive environment such as a classroom (Arthur, Boadi, & Oduro, 2014).

The above findings point to the need to turn attention to the factors such as the affective variables and their effects on students' performance. However, the previous studies did not distinctively delve into the affective variables in relation to performance in elective mathematics in Ghana generally.

The current research tries to analyse the relationship between SHS elective mathematics students' affective variables (motivation, attitude and anxiety) and their achievement in elective mathematics.

Purpose of the Study

This to examine the relationship between SHS Elective Mathematics students' motivation, attitude and anxiety and their achievement in the subject.

Objectives of the Study

The objectives of the study were to:

1. Find out if each of attitude, motivation and anxiety has a significant effect on achievement.
2. Determine the correlation between the achievement and each of attitude, motivation and anxiety.
3. Find out if there are correlations among attitude, motivation and anxiety.

Research Questions

The following research questions were formulated to guide the study:

1. Is there a significant effect of each of attitude, motivation and anxiety on achievement?
2. What is the correlation between the achievement result and each of attitude, motivation and anxiety?
3. What are the correlations among attitude, motivation and anxiety?

Hypotheses

Considering the stated purposes of the study, the following hypotheses were formulated to guide the study.

1. **Hypothesis**

   H_o: There is no significant effect of attitude, motivation and anxiety on achievement.

   H_1: There is a significant effect of attitude, motivation and anxiety on achievement.

2. **Hypothesis**

   H_o: There is no correlation between the achievement and attitude, motivation and anxiety.

   H_1: There is a correlation between the achievement and attitude, motivation and anxiety.

3. **Hypothesis**

   H_o: There are no correlations among attitude, motivation and anxiety.

   H_1: There are correlations among attitude, motivation and anxiety.

Significance of the Study

The study will be added to the existing literature. The study will be an eye opener to other researchers to carry a further research in areas that might arise from the study. It will also help the researcher and both core and elective mathematics teachers to motivate and encourage the students to develop interest, the desire and the right attitude towards the study of mathematics. This will lessen students' mathematics anxiety. Finally, the study will help curriculum planners to plan the elective mathematics syllabus easy to study for both teachers and students.

Delimitation

The study was restricted to the public grade B mixed Senior High Schools; two from Ga West Municipal, in the Greater Accra Region, one from Nsawam-Adoagyiri and two from Birim Central Municipals, both Municipals in the Eastern Region. This was due to time and financial constraints. The study focused only on all the form two Elective Mathematics students in each school. The results of this study would not be generalized to cover the entire country, not even the Greater Accra and the Eastern Region per se.

Limitations

This research is limited to only form two Elective Mathematics students. Also purposively selecting five public grade B mixed Senior High Schools; two from Ga West Municipal, in the Greater Accra Region, one from Nsawam-Adoagyiri and two from Birim Central Municipals, both Municipals in the Eastern Region, for the study has decreased generalizability of the findings.

Also, many students did not participate in the study because they were

sacked due to non-payment of fees since this was done before a Free SHS was introduced in Ghana. In some schools, Mathematics Departmental Heads did not inform their subordinates about the administration of the questionnaire and achievement test on that particular day. This brought a lot of confusion and misunderstanding among the teachers and their HODs, hence, failing to release their classes to take part in the study on time.

Definition of Terms

Achievement: The score a student obtains in a test.

Attitude towards mathematics:

The displayed behaviour of an individual towards mathematics that indicates how he or she feels and thinks about mathematics.

Mathematics Anxiety:

A state of feeling that a person has towards mathematics as a subject that may motivate or de-motivate his or her learning.

Motivation of students towards Elective Mathematics. How they are inspired both internally and externally to develop interest in the subject.

SHSs: Senior High Schools. An educational level, that prepares students to enter into tertiary institutions.

WASSCE: West African Secondary School Certificate Examination. Examination conducted among the five English speaking countries in West Africa. It qualifies SHS students to enter into tertiary institutions.

Organization of the Study

The study is presented in five chapters. The chapter one discussed background to the study, statement of the problem, purpose of the study, hypotheses, significance of the study, delimitations, limitations, definition of

terms and summary.

Chapter two focused on review of related literature covering the following sub-headings: the concept and definition of attitude, effective motivation in elective mathematics, elective mathematics anxiety.

Chapter three, methodology also consisted of brief introduction to the chapter, the research design, population, sampling procedures, data collection instruments, data collection procedures, data processing and analysis and chapter summary.

Chapter four also consists of results and findings while chapter five included discussions, summary, conclusion, recommendations and suggestions for further research. `

CHAPTER TWO

LITERATURE REVIEW

Introduction

This part defined, explained and described students' attitude towards mathematics, motivation towards mathematics, mathematics anxiety, and relationship between students' affective variables (attitude, motivation, anxiety) and achievement in Elective Mathematics, and review of some selected literatures concerning students' achievement in core and elective mathematics. These affective variables were selected based on other researchers' recommendations.

Enemark and Wise (1981) established that the mathematics achievement had indicators such as affective variables which were significant.

Theoretical Framework

Students' Attitude and Achievement in Elective Mathematics

Aiken (1970), researchers had measured attitude towards mathematics using many scales. They also revealed that attitude and achievement related.

AAUW, (1994); Beilock, Gunderson, Ramirez, and Levine, (2010), researches relating to achievement-attitude remained a topic of consideration till today.

However, students study mathematics by memorizing formulae. This does not make the students to understand the concept they are to acquire to make the learning of mathematics interesting and simple, (Amanyi, Owuba, & Adjabui, 2015).

Attitude towards mathematics is just a positive or negative emotional disposition towards mathematics. Students with negative attitude towards mathematics are afraid of writing examinations in mathematics, (Zan, & Martino, (2007).

Mohamed and Waheed (2011), identified some factors that influence students' attitudes, namely students' factors, teachers, the school, teaching factors, and home environment and society factors.

Students' Anxiety and Achievement in Elective Mathematics

Negative feelings towards mathematics learning prevent students from performing better. The positive attitudes towards mathematics, Science and Technology should be taught among children as early as from nursery. This will help the teachers to identified students having problem with learning

elective mathematics. These students' frustrations and anxiety towards mathematics can be corrected at the early stage (Yetkiner, Z.E., Zientek, L.R., & Thompson, B., 2010).

According to Ball (1990), mathematics anxiety causes the learner to keep on avoiding the learning of mathematics and at the end perform poorly in it. Mathematics anxiety makes the learner feels helpless, panicky and disorganized.

Students' Motivation and Achievement in Elective Mathematics

Motivation to achieve in mathematics can be improved using intervention programmes. Motivation to achieve in mathematics is highly influenced if the learner has both intrinsic and extrinsic motivation. This helps the children to learn to like and appreciate mathematics (Maehr & Anderman, 1993).

When students are put in groups and incentives are provided, it brings about cooperation and reciprocal instruction in mathematics among the students. This gives all children, the opportunity to succeed by involving themselves in problem solving activities, (Slavin, 1984). Interesting contexts and mathematics problems can be created for students to identify, solve and value mathematics as useful when applying it in various fields, (Bransford, Hasselbring, Barron, Kulewicz, Littlefield & Goin 1988).

Students' behavior to achieve in mathematics depends on their motivation to achieve, their expectation to achieve, and their fear of failure. People work hard when they foresee a success in future than when they have no reason for what they are doing. One can measure children's expectations of success through their predictions of grade, (Atkinson, 1964).

Procedures and materials to make mathematics learning active, investigative and exciting should be used to make learning of mathematics interesting. Though students have different ability levels, they should be able to answer at least a question correctly, (Akinsola, Adedeji, & Adeyinka, 2007).

According to Suydam and Weaver (1975), all that have keen interest in mathematics education believe that children learn more effectively when they are interested in what they are learning. It helps them to achieve better results in the subject since they like it.

Review of some Empirical Studies

The literature was reviewed under the following subheadings:

a. Students' Attitude and Achievement in Elective Mathematics.
b. Students' Anxiety and Achievement in Elective Mathematics
c. Students' Motivation and Achievement in Elective Mathematics.

Students' Attitude and Achievement in Elective Mathematics

According to (Papanastasiou, 2000; Ma & Kishor, 1997), as the students who have interest in learning of mathematics progress, their attitude in the study of mathematics also progresses and vice versa.

According to Steinkamp (1982), attitude was one of the important variables that determined achievement in mathematics. There was a strong relationship between attitude towards mathematics and achievement. It was found out that factors of both motivation and attitude related to the problems of learning mathematics.

Students' Anxiety and Achievement in Elective Mathematics

Research conducted by Sarfo and Adusei (2016), showed significantly

low mathematics anxiety levels in both Core and Elective Math subjects. There was a significant positive correlation among the performances of male students in Core and Elective Math achievement.

According to Boyd, Foster, and Smith, (2014), results from the PISA, confirmed negative correlation between anxiety and achievement, directing also to cultural differences in respect to mathematics anxiety" (p. 208).

Acevedo, Arenas, and Calderón, (2020), revealed that there was inverse relationship between mathematics anxiety and achievement in mathematics, that is, the greater the anxiety, the lower the achievement and vice versa.

Students' Motivation and Achievement in Elective Mathematics

The findings of Zakaria, Zain, Ahmad, and Erlina (2012), revealed that the lower the level of students' mathematics anxiety, the more excited, hopeful and highly motivated they are to learn mathematics. On the other hands, the high the level of students' mathematics anxiety, the less excited, hopeful and low motivated they are to learn mathematics. Based on the result, there was enough evidence to reject H_0. There was a significant relationship among the pairs of the affective variables in studying of elective mathematics" (p 1761).

Motivation and strategy variables determine students 'interest and growth in students' mathematics achievement.

Chapter Summary

This chapter discussed the following; theoretical framework, students' attitude and achievement in elective mathematics, students' anxiety and achievement in elective mathematics, students' motivation and achievement in elective mathematics, review of some empirical studies, students' attitude and

achievement in elective mathematics, students' anxiety and achievement in elective mathematics and students' motivation and achievement in elective mathematics.

CHAPTER THREE

RESEARCH METHODS

Introduction

The current study sought to analyze the relationship between SHS students' affective variables and their achievement in elective mathematics, in relation to the students' attitudes, anxieties, and effective motivation, as these variables were of a particular interest to the researcher. This chapter captured the research design, population, sampling technique, data collection instruments, data collection procedures and data processing and analysis.

Research Design

A research design is a strategy for answering research questions by using an empirical data (Vanderstoep & Johnston, 20009). The research designs used in this study were the descriptive survey and inferential statistical methods. The descriptive survey design and inferential statistical methods were used to draw conclusions about significant relationships between variables (Vanderstoep & Johnston, 20009). The two designs were found most suitable for the current study.

Population

The population of the study was all elective mathematics students of Senior High Schools in Greater Accra and Eastern Regions. However, the accessible population was all elective mathematics students of five Senior High Schools; two from Ga West Municipal, one from Nsawam-Adoagyiri Municipal and two from Birim Central Municipal.

Sample

The sample consisted of all SHS 2 students doing Elective Mathematics in five (5) SHSs in the three selected municipalities. The sample was drawn from programmes such as General Arts, Science, Agricultural Science, Business and Technical. They ranged in age between 15 and 23 years. The researcher used form 2 students because from January to April, form 3 students were having final preparation for WASSCE and did not get time to participate in the questionnaire and the achievement test. First years too could not cover enough topics at the time the questionnaire and the achievement test were administered.

Sampling Procedure

Purposive sampling (a non-probability sampling technique), was used to select the units (the schools and the programmes) based on their similar characteristics (all running programmes involving elective mathematics).

Purposive sampling method of homogeneous sampling was used to select the two regions, the three municipalities, the five Senior High Schools; two from Ga West Municipal, one from Nsawam-Adoagyiri Municipal and two from Birim Central Municipal, and the sample, which was all form 2 students doing Elective Mathematics in the schools running General Arts, Science, Agricultural Science, Business and Technical programmes of study. The reasons for using purposive sampling technique include the following:

1. To have the schools of same characteristics that run the programmes of study that the researcher needed to achieve his objectives set.
2. To save time and money.
3. To avoid traveling to a far distance place for an information.

Data Collection Instruments

The main instruments that were used to gather the data were a questionnaire and achievement test. The questionnaire was used to find the SHS students' affective variables – Attitude towards the learning of elective mathematics, effective motivation towards the study of Elective Mathematics, and Elective Mathematics anxiety. “The statements were measured using a 4-point Likert-type response format (Strongly Agree, Agree, Disagree and Strongly Disagree)”. It was designed for Elective Mathematics students in form 2 by the researcher himself. For positive statements, a value of 4 was assigned to "strongly agree", and decreasing values of 3, 2, 1 were given to the other statements, where "strongly disagree" was assigned the value 1. For negative statements, Strongly Agree = 1, Agree = 2, Disagree = 3 and Strongly Disagree = 4. The maximum score for each scale - Attitude scale, Motivation scale and Anxiety scale, was 60, while the minimum score for each of them was 15. According to Fenu (2017, p. 126), the questionnaire was the best choice in the study like this because;

- It can be administered to a whole class at the same time.
- It increases accessibility to potential respondents at a cheaper cost.
- It also offers the opportunity to respondents to express their feelings freely and unanimously without any embarrassment.

Validity of the Instruments

To ensure content validity the questions strictly based on the objectives of the study. This guaranteed that nothing of importance was left out in the data collection and subsequent analysis.

For the construct validity, apart from the scrutiny by the supervisor, the instrument was pre - tested. Data from the pre - test was subjected to reliability

test by calculating the Cronbach's alpha coefficient for all the statements under the three affective variables (attitude, motivation and anxiety), (Fenu, 2017). To guarantee the face validity of the instrument, the researcher rigorously scrutinized the instrument personally before presenting it to the supervisor. Based on the feedback from the expert who reviewed the instrument, the researcher ensured that the print out was very legible, and the difficulty level of the questions was appropriate for the respondents, spellings were correct and instructions were clear and unambiguous. Finally, the final versions of the instruments were used.

Pre - Testing of Questionnaire and Achievement Test

This was to get all unnecessary constructions "out of the instruments so that respondents in the main study will be free of ambiguity, (Bell, 2008). To determine this, the researcher pre - tested both the questionnaire and the achievement test to 50 students at Adeiso Senior High School in West Akim District outside the three selected municipalities. The achievement test consisted of five different sets of questions (A, B, C, D and E) but similar on the same topics were used. The result obtained was analysed to see whether the instruments would produce the information needed for the research.

Reliability

To determine the reliability of the instrument, the researcher calculated the Cronbach's alpha coefficients for all the statements under the three affective variables (attitude, motivation and anxiety) on the close-ended likert scale questionnaire.

The rating of 0.7 was used. The ambiguities, difficulties and grammatical errors identified were corrected to make the instruments ready for

presentation to the supervisor to examine. The alpha values were closer to 1.0. It indicated that there was high similarity of responses. (Pallant, 2007 p. 95-99).

Internal Reliability Analysis

Cronbach Alpha was computed for each component using the items defining the component. Tables 4 to 6 gave the results.

Table 4: Reliability Analysis of Attitude

	Items	Cronbach Alpha if Item Deleted
1	I feel confident enough to ask questions in Elective Mathematics class.	.749
2	I believe I can do well in Elective Mathematics test.	.558
3	I will use knowledge acquired from Elective Mathematics in my future career.	.776
4	I will be able to get a good grade in Elective Mathematics	.742
5	I believe I am very good at Elective Mathematics.	.681
6	Elective Mathematics is one of the subjects I like best.	.509
7	I understand the concept of a topic in Elective Mathematics easily.	.735
8	I believe l can get an "A1" in Elective Mathematics.	.740
9	If I have the chance, I will replace the Elective Mathematics with a reading subject.	.755
10	Elective Mathematics is boring.	.701
11	I learn Elective Mathematics better than any other subject.	.631
12	I have enough knowledge in Core Mathematics to enable me do well in Elective Mathematics.	.544
13	I do not have much interest for the study of Elective Mathematics.	.705
14	I believe I will be an Elective Mathematics teacher in future.	.766
15	I learn Elective Mathematics every day.	.619
	Overall Cronbach Alpha	**0.795**

From table 4, the responses for Attitude component items gave a Cronbach Alpha of 0.795, showing high consistent responses for the items. It can also be noticed that, omitting an item will not change the Cronbach Alpha

significantly. Hence, there was no need to remove any of these items in the final design of the questionnaire.

Table 5: Reliability Analysis of Motivation

	Items	Cronbach Alpha if Item Deleted
1	Elective Mathematics is an exciting subject.	.604
2	I never get tired of learning Elective Mathematics.	.738
3	I like learning Elective Mathematics even after school.	.600
4	I am very serious when it comes to the study of Elective Mathematics.	.759
5	Learning of Elective Mathematics becomes interesting if I get an answer to a question correct.	.604
6	Elective Mathematics is one of the easiest subjects.	.647
7	I feel with joy when I have Elective Mathematics lesson.	.740
8	Non-Elective Mathematics students praise me for doing Elective Mathematics.	.503
9	Learning Elective Mathematics is enjoyable.	.702
10	Elective Mathematics questions are not tricky.	.769
11	I get satisfied for solving Elective Mathematics question correctly.	.621
12	Elective Mathematics has been my worst subject.	.699
13	I am very proud for being Elective Mathematics student.	.718
14	Elective Mathematics WASSCE questions are simple.	.741
15	I am very serious with the study of Elective Mathematics.	.665
	Overall Cronbach Alpha	**0.791**

From Table 5, the internal consistency of the items from the Motivation component showed a very high consistent response (0.791). The Cronbach Alpha will not change significantly when any of the items is taken out. Hence, there is no need to remove any of the items.

Table 6: Reliability Analysis of Anxiety

	Items	Cronbach Alpha if Item Deleted
1	I am disturbed that I may not do well in Elective Mathematics.	.773
2	I get tense when it is time for an Elective Mathematics test.	.672
3	I get nervous when taking an Elective Mathematics exam.	.699
4	I am disturbed that I may not get a pass mark in Elective Mathematics.	.595
5	I get discouraged when I see the plenty formulae work in Elective Mathematics.	.651
6	I cannot solve a question correctly in Elective Mathematics.	.723
7	Working on Elective Mathematics homework is stressful.	.690
8	I feel nervous asking a question in Elective Mathematics class.	.624
9	When I see an Elective Mathematics problem, I feel nervous.	.603
10	When it is time for Elective Mathematics lesson, I become sick instantly.	.608
11	Very confident when writing Elective Mathematics test.	.750
12	I do not participate in group discussion that involves Elective Mathematics.	.737
13	I do not have the knowledge to solve Elective Mathematics problems.	.571
14	I am not sure of getting a correct answer in Elective Mathematics class.	.755
15	I sleep in class during Elective Mathematics lessons.	.746
	Overall Cronbach Alpha	**0.767**

From Table 6, the Anxiety component items recorded a very high Cronbach Alpha value of 0.767. The result showed that the responses given under each component were consistent and internally valid. It was observed from the table that omission of any of the items does not change Cronbach Alpha very much. Therefore, all items were maintained for the final questionnaire.

Inter-Item Correlation Matrix

According to Pallant, (2007, p. 98), Inter-Item Correlation Matrix values for Attitude, Motivation and Anxiety in the tables below were positive showing that the items measure what they are intended to measure and were maintained. Those items with negative values were removed, which showed that items used were all measuring the same characteristic. Check Tables 7 to 9 for the results.

Table 7: Inter-Item Correlation Matrix Among Attitude Items

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.000	.704	.747	.609	.449	.560	.321	.319	.438	.538	.345	.474	.494	.529	.426
2		1.000	.418	.470	.333	.386	.520	.544	.478	.378	.659	.549	.376	.539	.591
3			1.000	.448	.488	.430	.394	.498	.538	.497	.563	.436	.421	.438	.500
4				1.000	.448	.346	.472	.474	.473	.322	.469	.412	.408	.563	.469
5					1.000	.445	.355	.460	.401	.523	.349	.507	.335	.373	.406
6						1.000	.553	.501	.345	.339	.475	.401	.555	.466	.499
7							1.000	.433	.451	.507	.353	.510	.473	.354	.535
8								1.000	.582	.355	.629	.314	.343	.666	.459
9									1.000	.431	.607	.393	.318	.554	.320
10										1.000	.351	.483	.460	.445	.706
11											1.000	.577	.633	.421	.404
12												1.000	.398	.479	.500
13													1.000	.361	.549
14														1.000	.360
15															1.000

The numbers, 1 to 15, represent the 15 attributes on attitude scale. There were moderate and high significant positive correlations among Attitude Items that were retained. Attitude values above gave an signal about the level at which each item correlated with the overall score. The items maintained had values more than 0.3, (Pallant, 2007, p. 98). The highest correlation was between the first item and the third item (I will use knowledge acquired from Elective Mathematics in my future career) = (.747) and the lowest was between 2nd item (I get tense when it is time for an Elective Mathematics test)

and 5th item (I get discouraged when I see the plenty formulae work in Elective Mathematics) = (.333).

Table 8: Inter-Item Correlation Matrix Among Motivation Items

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.00	.495	.432	.315	.414	.541	.541	.389	.425	.546	.536	.318	.493	.570	.651
2		1.000	.606	.553	.405	.304	.506	.501	.540	.341	.679	.682	.563	.346	.448
3			1.000	.520	.338	.431	.505	.622	.386	.709	.504	.567	.385	.564	.434
4				1.000	.317	.452	.726	.700	.352	.581	.518	.525	.352	.498	.535
5					1.000	.385	.476	.443	.475	.321	.715	.525	.494	.338	.665
6						1.000	.524	.397	.401	.462	.698	.337	.432	.414	.530
7							1.000	.397	.469	.621	.409	.309	.420	.553	.560
8								1.000	.587	.522	.436	.361	.460	.447	.506
9									1.000	.567	.448	.595	.349	.482	.435
10										1.000	.536	.493	.551	.311	.640
11											1.000	.455	.370	.521	.602
12												1.000	.329	.546	.614
13													1.000	.384	.467
14														1.000	.502
15															1.000

The numbers, 1 to 15, represent the 15 attributes on motivation scale. There were both moderate and strong significant positive correlations among Motivation Items that were retained. Motivation values above gave an signal about the level at which each item correlated with the overall score. The items maintained had values more than 0.3, (Pallant, 2007, p. 98). The highest correlation was between the 5th item (Learning of Elective Mathematics becomes interesting if I get an answer to a question correct) and 11th item = (.715) and the lowest was between 7th item (I feel with joy when I have Elective Mathematics lesson) and the 12th item (Elective Mathematics has been my worst subject) = (.309).

Table 9: Inter-Item Correlation Matrix Among Anxiety Items

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1	1.000	.337	.670	.497	.563	.377	.542	.386	.573	.379	.414	.404	.517	.445	.403
2		1.000	.414	.618	.420	.377	.300	.575	.640	.465	.430	.440	.413	.623	.542
3			1.000	.416	.319	.451	.584	.587	.380	.576	.511	.520	.783	.463	.416
4				1.000	.508	.331	.326	.534	.622	.467	.317	.627	.567	.656	.333
5					1.000	.488	.500	.511	.417	.648	.435	.398	.497	.526	.531
6						1.000	.499	.443	.473	.443	.392	.483	.399	.313	.397
7							1.000	.464	.327	.485	.517	.314	.521	.546	.447
8								1.000	.431	.453	.328	.570	.348	.363	.449
9									1.000	.431	.447	.582	.453	.500	.550
10										1.000	.409	.535	.374	.616	.425
11											1.000	.373	.501	.446	.386
12												1.000	.634	.322	.520
13													1.000	.485	.657
14														1.000	.474
15															1.000

The numbers, 1 to 15, represent the 15 attributes on anxiety scale. There were both moderate and strong significant positive correlations among Anxiety Items that were retained. Anxiety values above gave an signal about the level at which each item correlated with the overall score. The items maintained had values more than 0.3, (Pallant, 2007, p. 98). The highest correlation was between 3rd item (I get nervous when taking an Elective Mathematics exam) and the 13th item (I do not have the knowledge to solve Elective Mathematics problems) = (.783) and the lowest was between 6th item (I cannot solve a question correctly in Elective Mathematics) and the 14th item (I am not sure of getting a correct answer in Elective Mathematics class) = (.313).

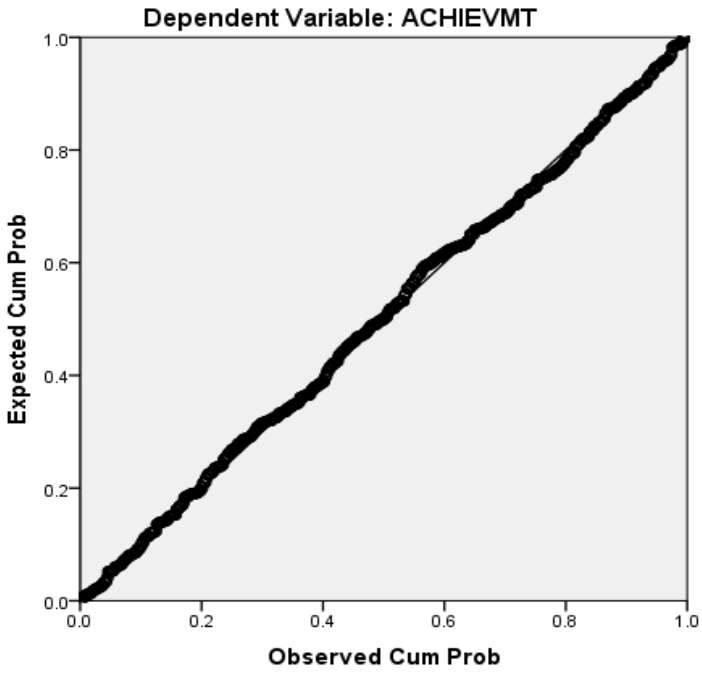

Figure 1: Normal Probability Plot (P-P) of the Regression Standardised Residual

Normal Probability Plot (P-P) of the Regression Standardised Residual was drawn to check the assumptions as part of the analysis. In the Normal P-P Plot, the points lied in a practically straight diagonal line from bottom left to top right. This suggested that there was no key deviation from normality. The Normal Probability Plot (P-P) above, displayed the expected conditions without violating the assumptions.

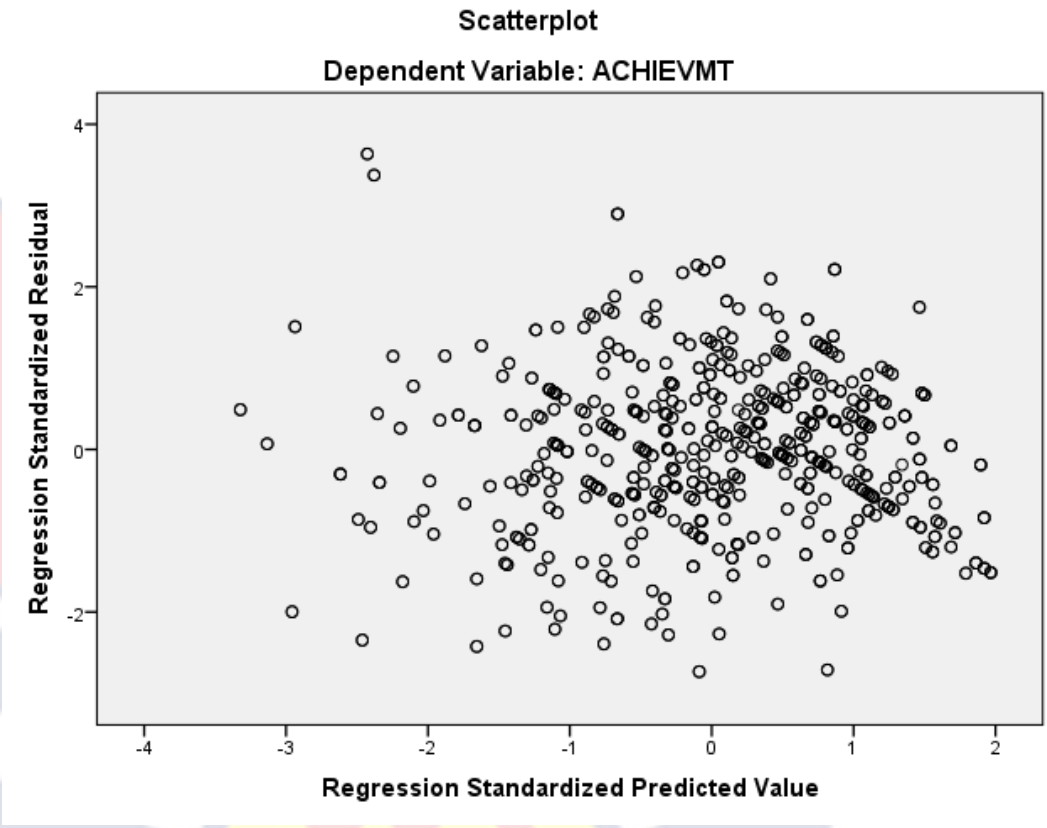

Figure 2: Scatter Plot

Scatterplot was also drawn to check the assumptions as part of the analysis. In the Scatterplot of the standardised residuals, the scores were roughly rectangularly distributed, with most of the scores concentrated in the centre. This showed that there was no violation of the assumptions.

The Scatterplot above displayed the expected conditions without violating the assumptions. The plots are within the range of -3.3 and 3.3 as displayed on the diagram.

Questionnaire and Achievement Test for the Final Study

Relationship between SHS students' affective variables and their achievement in elective mathematics were collected by administering an elective mathematics affective variables' scale in a questionnaire and achievement test prepared for the purpose.

The attributes for students' affective variables towards elective mathematics in a questionnaire consisted of three sets of 15 statements each on Attitude, Motivation and Anxiety scales, totaling 45 statements. The students responded to the 45 statements using a four-point Likert scale – strongly agree, agree, disagree and strongly disagree. The statements related to the three affective variables – attitude towards learning of elective mathematics, the effective motivation in elective mathematics, and elective mathematics anxiety.

Parallel test was used since all the five schools did not write the test on the same day and time. The assumption was that; two or more students may live in the same community but attend different schools that were selected. This was to prevent leakage of questions from one school to another since students do communicate about what goes on in their various schools to other students in other schools.

In all, five different sets of questions but similar on the same topics were used. Each set for each school comprised of ten questions in which students answered seven out of the ten within 40 minutes, due to a time factor.

Data Collection Procedure

Given the introduction letter from the Department of Mathematics and ICT Education, the researcher presented a copy to the authorities of the selected schools. After that the researcher had arranged with the school authorities to meet the students to discuss the importance of the study and how the study was going to help both the school and the community. This had enabled the authorities to counsel the students concerning the study to

cooperate with the researcher. Both the questionnaire and the achievement test were carried out in all the schools between February and July, 2017.

The researcher encountered problems like students being sacked from classes for non-payment of school fees, other mathematics teachers were not aware of the activity and were not ready to welcome the researcher to their classes, the mathematics departmental head was not available even though he was aware of the day and time of the activity, etc.

Data Processing and Analysis

All the copies of the questionnaires were numbered serially, edited, coded and fed into the computer and analyzed using SPSS version 21. Questionnaire scores of each affective variable were matched with each achievement scores of students.

The data generated from the research questions which sought to find:

(i) significant effects of the affective variables on achievement.

(ii) correlations between the achievement test and the affective variables,

(iii) correlations between the affective variables;

were analyzed using both descriptive statistics and standard multiple regression. The data was analyzed and presented in tables using descriptive survey and inferential statistical method.

Standard Multiple Regression

This approach was used since the researcher used a set of independent variables (attitude, motivation and anxiety scales).

Standard multiple regression was used to evaluate the overall F test. At the significance level of 0.05, it was concluded that there was significant relationship between motivation and achievement, Attitude and achievement, and anxiety and achievement. This suggested that variances for each of the three groups, Attitude and achievement, Motivation and achievement, and anxiety and achievement, were not equal. It was concluded for each of the independent variables and achievement that, there was a significant relationship between them, which suggested that there was a linear relationship between them. Standard multiple regression with dependent variable Y and independent variables x_1, x_2, and x_3, for instance, the model was specified as

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \varepsilon_i.$$

where

β_0 = Y intercept

β_1 = slope of Y with variable X_1, holding variables X_2 and X_3 constant

β_2 = slope of Y with variable X_2, holding variables X_1 and X_3 constant

β_3 = slope of Y with variable X_3, holding variables X_1 and X_2 constant

ε_i = random error in Y for observation i.

Confidence Interval Estimate

This has been constructed for each of the slopes on each of the hypothesis to know the effects of independent variables on achievement. It was revealed that the regression coefficients of β_1 (attitude) and β_2 (motivation), and β_3 (anxiety) had significant effects on the achievement test.

Chapter Summary

This chapter discussed the following;Research design, population, sampling procedure, data collection instrument, data collection procedure, data

processing and analysis, standard multiple regression and confidence interval estimate.

CHAPTER FOUR

RESULTS AND DISCUSSION

Introduction

This chapter presents the analysis of the data that was collected during the study and discusses the results. In all, nine hundred and sixty-seven (967) questionnaires were accepted after rejecting achievement test papers without

questionnaires and questionnaires without achievement test papers. Out of this, 595 questionnaires were responded to by males and 372 by females. The respondents aged between 15 and 23 years. Majority of the respondents were males (62%) and (38%) represented females.

The data gathered were analyzed statistically using the SPSS software. The software enabled the researcher to answer the research questions. The main statistical tools used to analyse the research questions were Pearson's Product Moment Correlation and Standard Multiple Regression. The results section began with the demographic characteristics of the respondents. The results were presented according to the sequence of the research questions as follows:

i. Is there a significant effect of each of attitude, motivation and anxiety on achievement?
ii. What is the correlation between the achievement result and each of attitude, motivation and anxiety?
iii. What are the correlations among attitude, motivation and anxiety?

Results

Table 10: Sample From School A

Programmes	**Males**	**Females**	**Total Frequency**	**Percentage**
Science	89	61	150	**46.6%**
Agric. Science	51	33	84	**26.1%**

General Arts	27	23	50	**15.5%**
Business	23	15	38	**11.8%**
TOTAL RESPONDENT	**190**	**132**	**322**	**100%**

From table 10, total respondent was 322, comprising 190 males, representing 59% and 132 females, representing 41%. Science students were 150 which was the highest, representing 46.6%, Agric. Science students were (84), representing 26.1%, General Arts students were 50, representing 15.5 %, and finally, Business students were 38, representing 11.8%.

Table 11: Sample From School B

Programmes	**Males**	**Females**	**Total Frequency**	**Percentage**
Technical	31	7	38	**54%**
General Arts	15	3	18	**25%**
Business	12	3	15	**21%**
TOTAL RESPONDENT	**58**	**13**	**71**	**100%**

From table 11, total respondent was 71, comprising 58 males, representing almost 82% and 13 females, representing 18%. Technical students were 38 which was the highest, representing 54%, General Arts students were 18, representing 25%, and finally, business students were 15, representing 21%.

Table 12: Sample From School C

Programmes	Males	Females	Total frequency	Percentage
Science	39	26	65	**25%**
Agric. Science	43	29	72	**28%**
General Arts	38	32	70	**27%**
Business	30	21	51	**20%**
TOTAL RESPONDENT	**153**	**105**	**258**	**100%**

From table 12, total respondent was 258. This was made up of 153 males, representing 59% and 105 females, representing 41%. Agric. Science students were 72, which was the highest, representing 28%, Agric. Science General Arts students were 70, representing 27%, Science students were 65, representing 25%, and finally, 51 Business students, representing 20%.

Table 13: Sample From School D

Programmes	Males	Females	Total Frequency	Percentage
Science	28	19	47	**24.7%**
Technical	35	8	43	**22.6%**
General Arts	32	27	59	**31.1%**
Business	24	17	41	**21.6%**
TOTAL RESPONDENT	**117**	**73**	**190**	**100%**

The table 13, showed 190 respondents, including 117 males, representing 62% and 73 females, representing 38.%. 59 General Arts students, which was the highest, representing 31.1%, 47 Science students, representing 24.7%, 43 Technical students, representing 22.6%, and finally, 41 Business students, representing 21.6% as the lowest.

Table 14: Sample From School E

Programmes	Males	Females	Total Frequency	Percentage
Technical	35	23	58	**46%**
General Arts	15	9	24	**19%**
Business	27	17	44	**35%**
TOTAL RESPONDENT	**77**	**49**	**126**	**100%**

The table 14, showed 126 respondents, which made up of 77 males, representing 61% and 49 females, representing 39.%. 58 Technical students, which was the highest, representing 46%, 44 Business students, representing 35%, and 24 General Arts students, representing 19% as the lowest.

Table 15: Biographic Data of Respondents From Each School

Schools Used	Males	Females	Total Frequency	Total Percentage
SCHOOL A	190(19.6%)	132(13.7%)	322	**33.3%**
SCHOOL B	58(6%)	13(1.3%)	71	**7.3%**
SCHOOL C	153(15.8%)	105(10.9%)	258	**26.7%**
SCHOOL D	117(12.1%)	73(7.5%)	190	**19.6%**
SCHOOL E	77(8%)	49(5.1%)	126	**13.1%**
TOTAL RESPONDENT	**595(61.5%)**	**372(38.5%)**	**967**	**100%**

From table 15, total respondent was 967, comprising 595 males, representing almost 61.5% and 372 females, representing 38.5%. School A produced the highest number (322) of students, representing 33.3%, School C followed with (258) students, representing 26.7%, School D produced (190) students, representing 19.6%, School E produced (126), representing 13.1%,

and finally, School B produced (71) representing 7.3%.

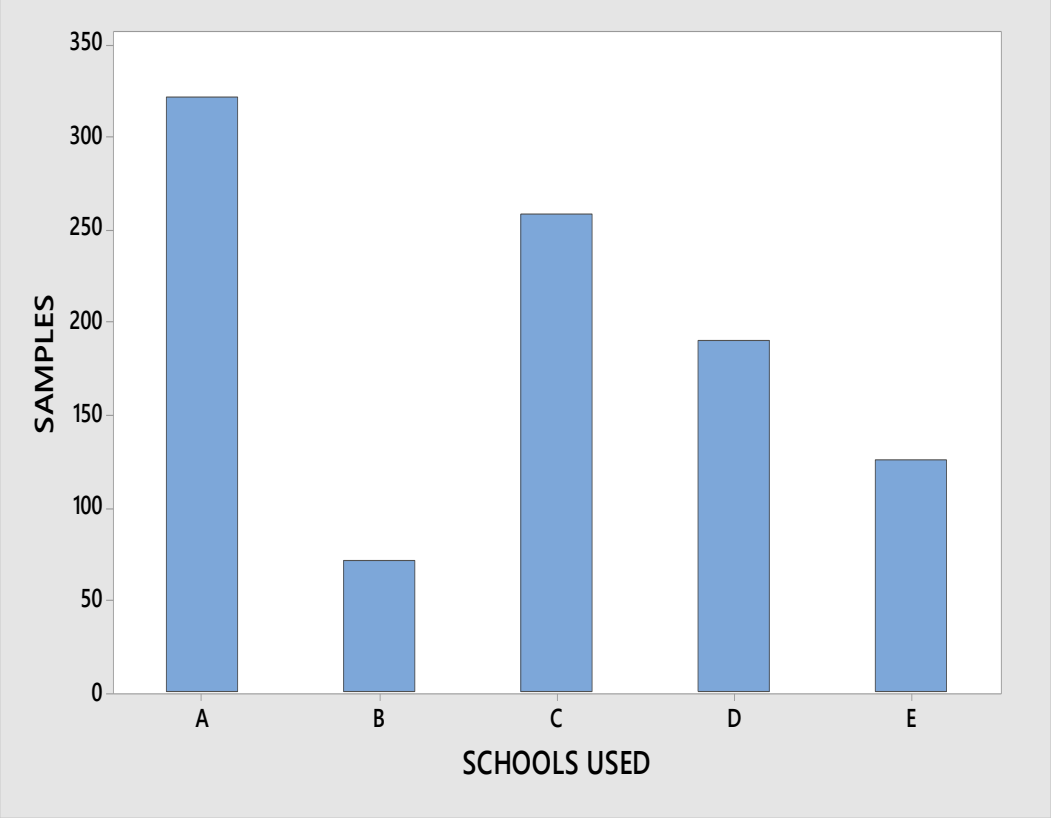

Figure 3: Sample From Each School

School A had the highest sample of (322), representing 33%, School C followed with (258) sample, representing 27%, School D produced (190) sample, representing 20%, School E had (126) students, representing 13%, and finally, School B produced (71) students, representing 7%.

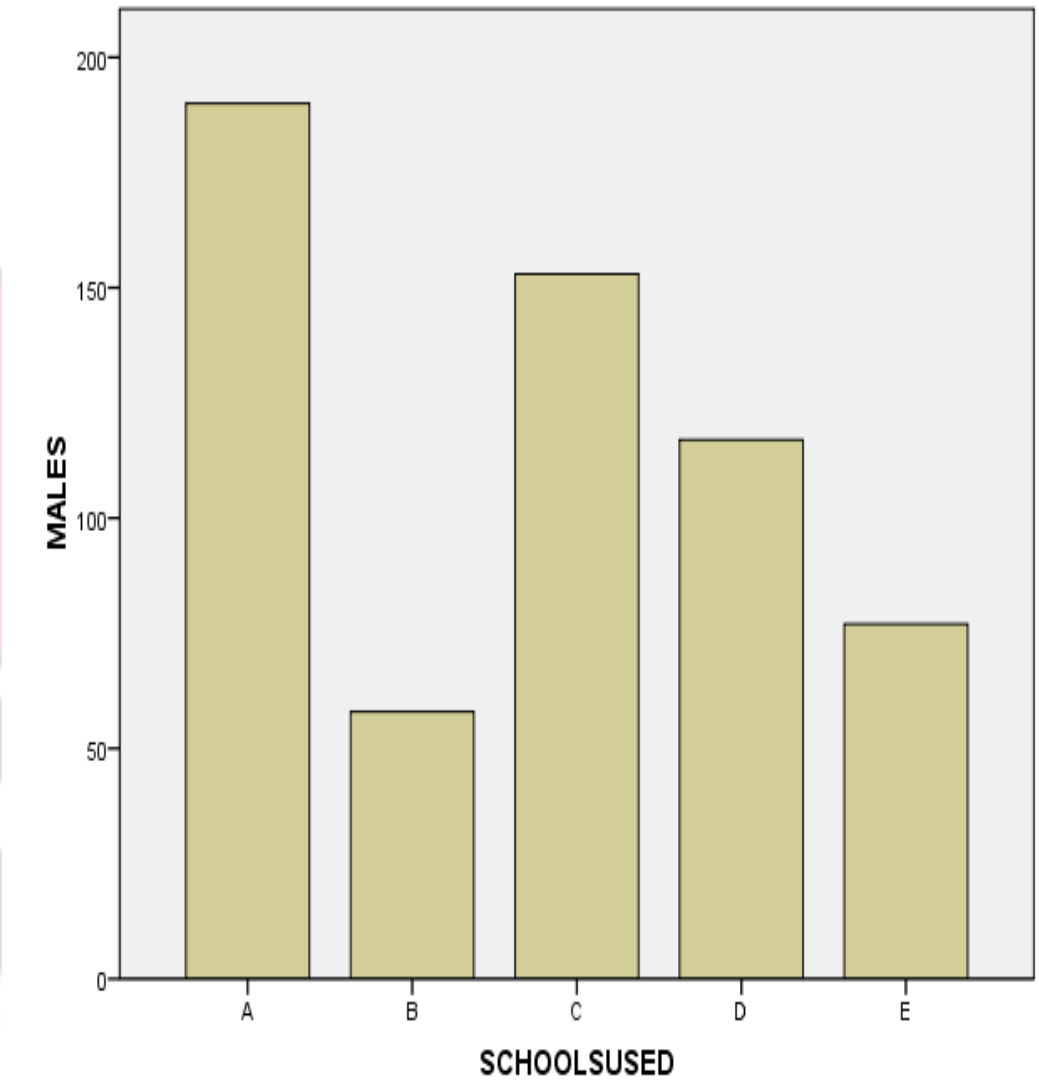

Figure 4: Number of Males From Each School

School A produced the highest number of males (190), representing 19.6%, School C followed with (153) males, representing 15.8%, School D produced (117) males, representing 12.1%, School E produced (77) males, representing 8%, and finally, School B produced (58) males, representing 6%.

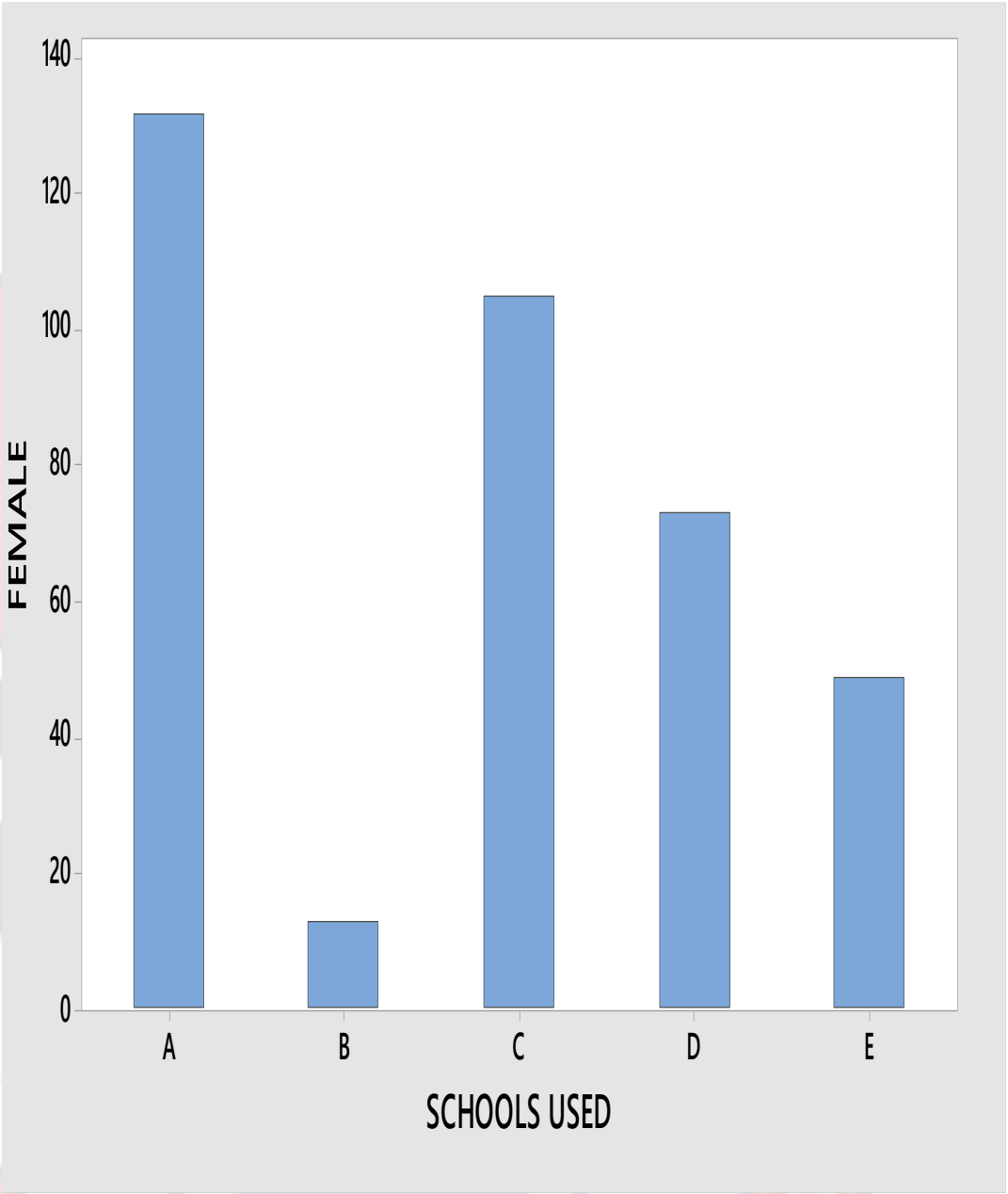

Figure 5: Number of Females From Each School

School A produced the highest number of females (132), representing 13.7%, School C followed with (105) females, representing 10.9%, School D produced (73) females, representing 7.5%, School E produced (49) females, representing 5.1%, and finally, School B produced (13) females, representing 1.3%.

Table 16: Sample From Each Programme.

PROGRAMMES	MALES	FEMALES	TOTAL/ Total Frequency
GENERAL ARTS	121 (12.5%)	100 (10.3%)	221(22.9%)
SCIENCE	156 (16.1%)	106 (11%)	262(27.1%)
BUSINESS	112 (11.6%)	77 (8%)	189(19.5%)
AGRIC SCIENCE	94 (9.7%)	62 (6.4%)	156(16.1%)
TECHNICAL	112 (11.6%)	27 (2.8%)	139(14.4%)
TOTAL	595 (61.5%)	372 (38.5%)	967(100%)

Based on programme, Science students were 262, which was the highest, representing 27.1%, General Arts students were 221, representing 22.9%, Business students were 189, representing 19.5%, Agric. Science students were 156, representing 16.1%, and finally, 139 Technical students, representing 14.4% as the lowest.

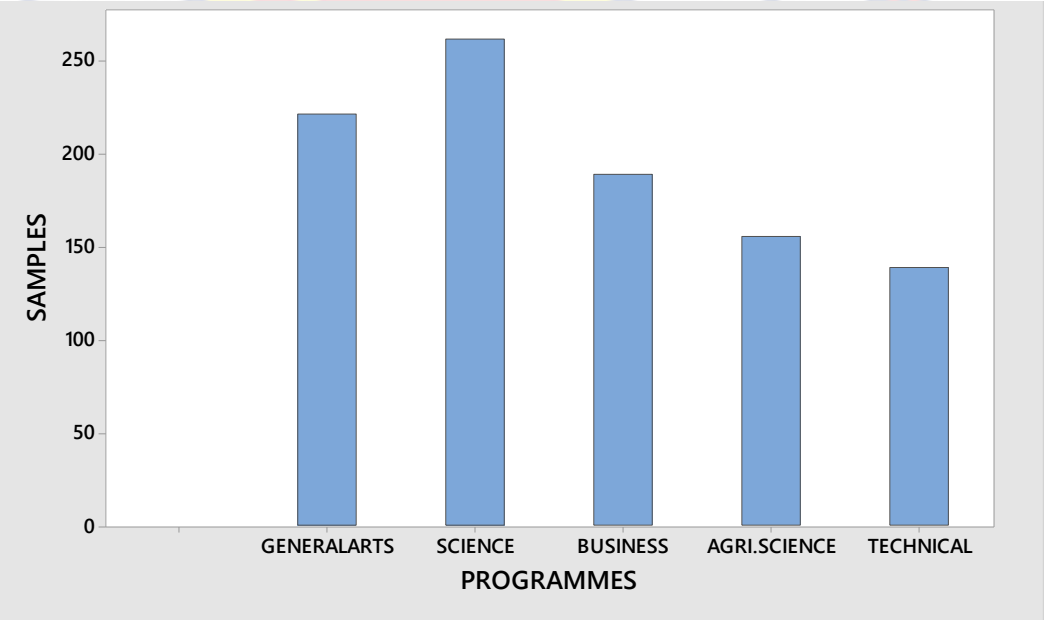

Figure 6: Sample From Each Programme

The chart showed that the bar representing Science students was the highest and the bar representing Technical students was the lowest.

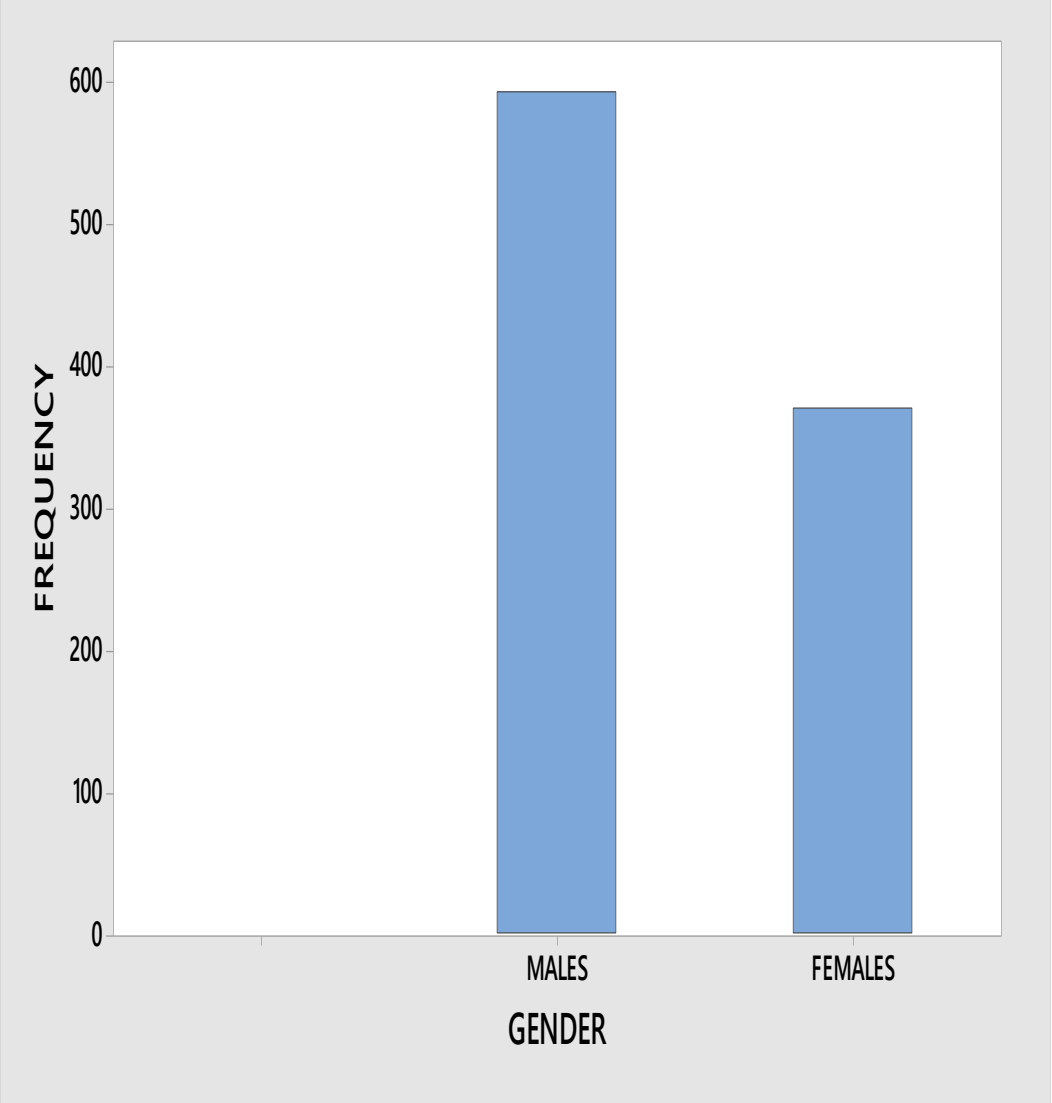

Figure 7: Total Number of Males and Females

The chart showed the total number of males (595), representing 61.5% and the total number of females (372), representing 38.5%.

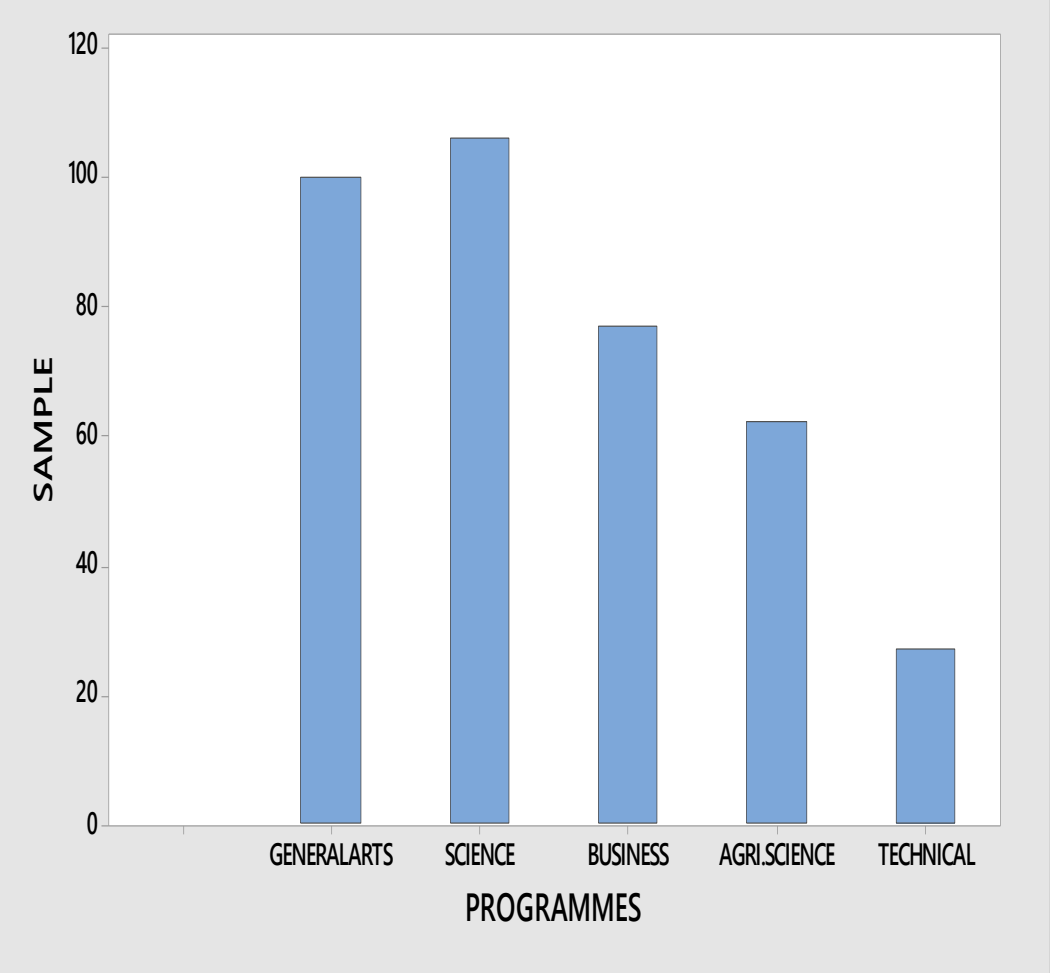

Figure 8: Male Sample For Each Programme

The total sample of males was 595 (61.5%), comprising 121 (12.5%) General Arts students, 156 (16.1%) Science students, 112 (11.6%) Business students, 94 (9.7%) Agric. Science students, and 112 (11.6%) Technical students. Science male students were the highest and Agric. Science male students were the lowest.

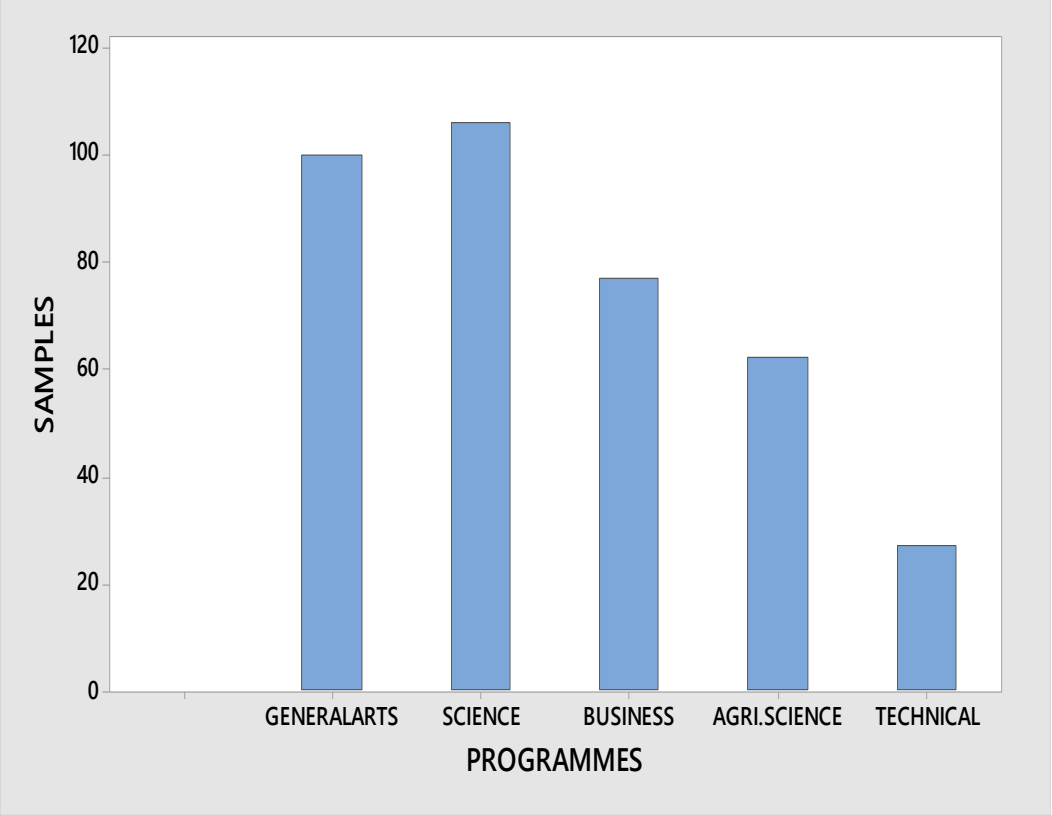

Figure 9: Female Sample For Each Programme

The female number of Science students was the highest and that of Technical students was the lowest. The total sample of females was 372 (38.5%) comprising 100 (10.3%) General Arts students, 106 (11%) Science students, 77 (8%) Business students, 62 (6.4%) Agric Science students, and 27 (2.8%) Technical students.

Table 17: Age Range of Respondents

Age Groups	Number of Students	Percentages
15 – 17	**452**	**46.7**
18 – 20	**406**	**42**
21 – 23	**109**	**11.3**
TOTAL	**967**	**100%**

The number of students from (15 – 17) years was (452), representing (46.7%), followed by (18 – 20) years with (406), representing (42%), and lastly (21 – 23) years was (109), representing (11.3%).

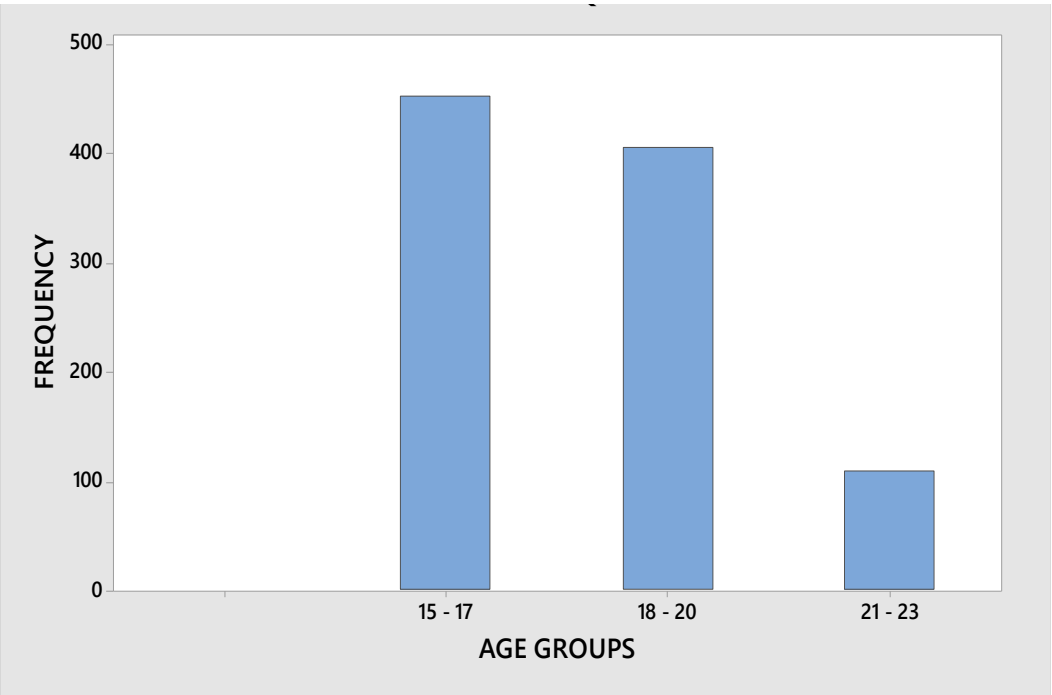

Figure 10: Age Range of Respondents

Developing a Multiple Regression Model

A sample of 967 public grade B mixed SHS two (2) Elective Mathematics students, doing General Arts, Science, Agricultural Science, Business and Technical courses were finally selected for the study. Three independent variables (Attitude, Motivation and Anxiety) were considered for the study. Attitude was measured as (X_1), Motivation was measured as (X_2) and Anxiety was measured as (X_3). The dependent variable, Achievement, was measured as Y.

The Model;

$$Y_i = \beta_0 + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \varepsilon_i$$

where

β_0 = Y intercept

β_1 = slope of Y with variable X_1, holding variables X_2 and X_3 constant

β_2 = slope of Y with variable X_2, holding variables X_1 and X_3 constant

β_3 = slope of Y with variable X_3, holding variables X_1 and X_2 constant

ε_i = random error in Y for observation i.

In the multiple regression model, the slope, β_1, represents the change in the mean of Y per unit change in X_1, taking into account the effects of X_2 and X_3. The slope, β_2, represents the change in the mean of Y per unit change in X_2, taking into account the effects of X_1 and X_3. The slope, β_3, represents the change in the mean of Y per unit change in X_3, considering the effects of X_2 and X_3.

Tolerance and VIF values, scatter diagram, and Normal P-P Plot were used to check outliers or extreme values the data was analysed.

Table 18: Coefficient of Multiple Regression

Model		Unstandardized Coefficients		t	Sig	95.0% Confidence Interval for B		Correlations		Collinearity Statistics	
		B	Std. Error			Lower Bound	Upper Bound	Zero-order	Part	Tolerance	VIF
1	Constant / intercept	11.426	1.065	10.724	.000	9.335	13.517				
	Attitude	.315	.027	11.844	.000	.263	.367	.636	.253	.587	1.702
	Motivation	.285	.030	9.516	.000	.227	.344	.670	.204	.450	2.224
	Anxiety	.198	.022	9.096	.000	.156	.240	.585	.195	.610	1.640

The Unstandardised Coefficient Values Under B

From Table 18, unstandardised coefficient values under B were used to construct the regression equation. The computed values of the regression coefficients were;

$B_0 = 11.426$, $\beta_1 = .315$, $\beta_2 = .285$, $\beta_3 = .198$

Therefore, the multiple regression equation / model was;

$$Y_i = 11.426 + 0.315X_{1i} + 0.285X_{2i} + 0.198X_{3i,}$$

The sample Y intercept ($\beta_0 = 11.426$) estimated the students' score if their Attitude towards the study of Elective Mathematics was zero (0), Motivation towards the study of Elective Mathematics was zero (0), and Elective Mathematics Anxiety was zero (0). The value of β_0 has no practical interpretation.

The slope of Attitude towards the study of Elective Mathematics ($\beta_1 = .315$) indicated that, for each given amount of Motivation and Anxiety, the mean achievement scores were estimated to increase by .315 for each 1unit increase in attitude. The slope of Motivation towards the study of Elective Mathematics ($\beta_2 = .285$) indicated that, for each given amount of Attitude and Anxiety, the mean achievement scores were estimated to increase by .285 for each 1unit increase in motivation. Finally, the slope of Elective Mathematics Anxiety ($\beta_3 = .198$) indicated that, for each given amount of Attitude and Motivation, the mean achievement scores were estimated to increase by .198 for each 1unit increase in anxiety.

Tolerance and VIF (Variance Inflation Factor) Values

From Table 18, if tolerance value is large (larger than .10), it indicates that the multiple correlation with other variables is high, then, it suggests that there is no possibility of multicollinearity (Pallant, 2007, pp 156). For this current work, Tolerance values (.587, .450 and 1.610) in the table were far greater than .10, which showed that there was no possibility of multicollinearity.

The VIF (Variance inflation factor) values on the other hand, above 10

would be a concern, indicating presence of multicollinearity. If the results exceed the recommended value (10) in the work, one of the highly intercorrelated independent variables should be removed from the model (Pallant, 2007, pp 156). For this work, VIF values were 1.702, 2.224 and 1.640, which were all less than 10. So, all the independent variables were maintained.

Evaluating Each of the Independent Variables

The researcher tried to know which of the variables included in the model contributed to the prediction of the dependent variable most. Looking down the Beta column in (Table 18), Attitude value was the largest (.331), followed by Motivation (.304) and Anxiety was the lowest (.249). This means that Attitude made the "strongest unique contribution to explaining the dependent variable, when the variance explained by all other variables in the model was controlled for. The values for motivation and anxiety indicating that they made less contribution". The p-values of attitude, motivation and anxiety were .000, less than (.05, .01, or .0001, etc.), showed that the "variables made a significant unique contribution to the prediction of the dependent variable". This also showed that there was no overlapping among the independent variables in the model.

Research Question 1

Is there a significant effect of each of attitude, motivation and anxiety on achievement?

Research Question 1 was evaluated using the following procedures:

1. Coefficient of Multiple Determination (r^2) or R Square.
2. Coefficient of Regression Adjusted R square (r^2_{adj}).
3. The overall F test
4. Test of Significance of Each of the Slopes in Multiple Regression Model
5. A 95% Confidence Interval Estimate for each of the Population Slopes.

Table 19: Evaluating Multiple Regression Model

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.748[a]	.559	.558	4.817

a. Predictors: (Constant), ANXIETY, ATTITUDE, MOTIVATION

b. Dependent Variable: ACHIEVEMENT

Coefficient of Multiple Determination (r^2) or R Square

This represented the proportion of the variation in Y that was explained by the set of independent variables. From Table 19, the coefficient of multiple determination (r^2 = 0.559) indicated that 55.9% of the variation in Achievement was explained by the variation in the Attitude, Motivation and Anxiety". This implied that about 56% of the data points were on or closer to the regression line. It also indicated that there was strong relationship between the Achievement and the independent variables.

Coefficient of Regression Adjusted R square (r^2_{adj})

This was used "to reflect both the number of independent variables in the model and the sample size. From Table 19, the coefficient of adjusted R square ($\mathbf{r}^2_{\mathbf{adj}}$ = 0.558). Hence, 55.8% of the variation in achievement was explained by the multiple regression model adjusted for the three independent variables and the sample size". With 55.8%, any additional independent variable would decrease the adjusted value and would not improving the model. The researcher therefore, maintained the three independent variables.

The Overall F Test

The overall F test was used to test whether there was a significant relationship between the achievement, attitude, anxiety and motivation. The following null and alternative hypotheses were used:

H_0: $\beta_1 = \beta_2 = \beta_3 = 0$. (There is no linear relationship between the dependent variable and the independent variables.)

H_1: At least one $\beta j \neq 0$, j = 1, 2, and 3. (There is a linear relationship between the dependent variable and at least one of the independent variables).

Table 20: ANOVA Test

ANOVA[a]

Model		Sum of Squares	Df	Mean Square	F_{cal}	Sig.
1	Regression	28352.754	3	9450.918	407.375	.000[b]
	Residual	22341.159	963	23.200		
	Total	50693.913	966			

a. Dependent Variable: ACHIEVEMENT

b. Predictors: (Constant), ANXIETY, ATTITUDE, MOTIVATION

Multiple Regression estimates for relationship between attitude, motivation, anxiety, and achievement using F test. The decision rule was to reject H_0 at the level of significance if $F_{cal} > F_{0.05(3, 963)}$; otherwise, do not reject H_0. From the ANOVA table, using a 0.05 level of significance, the critical

value of the F distribution with 3 and 963 degrees of freedom, was approximately 2.60. The F statistic given in the ANOVA summary table was 407.375. Since 407.375 > 2.60, or because the p-value = 0.000 < 0.05, H_0 was rejected and it was concluded that at least one of the independent variables (Attitude, Motivation or Anxiety) was related to Achievement.

Test of Significance of Each of the Slopes in Multiple Regression Model

To determine whether each of the independent variables, X_1, X_2 and X_3 (Attitude, Motivation and Anxiety) have a significant effect on the dependent variable (Achievement), taking into account the values of the other two variables at a time, the null and alternative hypotheses of each of them were stated and interpreted. From table 18, at the level of significance of 0.05, the critical values of t for 963 degrees of freedom were -1.9600 and +1.9600 respectively.

For X_1 (Attitude):

H_0: $\beta_1 = 0$. (There is a significant relationship between the variable X_1 (Attitude) and the achievement.)

H_1: $\beta_1 \neq 0$. (There is no significant relationship between the variable X_1 (Attitude) and the achievement.)

The p-value was 0.000. Because t = 11.844 > 1.9600 or the p-value of .000 < 0.05, H_0 was rejected and it was concluded that there was a significant relationship between the variable X_1 (Attitude) and the achievement, taking into account the X_2 (Motivation) and X_3 (Anxiety).

For X_2 (Motivation):

H_0: $\beta_2 = 0$. (There is a significant relationship between the variable X_2

(Motivation) and the achievement).

H_1: $\beta_2 \neq 0$. (There is no significant relationship between the variable X_2 (Motivation) and the achievement). The p-value was 0.000. Because t = 9.516 > 2.0395 or the p-value of 0.000 < 0.05, H_0 was rejected and it was concluded that there was a significant relationship between the variable X_2 (Motivation) and the achievement, considering the effects of X_1 (Attitude) and X_3 (Anxiety).

For X_3 (Anxiety):

H_0: $\beta_3 = 0$. (There is a significant relationship between the variable X_3 (Anxiety) and the achievement).

H_1: $\beta_3 \neq 0$. (There is no significant relationship between the variable X_3 (Anxiety) and the achievement).

The p-value was 0.000. Because t = 9.096 > 2.0395 or the p-value of .000 < 0.05, H_0 was rejected and it was concluded that there was significant relationship between the variable X_3 (Anxiety) and the achievement, taking into account the X_1 (Attitude) and X_2 (Motivation).

A 95% Confidence Interval Estimate for each of the Population Slopes

A 95% confidence interval estimate was constructed for each of the population slopes β_1, β_2 and β_3. This showed the effect each of the slopes of the independent variables had on Achievement, Y.

For β_1 (Attitude):

From table 18, 95.0% Confidence interval for Attitude gave lower bound as 0.263 and upper bound as 0.367. Therefore, the interval of slope β_1 was $0.263 \leq \beta_1 \leq 0.367$.

In addition, considering the effect of attitude, a unit change of

motivation and anxiety would increase achievement mean by approximately 0.263 to 0.367. From a hypothesis-testing viewpoint, because this confidence interval did not include zero (0), β_1 had a significant effect on Achievement.

For β_2 (Motivation):

From table 18, Motivation had 95.0% Confidence interval lower bound as 0.227 and upper bound as 0.344. Therefore, the interval of slope β_2 was $0.227 \leq \beta_2 \leq 0.344$.

Again, considering the effect of motivation, a unit change of attitude and anxiety would increase achievement mean by approximately 0.227 to 0.344. From a hypothesis-testing viewpoint, because this confidence interval did not include zero (0), β_2 had a significant effect on Achievement.

For β_3 (Anxiety):

From table 18, Anxiety also had 95.0% confidence interval lower bound as 0.156 and upper bound as 0.240. Therefore, the interval of slope β_3 was $0.156 \leq \beta_3 \leq 0.240$. Therefore, taking into account the effect of anxiety, a unit change of attitude and motivation would increase achievement mean by approximately 0.156 to 0.240. From a hypothesis-testing viewpoint, because this confidence interval also did not include zero (0), β_3 also had a significant effect on Achievement.

According to (Pallant 2007, p. 132), suggested the following guidelines in the table below to interpret correlation coefficient (r):

Table 21: Range of Correlation Co-efficient

Small / Low	r = .10 to .29
Medium / Moderate	r = .30 to .49
Large / Strong / High	r = .50 to 1.0

Research Question 2:

What is the correlation between the achievement result and each of attitude, motivation and anxiety?

Table 22: Correlation Between the Achievement and the Independent Variables

Correlations Between the Achievement and the Independent Variables

		Achievement	Attitude	Motivation	Anxiety
Pearson Correlation	Achievement	1.000	.636	.670	.585
Sig. (1-Tailed)	Achievement	.	.000	.000	.000
N	Achievement	967	967	967	967

The correlations between achievement and each of the independent variables were positive high and significant at alpha level of 0.05 (1-tailed). The correlation between achievement and attitude (r = .636). It means that students' positive attitude leads to high performance in elective mathematics. The correlation between achievement and motivation (r = .670). achievement and Anxiety (r = .585). In this case, the independent variable correlated significantly with the Achievement (.636, .670 and .585 respectively), with motivation being the highest and anxiety being the lowest.

This showed that a high level of motivation on elective mathematics students will change their attitude towards the study of elective mathematics, hence, it lows their anxiety level towards the study of elective mathematics.

From table 22, there was enough evidence to reject H_0. "It was concluded that there was a significant relationship between students' achievement in elective mathematics and attitude, motivation, and anxiety.

Part correlation coefficient square

From Table 18, Part correlation coefficient square value gave an indication of a contribution a variable made to the total R square. In other words, it showed how much of the total variance in the dependent variable which was uniquely explained by that variable and how much R square dropped if it was not included in the model (Pallant, 2007, pp. 159). In this work, from table 18, the Attitude scale has a part correlation coefficient of .253, its square gave .0640, indicating only a unique contribution of 6.4% to the explanation of variance in Achievement. The Motivation scale has a part correlation coefficient of .204. Its square was .0416, indicating that Motivation uniquely explains only 4.16% of the variance in Achievement. For the Anxiety, part correlation coefficient was .195, which its square gave .0380, indicating a very small unique contribution of 3.8% to the explanation of variance in Achievement. The result showed that if the students' attitude and motivation are high, it leads to low anxiety of the students hence, students performing highly in the subject.

Research Question 3

What are the correlations among attitude, motivation and anxiety?

Table 23: Correlation Between Pairs of Independent Variables

Correction Between Pairs of Affective Variables

		Attitude	Motivation	Anxiety
Pearson Correlation	Attitude	1.000	.639	.445
	Motivation		1.000	.622
	Anxiety			1.000
Sig. (1-Tailed)	Attitude		.000	.000
	Motivation		.	.000
	Anxiety			.
N				
	Attitude	967	967	967
	Motivation		967	967
	Anxiety			967

According to Pallant, (pp. 155), the correlation among pairs of independent variables should not be too high (.7 or more) in the same analysis. When this happens, one of the independent variables must be omitted.

From Table 23, the correlation between each of the independent variables was not too high. That is, the correlations were not .7 or more than .7. The correlations were calculated between Attitude and Motivation (r = .639), Attitude and Anxiety (.445), and Motivation and Anxiety (.622), which were all less than .7. Therefore, all independent variables were retained. The results showed that motivation of the students will change the attitude of students positively towards the learning of elective mathematics. Motivation also will change learners' negative anxiety - (Not participating in elective mathematics lessons, not learning the subject, not doing assignments, not writing end of term exams, with the notion that elective mathematics is difficult, and he /she cannot pass the subject), to positive anxiety – (Not ready

to bear shame no more by participating in elective mathematics lessons, learning the subject, doing assignments, writing end of term exams, hoping to achieve highly in the subject) towards the study of elective mathematics. The two instances will help the students to perform highly in the subject.

Discussion

There was a significant relationship between achievement and each of the three main affective variables, that is, attitude, motivation, and anxiety. The findings are consistent with other empirical research findings. According to Khun-Inkeeree; Omar-Fauzee; Othman; and Salleh (2016), there was a positive relationship between students' attitude towards learning mathematics and their achievement. According to Michelli, (2013), there was a significant relationship between attitudes toward mathematics and achievement in it**.** Also, Awuah (2009, p. 17), found that there was a relationship between mathematics anxiety and achievement. The study was consistent with the findings of Hembree, (1990), who found that positive attitudes towards mathematics have often correlated with lower mathematics anxiety, and increased motivational self-monitoring in mathematics.

Two; Achievement correlated highly with attitude (r = .636), motivation (r = .670), and anxiety (r = .585) towards learning of elective mathematics. The findings are consistent with other empirical research findings such as Cheung (1998), who found out that there was a positive correlation between attitude and mathematics achievement among junior secondary schools in Hong Kong. Poku, (2019), also revealed that students had a positive attitude towards mathematics learning in the selected schools. The students' positive attitude had a strong positive correlation between

attitude and mathematics performance in their field of study. According to Salimaco (2020), mathematics achievement of the senior high school students correlated significantly with mathematics anxiety. Eshun (2004, p. 3) also found out that high anxiety is associated with lower achievement in mathematics. Findings of Pantziara and Philippou, (2013), on students' motivation and their performance in mathematics revealed that students' performance and their interest in mathematics were influenced by fear of failure, self-efficacy beliefs, and achievement goals.

Finally, there existed a significant positive high correlation at alpha level of .05 (1-tailed) between Attitude and Motivation (r = .639), Attitude and Anxiety (r = .445), and Motivation and Anxiety (r = .622). The results showed that motivation of the students will change the attitude of students positively towards the learning of elective mathematics. Motivation also will change learners' negative anxiety - (Not participating in elective mathematics lessons, not learning the subject, not doing assignments, not writing end of term exams, with the notion that elective mathematics is difficult, and he /she cannot pass the subject) to positive anxiety – (Not ready to bear shame no more by participating in elective mathematics lessons, learning the subject, doing assignments, writing end of term exams, hoping to achieve highly in the subject) towards the study of elective mathematics. The two instances will help the students to perform highly in the subject. Based on the result, there was enough evidence to reject H_0. It was concluded that there was a significant relationship among the pairs of the affective variables in studying of elective mathematics.

Chapter Summary

X_1 represented Attitude, X_2 represented Motivation, and X_3 represented Anxiety, while Y represented the dependent variable, Achievement. Therefore, the multiple regression equation / model for this current work was;

$$Y_i = 11.426 + 0.315X_{1i} + 0.285X_{2i} + 0.198X_{3i,}$$

The three slopes ($\beta_{1,}$ β_2 and β_3) of the independent variables had significant effects on Achievement.

All the three independent variables in the model had significant relationships with the achievement.

The Scatterplot and the Normal P-P Plot showed that there was no multicollinearity and outliers.

The correlations between Achievement and each of the independent variables were positive high and significant at alpha level of 0.05 (1-tailed). The correlations between Achievement and Attitude was (r = .636), Achievement and Motivation was (r = .670), and Achievement and Anxiety was (r = .585). The highest correlation was between Achievement and Motivation (r = .670), and the lowest was between Achievement and Anxiety (r = .585).

The correlation between each of the independent variables was not too high as compared to the standard value 0.7 (not .7 or more than .7). The correlation between Attitude and Motivation was (r = .639), Attitude and Anxiety was (.445), and Motivation and Anxiety was (.622). The highest correlation was between Attitude and Motivation (r = .639), and the lowest was between Attitude and Anxiety (r = .445).

Attitude made the strongest unique contribution to explaining the

dependent variable, when the variance explained by Motivation and Anxiety in the model were controlled. The motivation and anxiety made less contribution to explaining the dependent variable. For p-value = .000 <.05, the independent variables made a significant unique contribution to the prediction of the dependent variable. This also showed that there was no overlapping among the independent variables in the model.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

This chapter presents a summary of the study, conclusions from the study, recommendations and suggestions on areas appropriate for further study. The main Purpose of the study was to examine the relationship between

SHS Elective Mathematics students' motivation, attitude and anxiety and their achievement in the subject. The data was collected from five public grade B mixed SHSs; two from Ga West Municipal, one from Nsawam-Adoagyiri Municipal and two from Birim Central Municipal.

The following research questions guided the study:

1. Is there a significant effect of each of attitude, motivation and anxiety on achievement?
2. What is the correlation between the achievement result and each of attitude, motivation and anxiety?
3. What are the correlations among attitude, motivation and anxiety?

Data were collected from nine hundred and sixty-seven (967) SHS two students offering elective mathematics in five public grade B mixed SHSs. Out of this total, respondents comprising 595 males and 372 females, were selected purposively from five (5) schools. The tools used to collect the data were questionnaire and achievement test. The questionnaire consisted of only closed-ended items. It was designed to find responses from the respondents based on the research questions. It was administered personally by the researcher. The data were analyzed using both descriptive survey and inferential statistical method.

X_1 represented Attitude, X_2 represented Motivation, and X_3 represented Anxiety, while Y represented the dependent variable, Achievement. Therefore, the multiple regression equation / model for this current work was;

$$Y_i = 11.426 + 0.315X_{1i} + 0.285X_{2i} + 0.198X_{3i,}$$

Summary of Key Findings

Is there a significant effect of each of attitude, motivation and anxiety on achievement?

There was significant relationship between each of the independent variables, X_1 (Attitude), X_2 (Motivation), X_3 (Anxiety) and the achievement.

The three slopes (β_1, β_2 and β_3) of the independent variables had significant effects on Achievement.

Attitude made the strongest unique contribution to explaining the achievement, when the variance explained by all other variables in the model was controlled for. The values for motivation and anxiety indicating that they made less contribution. The p-values of attitude, motivation and anxiety were .000, less than (.05, .01, or .0001, etc.), which showed that the variables made a significant unique contribution to the prediction of the dependent variable. This also showed that there was no overlapping among the independent variables in the model.

What is the correlation between the achievement result and each of attitude, motivation and anxiety?

The correlations between Achievement and each of the independent variables were positive high and significant at alpha level of 0.05 (1-tailed). The correlation between Achievement and Attitude was (r = .636), Achievement and Motivation was (r = .670), and Achievement and Anxiety was (r = .585). The highest correlation was between Achievement and Motivation (r = .670), and the lowest was between Achievement and Anxiety (r = .585). There was enough evidence to reject H_0 and concluded that there was a significant relationship between students' achievement in elective mathematics and their affective variables.

What are the correlations among attitude, motivation and anxiety?

There existed positive high correlation (r = .639), which was significant at alpha level of .05 (1 tailed) between Attitude and Motivation. There was also positive high correlation (r = .445), between Attitude and Anxiety which was significant at alpha level of .05 (1 tailed). Finally, there was significant positive high correlation (r = .622) between Motivation and Anxiety. The highest correlation was between Attitude and Motivation (r = .639), and the lowest was between Attitude and Anxiety (r = .445). Again, there was enough evidence to reject H_0 and concluded that there was a significant relationship pairs of the affective variables in studying elective mathematics.

Conclusions

I concluded that:

1. There was a significant relationship between achievement and each of the three main affective variables, that is, attitude, motivation, and anxiety.
2. Achievement correlated highly with attitude (r = .636), motivation (r = .670), and anxiety (r = .585) towards learning of elective mathematics.
3. There existed a significant positive high correlation at alpha level of .05 (1-tailed) between the affective variables in the study of elective mathematics, Attitude and Motivation (r = .639), Attitude and Anxiety (r = .445), and Motivation and Anxiety (r = .622).

Recommendations

I would like to recommend that:

In this current work, the researcher used only category 'B' of Senior

High Schools. It is therefore, recommended that this same study should be carried out by using other categories of Senior High Schools other than 'B' for future research.

The result showed that there was a significant relationship between Senior High School students' achievement in elective mathematics and each of the three main affective variables, that is, attitude, motivation, and anxiety. It is therefore, recommended that teachers and parents should check on students' attitudes, motivation and anxiety towards the study of elective mathematics.

The students' achievement in elective mathematics correlated highly with attitude, motivation, and anxiety. It is recommended that same work should be extended to find out correlation between the performances of SHS or JHS students in mathematics and their affective variables.

The result also showed that pairs of affective variables correlated highly among themselves in the learning of elective mathematics. It is therefore recommended that teachers and parents work on students' attitudes and motivation towards the learning of elective mathematics to reduce their elective mathematics anxiety.

Suggestions for Further Research

Based on the findings of the research work done, further research is needed on:

1. Effects of affective variables on students' performance in elective mathematics.
2. Relationship between SHS students' affective variables and their achievement in core mathematics.
3. Relationship between JHS students' affective variables and their

performances in mathematics.

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APPENDICES

APPENDIX A

AN INTRODUCTORY LETTER

UNIVERSITY OF CAPE COAST
COLLEGE OF EDUCATION STUDIES
DEPARTMENT OF SCIENCE AND MATHEMATICS EDUCATION

Telephone: 03321-32440/32444/
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University Post Office
Cape Coast, Ghana

Your Ref:
Our Ref: DMSE/R.3/V.1/56

Date: 10th February, 2016

TO WHOM IT MAY CONCERN RESEARCH VISIT

The bearer of this letter, Mr. Azila John Kudjo, with registration number ED/PDP/14/0005 is a M.phil (Mathematics Education) student of the Department of Mathematics and ICT Education, College of Education Studies, University of Cape Coast.

As part of the requirement for the award of a Master of Philosophy degree, he is required to undertake a research visit to your school for the purpose of collecting data on the topic "RELATIONSHIP BETWEEN SHS STUDENTS' ATTITUDE, MOTIVATION, ANXIETY, AND ACHIEVEMENT IN THE STUDY OF ELECTIVE MATHEMATICS".

I would be grateful if you could give him the necessary assistance he may need.

Thank you for your usual support.

10/02/2016

Mr. Asare Inkoom
SUPERVISOR

APPENDIX B

SECTION A: Demographic Characteristics of Respondents

Answer the questionnaire by ticking (√) in the appropriate boxes.

GENDER: Male ( ),

Female ( ),

AGE GROUP: 15 – 17 years ( ),

18 – 20 years ( ),

21 – 23 years ( ),

Others, please, specify ……

PROGRAMME: General Arts ( ),

Science ( ),

Business ( ),

Agricultural Science ( ),

Technical ( ).

SECTION B:

THREE SETS OF STATEMENTS (A to C).

Read the following statements carefully. You are required to state whether you Strongly Agree (SA), Agree (A), Disagree (DA) and Strongly Disagree (SDA). Tick (√) in the appropriate box which best fit your idea about each of the FIVE SETS of statements (A to E). This is not a test for you to be graded. Feel free to give the true answer to each of the statements.

A						
Affective Variable	No.	Statements	SA	A	DA	SDA
Attitude towards Learning of Elective Mathematics	1	I feel confident enough to ask questions in Elective Mathematics class.				
	2	I believe I can do well in Elective Mathematics test.				
	3	I will use knowledge acquired from Elective Mathematics in my future career.				
	4	I will be able to get a good grade in Elective Mathematics				
	5	I believe I am very good at Elective Mathematics.				
	6	Elective Mathematics is one of the subjects I like best.				
	7	I understand the concept of a topic in Elective Mathematics easily.				
	8	I believe l can get an "A1" in Elective Mathematics.				
	9	If I have the chance, I will replace the Elective Mathematics with a reading subject.				
	10	Elective Mathematics is boring.				
	11	I learn Elective Mathematics better than any other subject.				
	12	I have enough knowledge in Core Mathematics to enable me do well in Elective Mathematics.				
	13	I do not have much interest for the study of Elective Mathematics.				
	14	I believe I will be an Elective Mathematics teacher in future.				
	15	I learn Elective Mathematics every day.				

B						
Affective Variable	No.	Statements	SA	A	DA	SDA
Motivation Towards learning of Elective Mathematics	1	Elective Mathematics is an exciting subject.				
	2	I never get tired of learning Elective Mathematics.				
	3	I like learning Elective Mathematics even after school.				
	4	I am very serious when it comes to the study of Elective Mathematics.				
	5	Learning of Elective Mathematics becomes interesting if I get an answer to a question correct.				
	6	Elective Mathematics is one of the easiest subjects.				
	7	I feel with joy when I have Elective Mathematics lesson.				
	8	Non-Elective Mathematics students praise me for doing Elective Mathematics.				
	9	Learning Elective Mathematics is enjoyable.				
	10	Elective Mathematics questions are not tricky.				
	11	I get sense of satisfaction when I solve Elective Mathematics question correctly.				
	12	Elective Mathematics has been my worst subject.				
	13	I am very proud for being Elective Mathematics student.				
	14	Elective Mathematics WASSCE questions are simple.				
	15	I am very serious with the study of Elective Mathematics.				

C						
Affective Variable	No.	Statement	SA	A	DA	SDA
Elective Mathematics **Anxiety**	1	I worry that I will not be able to do well in Elective Mathematics.				
	2	I get tense when it is time for an Elective Mathematics test.				
	3	I get nervous when taking an Elective Mathematics exam.				
	4	I worry that I will not be able to get a pass mark in Elective Mathematics.				
	5	I get discouraged when I see the plenty formulae work in Elective Mathematics.				
	6	I cannot solve a question correctly in Elective Mathematics.				
	7	Working on Elective Mathematics homework is stressful.				
	8	I feel nervous asking a question in Elective Mathematics class.				
	9	When I see an Elective Mathematics problem, I feel nervous.				
	10	When it is time for Elective Mathematics lesson, I become sick instantly.				
	11	I feel confident when taking Elective Mathematics test.				
	12	I do not participate in group discussion that involves Elective Mathematics.				
	13	I do not have the knowledge to solve Elective Mathematics problems.				
	14	I am not sure of getting a correct answer in Elective Mathematics class.				
	15	I sleep in class during Elective Mathematics lessons.				

APPENDIX C

SCHOOL A:

ATTEMPT ONLY 7 QUESTIONS.

TIME : 40 MINUTES

Do Not Write Your Name. Write Only Your Number

1. Write down the first four terms of the expansion $(3 - x)^4$. Hence, use your result to evaluate $(2.98)^4$ correct to four decimal places.

2. Resolve $\frac{4x-5}{(x-2)(x-3)}$ into partial fractions.

3. A binary operation Δ is defined on the set R of real numbers by $x\Delta y = xy^2 - x^2y$ where $x, y \in R$.

(a) Determine whether or not Δ is commutative,

(b) Find the product of $(2\Delta 3)$ and $(3\Delta 2)$.

4. Solve the equation $\log_{10}(x^2 + 1) - 2\log_{10} x = 1$

5. Expand and simplify $(2 - 3\sqrt{3})(3 + 2\sqrt{3})$.

6. Given that $f: x \rightarrow x^2 + 1$ and g: $x \rightarrow \frac{3x+1}{x-1}$.

Find (i) g o f(x) (ii). Inverse of g(x)

7. If $(x - 1)$ and $(x - 2)$ are factors of the polynomial $f(x) = 2x^2 + 9x^2 + mx - n$ where m and n are constants, find the values of m and n.

8. Find the equation of the line which passes through the point (3, -5) and is parallel to the line with equation $3x + 2y - 5 = 0$.

9. If $U = \{1,2,3, ...,10\}$, $A = \{7,2,5,10\}$ and $B = \{1,3,5,7,8\}$.

(i) How many subsets are in the universal set?

(ii) List elements of A n B.

(iii) Draw a venn diagram to illustrate U, A, and B.

10.The 3rd term of an AP is 15 and the 15th term is 21. Find the common difference and the first term.

SCHOOL B

ATTEMPT ONLY 7 QUESTIONS.

TIME : 40 MINUTES

Do Not Write Your Name. Write Only Your Number

1. Expand $(2 + x)^8$ in ascending powers of x up to the 3rd term. Use your expansion to find the value of $(1.086)^8$ correct to four decimal places.

2. Express $\frac{X^2-2X-3}{(X-1)(X-2)(X+3)}$ in the form $\frac{A}{(X-1)} + \frac{B}{(X-2)} + \frac{C}{(x+3)}$

3. A binary operation * is defined on the set **T = {**1, 2, 3, 4} by a * b = a + b - ab where a, b ∈ T. (a) (i) Construct a table for the operation.

(ii) Is Set **T** closed with respect to *?

(b) Evaluate (2 * 3) * 4.

4. Find $\log_{10}(x + 2) - \log_{10}(x-2) = 1$

5. The set ***A*** = {x: 1 < ***x*** **< 3}** and ***B*** = [x: **x = 1, 10}** are subsets of **μ = {1 ≤ x ≥ 10}. If** 1 < x < **10}, where x is an** integer.

Find (i) $(A^1 \cap B^1)$ (ii) $(A^1 \cup B^1)$.

6. The functions *f* and g are defined by *f*: $x \rightarrow$ 4x - 7 and g: $x \rightarrow \frac{1-x}{x}$

(i) Determine whether or not g is one - to - one function.

(ii) If x - 2, simplify gof(x).

7. The 6th term of an AP is 17 and the 13th term is 38. Find the common difference and the first term.

8. If(x-2) is *a* factor of the polynomial $f(x) = x^3 + ax^2 - 31x - 4 - b$, where a and b are constants. When the polynomial is divided by (x - 1), the remainder is -32. Find the values of *a* and *b*.

9. **Simplify** $\left(2\sqrt{3} + \frac{1}{3\sqrt{2}}\right)\left(2\sqrt{3} - \frac{1}{3\sqrt{2}}\right)$

10. Find the equation of the perpendicular bisector of the line joining the points:

(i) (0, 0) and (2, 4) (ii) (3,-1) and (-5, 2),

SCHOOL C :

ATTEMPT ONLY 7 QUESTIONS.

TIME : 40 MINUTES

Do Not Write Your Name. Write Only Your Number

1. Find the first four terms of the binomial expansion, in ascending powers of x, of $(1 + 2x)^6$. Hence, use your expansion to estimate the value of $(1.025)^6$, leaving your answer to **four** decimal places.
2. Express $\frac{3-4x}{6-x-x^2}$ in partial fractions.
3. The binary operation A, is defined on the set R, of real numbers
   $xAy = x^2 + y^2 - 2xy$, for all x, ye R, where $x > 0$.
   (i) Evaluate (3 A 2) (3 **A** 4).
   (ii) Determine whether or not the operation A is commutative.
4. The third term of an Arithmetic Progression is -8 and the 6th term is 1. Find the common difference and the first term.
5. **If** $g(x) \frac{x+1}{x-3}$, $x \neq 3$ and $h(x) = 3x - 7$
   Find (i) inverse function of g. (ii) $goh(x)$.
6. (x - 1) is a factor of $bx^3 + 3x^2 + 3x + a$, and the remainder when the expression is divided by (x + 2), is 20. Find the values of a and b.
7. Express $\frac{1}{\sqrt{5}+\sqrt{3}}$ in the form $q + p\sqrt{5}$ where p and q are rational numbers.
8. Solve the equation $\log_{10}(x^2 - 1) - 3\log_{10} x = 1$
9. The points A(5, -2), B(2,7) and C(-10.4) are in the xy-plane. Find the equation of the line passing through A and parallel to line BC;
10. The universal set U = {1,2,3,4, 6,9,12,18, 36}, A = {1,2,3,4,6, 12} and B={1,2,3, 6, 9, 18}. List elements of (i) $(A' \cap B')$, (ii) $(A' \cup B')$.

SCHOOL D:

ATTEMPT ONLY 7 QUESTIONS.

TIME : 40 MINUTES

Do Not Write Your Name. Write Only Your Number

1. (i) Write down the first four terms of the binomial expression of **(2** + x)^5 in ascending powers of x.

(ii) Using your expression in (i), to find the value of $(2.025)^5$, correct to the nearest whole number.

2. Solve the equation $\log_{10}(x^2 + 4) - 2\log_{10} x = 1$

3. If $Q(x) = \frac{5-2x}{(x+2)(x-1)}$. Express Q(x) in partial fractions.

4. A binary operation * is defined on the set R of real numbers by m * n = mn - 3(m + n) where $m, n \in R$. (i) Calculate (3 * 2) * -4,

(ii) Determine whether or not the operation A is commutative.

5. Without using calculator, simplify $(3\sqrt{2} - \sqrt{3})(\sqrt{3} - \sqrt{2})$.

6. The second term of a linear sequence is -9 and the fourteenth term is —141.

Find the common difference and the first term.

7. Two functions, f and g, are defined on the set of real numbers by f: $x \rightarrow 3x + 2$

and $g: x \rightarrow 2x - 3$.

Find (i) the image of -1 under f ° g. (ii) the inverse function of f(x).

8. (a) (x-1) is a factor of g{x) = $ax^3 + bx^2 - 4x - 3$ and the remainder when $g(x)$ is divided by $(x + 2)$ is 9. Find the values of a and b.

9. Find the equation of the straight line passing through the point (—3, -1) and

(i) parallel to line $3x - 4y - 1 = 0$ (ii) perpendicular to the line 3x - 4y - l = 0.

10. If P ={1,2, 4, 5, 7} and Q = {3, 4, 7, 8} are the subsets of U = {1,2,3,4,5,6,7, 8,9,10}. Find (i) (P' n Q')

SCHOOL E:

ATTEMPT ONLY 7 QUESTIONS ONLY.

TIME : 40 MINUTES

Do Not Write Your Name. Write Only Your Number

1. Two functions, f and g, are defined on the set of real numbers by

   f: $x \rightarrow 3x + 2$ and $g: x \rightarrow 2x - 3$.

   Find (i) the image of -1 under $f \circ g$.

   (ii) the inverse function of f(x).

2. (a) $(x-1)$ is a factor of $g(x) = ax^3 + bx^2 - Ax - 3$ and the remainder when $g(x)$ is divided by $(x + 2)$ is 9. Find the values of a and b.

3. Solve the equation $\log_{10}(x^2 + 1) - 2\log_{10} x = 1$

4. The points A (5, -2), 5(2,7) and C(-10.4) are in the xy-plane. Find the equation of the line passing through A and parallel to line BC;

5. Expand $(1 + 2x)^5$ in ascending powers of x up to the 3rd term. Use your expansion to find the value of $(1.086)^5$correct to four decimal places.

6. Express $\frac{X^2 - 2X - 3}{(X-1)(X-2)(X+3)}$ in the form $\frac{A}{(X-1)} + \frac{B}{(X-2)} + \frac{C}{(x+3)}$.

7. A binary operation Δ is defined on the set R of real numbers by

   $x\Delta y = xy^2 - x^2y$ where $x, y \in R$.

   (a) Determine whether or not A is commutative,

   (b) Find the product of $(2\Delta 3)$ and $(3\Delta 2)$.

8. Solve the equation $\log_{10}(x^2 + 1) - 2\log_{10} x = 1$

9. Expand and simplify $(2 - 3\sqrt{3})(3 + 2\sqrt{3})$.