AN EXPLORATION OF FACTORS THAT AFFECT ACADEMIC PERFOMANCE OF FIRST YEAR FEMALE STUDENTS IN MATHEMATICS AT CHANCELLOR COLLEGE, UNIVERSITY OF MALAWI.

MASTER OF EDUCATION (POLICY, PLANNING AND LEADERSHIP) THESIS

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JULY, 2018

DECLARATION

I the undersigned hereby declare that this thesis is my own original work, which has not been submitted to any other institution for similar purposes. Where other people's work has been used acknowledgements have been made.

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CERTIFICATE OF APPROVAL

The undersigned certify that this thesis represents the student’s own work and effort and has been submitted with our approval

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DEDICATION

I dedicate this work to my dad *Elias J Susuwele* and mom *Ivy Susuwele*. Your commitment to educate your daughters and sons is farfetched. You are a reality of the existence of parenthood to me. God bless you.

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This work would not be a success without the unfailing love of God. Am very thankful to the almighty God for taking me this far. I sincerely appreciate the support from Dr Richard Nyirongo the main supervisor and Dr Frank Mtemang'ombe the co supervisor. Your contribution can never be taken for granted. The same goes to the head of department of the Education Foundations Dr Nertha Semphere Mgala.

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ABSTRACT

Although empirical literature is amassed with debates about plausible explanations for the relatively low academic performance in mathematics among female students in college or university, very little is known locally. Therefore, the aim of this study was to explore the factors that affect female students' academic performance in mathematics with a focus on the BSc and BEds students at Chancellor College. The researcher used an exploratory mixed methods design to deeply and broadly explore the issue. Variables for the quantitative phase were generated in the initial qualitative phase. These included work load, math self-efficacy, teaching and learning practices etc. The succeeding quantitative phase made us of a multiple regression to identify independent variables that significantly explain performance in mathematics. The results of the multiple regression indicated that while mathematics self-efficacy and workload significantly explain mathematics score (performance) parents' level of education does not. The findings do not confirm some past study results that had indicated that parent's level of education can explain students' performance and reaffirms study results that indicate that workload and self-efficacy can explain performance. The findings may be useful to guide the authorities on measures to improve the Beds and BSc female students' mathematics self-efficacy when they arrive in college.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS .... **V**

ABSTRACT .... **VI**

TABLE OF CONTENTS .... **VII**

LIST OF FIGURES .... **X**

LIST OF TABLES .... **XI**

LIST OF ABBREVIATIONS AND ACRONYMS .... **XII**

CHAPTER 1 .... **1**

INTRODUCTION TO THE STUDY **1**

1.0 CHAPTER OVERVIEW 1
1.1 BACKGROUND TO THE STUDY 1
1.1.1 IMPORTANCE OF MATHEMATICS AND FEMALE'S ACADEMIC PERFORMANCE IN MATHEMATICS 5
1.2 STATEMENT OF THE PROBLEM 12
1.3 PURPOSE OF THE STUDY 14
1.4 MAIN RESEARCH QUESTION 14
1.5 SPECIFIC QUESTIONS 14
1.6 SIGNIFICANCE OF THE STUDY 15
1.7 DEFINITION OF TERMS 16
1.8 SUMMARY OF THE CHAPTER 16

CHAPTER 2 .... **17**

LITERATURE REVIEW **17**

2.0 CHAPTER OVERVIEW 17
2.1 THEORETICAL FRAMEWORK 17
2.2. ACADEMIC PERFORMANCE DEFINED 21
2.3 STUDENT PRE-COLLEGE CHARACTERISTICS AND EXPERIENCES 22
2.3.1 Age 22
2.3.2. Students' Socio Economic Status 24
2.3.3 Academic Preparedness 26
2.4 COLLEGE EXPERIENCES: CONTEXTUAL ENVIRONMENT OF THE COURSE 28
2.4.1 SINGLE SEX-EDUCATION 28
2.4.2 ACADEMIC AND SOCIAL INTEGRATION 30
2.5 STUDENT COLLEGE EXPERIENCES: PEER ENVIRONMENT- INDIVIDUAL STUDENT EXPERIENCES 33
2.5.1 Mathematics Anxiety 33

2.5.2 Stereotype Threat......35
2.5.3 Self- efficacy......38
2.6 INDIVIDUAL EXPERIENCES: OUT OF CLASS EXPERIENCES......43
2.6.1 Time Spent Studying......43
2.7 CHAPTER SUMMARY......45

CHAPTER 3......46

METHODOLOGY......46

3.0 CHAPTER OVERVIEW......46
3.1 RESEARCH PARADIGM......46
3.2 APPROACH......48
3.3 RESEARCH DESIGN......48
3.3.1 Population and Sampling......50
3.3.2 Instruments for the Qualitative Strand......51
3.3.3 Data Collection Procedures......55
3.3.4 Trustworthiness, validity and Reliability......55
3.4 DATA PROCESSING AND INTERPRETATION......57
3.5 THE QUANTITATIVE STRAND......57
3.5.1 Selection of variables......58
3.6 INSTRUMENTATION......58
3.6.1 Mathematics Self-efficacy scale......59
3.6.2 Mathematics workload pressure......59
3.7 LIMITATION OF THE STUDY......59

CHAPTER 4......61

RESULTS AND DISCUSSION OF FINDINGS......61

4.0 QUALITATIVE DATA ANALYSIS......61

4.1 STUDENTS' PRE COLLEGE CHARACTERISTICS AND EXPERIENCES......61
4.1.1 Academic Background......61
4.2 COLLEGE EXPERIENCES: CONTEXTUAL ENVIRONMENT OF THE COURSE......63
4.2.1 Academic integration - Extra academic help......63
4.3 THE COLLEGE EXPERIENCES: PEER ENVIRONMENT – INDIVIDUAL STUDENT......66
EXPERIENCES......66
4.3.1 Mathematics stereotype threat......66
4.3.2 Mathematics Interest......69
4.3.3 Mathematics self-efficacy......70
4.4 INDIVIDUAL STUDENT EXPERIENCES: OUT OF CLASS EXPERIENCES......72
4.4.1 Mathematics work load......72
4.5 INDIVIDUAL STUDENT EXPERIENCES: CLASSROOM EXPERIENCES......73
4.5.1 Teaching and Learning strategies......73

4.6 DISCUSSION 81
4.6.1 Academic Background 81
4.6.2 Extra help 83
4.6.3 Mathematics stereotype threat 85
4.6.4 Mathematics interest. 86
4.6.5 Mathematics self-efficacy 87
4.6.6 Mathematics Work load 88
4.6.7 Teaching and learning strategies and learning pace 89
4.7 QUANTITATIVE RESULTS 91
CHAPTER 5 93
CONCLUSIONS AND IMPLICATIONS 93
REFERENCES... 98
APPENDICES 122
APPENDIX A: FOCUS GROUP DISCUSSION GUIDE 122
APPENDIX B: SEMI STRUCTURED INTERVIEW GUIDE (LECTURER) 123
APPENDIX C: SEMI STRUCTURED INTERVIEW GUIDE (STUDENTS) 124
APPENDIX D: QUESTIONNAIRE 125
APPENDIX E: INITIAL CODING 127
APPENDIX F: RAW DATA FOR IV AND DVS 128

LIST OF FIGURES

Figure 1. 1 BSc mathematics mean performance 3
Figure 1. 2 BEds mathematics mean performance 4

Figure 2. 1 A Comprehensive Model of Influences on Student Academic performance . 20

Figure 3. 1 Sequential exploratory mixed methods design from 49

LIST OF TABLES

Table 1. 1: combined average 4

Table 4. 1: Multiple regression results for math score 91

LIST OF ABBREVIATIONS AND ACRONYMS

ACT	American College Test
BEds	Bachelor of education science
BSc	Bachelor of Science
DV	Dependent variable
FGD	Focus group discussion
GPA	Grade point average
HE	Higher education
IV	Independent variable
MSEQ	Mathematics self-efficacy questionnaire
NS&T	National science and technology
OECD	Organization for Economic Cooperation and Development
QUAL	Qualitative
QUAN	Quantitative
SES	Socioeconomic status
SPSS	Statistical package for social scientists

CHAPTER 1

INTRODUCTION TO THE STUDY

1.0 Chapter Overview

This chapter is a presentation of background information on the issue of low mathematics academic performance among first year female students at Chancellor College. It mostly focuses on answering the question why should females' low performance be of concern? This is followed by the statement of the problem, purpose of the study and finally the significance of the study.

1.1 Background to the study

Substantial research in many parts of the world has sought to identify plausible explanations for differences in mathematics performance at all levels of schooling between males and females (Gilah & Fennemma, 1990 cited in kiptum, Rono & Too, 2013; Garcia, 2012; Amelink, 2009; Mcjunkin, 2009; Hyde et al.'s 1990 cited in Zhu, 2007). Studies that have been done over time and in different countries have not yielded universal findings. Some studies show sex differences in mathematics performance in favour of male students (Garcia, 2012; Abubakar & Oguguo, 2011; Niederle & Vesterlund, 2010

Halpern, Benbow, Geary, Gur, Hyde & Gernsbacher, 2007; Spencer, Steele & Quim ,1999) and others in favour of female students (ACT, 2013; Bridgeman & Wendler, 1991 in Dayioglu & Turut-Asik, 2004). Besides, other researches have reported no significant gender difference in academic performance in Mathematics (Witt-Rose, 2003 cited in Abubaker, 2012; Stout et al. 2011, cited in Cheryan, 2011; Abubakar & Eze, 2009; Spelke, 2005; Grassi, 2004, Bridgeman & Wendler, 1991). This variability in the existing findings, according to Gibbs, 2010 cited in Ganley & Vasilyeva (2011) can be attributed, in large part, to variability in the nature of the assessment instrument used. Contrastingly, Kane & Mertz (2012) suggest that the differences are due to a variety of socio-cultural factors present in the males and females' environment and this in part explains the different findings among countries and changes over time in mathematics variances and mean performances.

In Malawi, a body of research that specifically addresses the disparities in mathematics education between male and female students however has mostly focussed its analysis on students at primary and secondary education (Kadzamira, 1997 cited in Chidyaonga, 2003; Chamdimba, 2003). In a study, at Chancellor College by Hiddlestone (1991) on women's achievement in mathematics and science females who studied mathematics were found to have started performing below male levels, but to surpass male performance by the end of their first year and to continue to do so to the end of their university course. The researcher (Hiddlestone, 1994) concluded that the low achievement had nothing to do with any gender difference in ability in relation to mathematics and attributed the change in progress made by females to encouragement that was rendered to them. In the current study preliminary data on mathematics performance among first year students of similar course combination at Chancellor College from 2003 to 2007 continued to show gender disparity in mean performance in favour of male students (see graph below). Moreover, the averages of 2009 and 2010 GPA performance of first year mathematics students are show the same trend

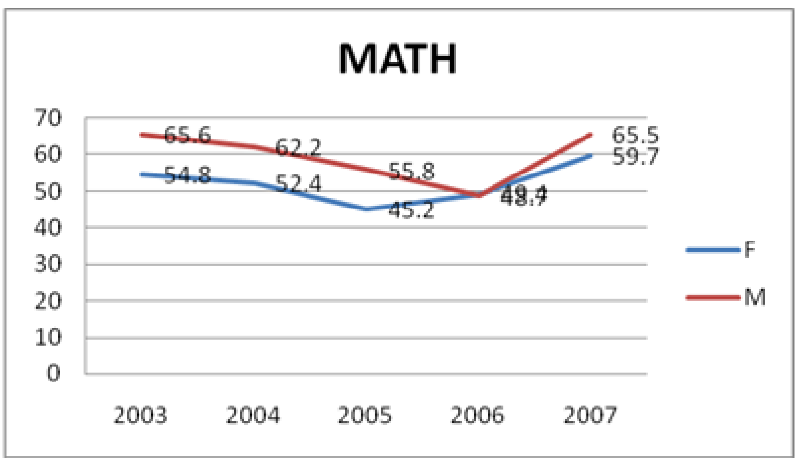

Figure 1. 1 BSc mathematics mean performance

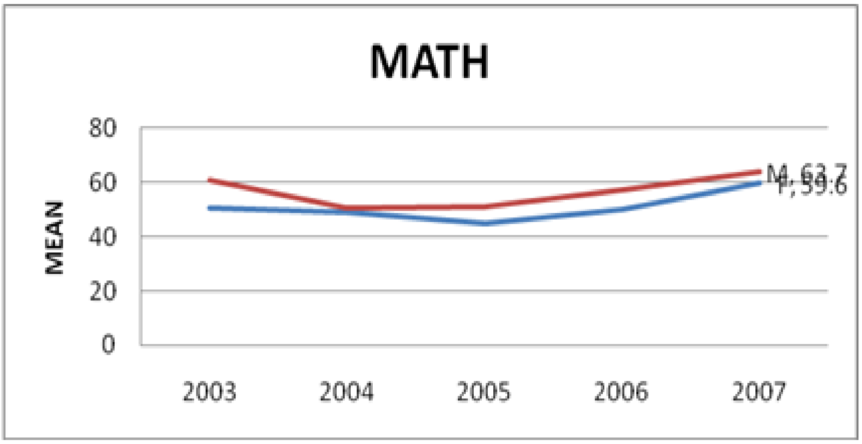

Figure 1. 2 BEds mathematics mean performance

Table 1. 1: combined average

Year	F-mean GPA	M- mean GPA
2009	2.6	3
2010	2.2	2.8

This low achievement among female students is disconcerting because experiencing a lower test score usually leads to disengagement with the subject (Balfanz, Herzog & Mac Iver, 2007; Steele, James & Barnett, 2002). Additionally, it has been observed that experiencing poor grades dramatically dampens one's perceived control and engagement in the course and consequently leads to failure (Neild & Balfanz, 2006a, 2006b).

Given the evidence on gender disparity, questions about the factors that influence these gender differences in mathematics academic performance are a popular inquiry. A study on origins of gender gap among tertiary students in California found that there are both Pre-College and college experiences that are responsible in explaining why females lag behind their male counterparts in their performance in college (Sax & Harper, 2005, Theremin & Reason, 2005). Many studies in Malawi have so far specifically studied elementary and secondary students as regards determining factors of gender disparity in mathematics performance, leaving a gap in research in regards to post-secondary education. This research therefore, builds upon this previous research to find out factors that explain the lower mathematics academic performance of female first year students at Chancellor College.

1.1.1 Importance of mathematics and female's academic performance in mathematics

One of the principal reasons why female students' academic performance in mathematics at tertiary level should be of concern is because low performance levels in this subject are a threat to the government's science and technology policy. As has been empirically evidenced, low performance leads to failure and disengagement from the course (Steele 2002, Balfanz, Herzog & Mac Iver, 2007). Low academic performance therefore, interferes with the science and technology policy that aims at encouraging females to study science and technology related subjects at all levels of schooling. Essentially, much of the increase in the enrollment in the nontraditional subjects at Chancellor College can be attributed to the government's science and technology policy (NS &T, 2001). Associated with the science and technology policy, public tertiary institutions in particular, have had to increase the proportion of females that enroll in nontraditional fields from 28% to 40% of the total enrollment by 2012 (PIF, 2000). It can therefore be argued that without any accompanying measures on performance of female students in mathematics, efforts by the Malawi government to improve participation of females in science and technology courses at tertiary may not fully materialize. This view is reinforced by OECD (2009) who advance that educational policy such as the science and mathematics participation policy has to take into account the existence of gender differences in performance to be effective in promoting quality student outcomes and equity. Chamdimba (2003) actually perceives females' poor performance particularly in Mathematics as a social justice issue that should be a cause for concern in promoting social justice in Malawi.

Evidence has also linked students' first-year academic performance to both persistence and degree completion in the sense that low performance may lead to permanent withdrawal (Pascarella & Terenzini, 1991, 2005). Besides, recent evidence indicates that mathematics achievement is more strongly correlated with labour market success than other measures of student achievement (Rose & Betts (2009). Although females perform better than males in humanities, education and social sciences, (Steele, James & Barnett, 2002) it may seem misplaced to focus on the dimension where females are falling short. However, in contrast to other test scores, a strong correlation exists between mathematics test scores in college and future income earned (Bharadwaj, Giorgi, Hansen & Neilson, 2013). In the USA, for example, ‘mathematics’ has been identified as the ‘critical filter’, acting as a gateway to many scientific fields of study and highly paid careers (Wynarczyk, 2006). Additionally, a poor mathematics test scores among students is a threat because it is a potentially massive loss economically (Bedard & Cho, 2007). Moreover, Pascallera & Terenzin (2005) in their longitudinal study of how college affects students found that the average net effect of undergraduate grades on earnings for women was approximately 1.3 times as large as the corresponding effect for men. Particularly, majoring in mathematics had a net impact on the subsequent earnings for a woman that is about 1.75 times as large as the corresponding effect for men. However, Rose & Betts (2009) are quick to point out that the correlations do not necessarily imply causation. There may be some underlying student characteristic that cause students to earn higher wages in the future. This probably explains why OECD (2009) advocates for an educational policy that has to take into account the existence of gender differences in performance to be effective in promoting quality student outcomes and equity. This is because imperative to raising the performance of one of the sexes to be similar to the other is the concomitant increase in economic and social benefits that this will bring (OECD, 2009).

Several other studies advance that mathematics occupies a pivotal position to almost all disciplines (Abubakar, 2012**;** Agwagah & Harbor-Peters, 1994; Tella & Tella, 2007; Olayemi, 2009; Abubakar & Eze, 2009; Abubakar & Uboh ,2010). Woodrow (2009) contends that mathematics is a subject that has been fruitfully applied in the natural sciences (astronomy, physics, chemistry, meteorology and biology). It is a strategic subject in the development of science and technology and it is fundamental in the study of engineering of all types. Woodrow, further asserts that even economists use mathematics neither to formulate, nor to theorise, but essentially to describe their world (ibid). In connection to the centrality of mathematics in other disciplines, Tuminaro (2003), in his unpublished doctoral thesis, found that many introductory, algebra-based physics students perform poorly due to lack of the mathematical skills needed to solve problems in physics. He (Tuminaro) concludes that a 'complete understanding of the concepts in physics requires fluency in mathematical language in which the concepts are couched'. Similarly, Bursal & Paznokas (2006) cited in Mokhtar, Yusof & Misiran (2012) assert that lack of understanding of basic mathematical principles can result in an inability to solve scientific problems in numerous subjects such as physics, chemistry and engineering. From the foregoing, one thus observes that a good performance in mathematics 'spills over' to other academic disciplines.

Multiple reports indicate that academic performance in mathematics cannot be predicted by a single variable (Reason, 2009; Terenzin & Reason, 2008; Pascallera & reason, 2005). It is dependent upon many factors both from the environment and outside the environment of the student. For example, a lot of literature shows that Mathematics is stereotyped as a male domain and this has an effect on the confidence of the female students about their competency (Lindberg, Hyde & Petersen, 2010; Steele, James & Barnett, 2000). Some studies on college students found that implicitly teachers have repeatedly demonstrated attitudes that link males and mathematics (Kiefer & Sekaquaptewa, 2007; Nosek, Banaji & Greenwald, 2002 cited in Lindberg, Hyde & Petersen, 2010; McGlone, 2013). Such negative stereotypes always lead to a stereotype threat among female students. According to Oswald & Harvey (2000-2001), stereotype threat is present when a woman takes a mathematics test even if she is not reminded verbally or visually of the stereotype and this threat substantially interferes with a woman's performance.

Furthermore, investigations in the past found high mathematics anxiety to be associated with low mathematics achievement (Yee, 1987 cited in Das & Baruah, 2010). It is stated that all people have some mathematics anxiety, but it disables women and minorities more than others (Usop, Sabri, Sam & Wa, 2009). In connection to that, study results of Woodard (2004) on 'the effect of mathematics anxiety on post-secondary developmental students on gender and age' indicated that female mathematics students were statistically significantly more mathematics anxious than male students (t= -2.66; p=.009) (Woodard, 2004). Interestingly other findings showed that for the most capable students, test anxiety acted as a facilitator in their mathematics performance (Das & Baruah, 2010).

Other determining factors include socio-economic status (Kyoshaba, 2009; Mlambo,2011; Ajayi & Muraina, 2011), age (Abubaker, 2009; Barrow, Reilly & Woodfield, 2009; Sakho, 2003 in Nykadzoi, Matamande, Taderera & Mandimika, 2013).), a gap in the mathematics at High school and mathematics at university(Klymchuk, Gruenwald & Javanoski, 2011) and self-efficacy (Vuong, Welty & Tracz, 2010; Mamwenda, 2009; Gore, 2006; Blake & Lesser, 2006).

Most eye catching is the assertion that many of the gender differences in mathematics performance do not emerge until the high school and college years (Steele 2003, Quest, Linn & Hyde, 2010). However, evidence from low and middle-income countries indicates that the gap emerges in grade four (Bharwadaj, Giorgi, Hansen & Neilson, 2013). As already indicated numerous studies in Malawi on determinants of low performance in mathematics among females have mostly focussed on primary and secondary school levels (Kadzamira, 1997 cited in Chidyaonga, 2003; Chamdimba 2003,). Besides, literature on performance at tertiary level is scanty in sub-Sahara Africa

(Mamwenda 2009). This current study therefore builds on the available literature and extends research to tertiary level. This shall as well contribute some knowledge to the body of research in sub Saharan Africa.

Indeed literature brings out multiple forces that operate in multiple settings to influence academic performance. Essentially students go to college with their unique backgrounds and characteristics which combine with their college experiences to influence academic performance (Pascarella & Terenzini, 2005)

As a policy related study, it is evidenced that the N S&T, (2001) policy in Malawi encourages participation in science and mathematics in particular and low performance in mathematics impedes the successful implementation of the policy.(Neild and Balfanz,2006a,2006b) The influences on mathematics performance may actually be elements in the environment where the policy implementation unfolds. Scholars, (Datnow and Park, 2009) have advanced that successful policy implementation should harness the influence of various actors and should remain sensitive to political, demographic, cultural and socioeconomic contexts. A study in Malaysia, by Ramli N.A.M & Awang, M. (2020) identified student factors, school factors, parent factors and administrator factors as critical in the implementation of a STEM education policy. Therefore an understanding of an array of factors that affect the performance in mathematics have a direct impact on the success of the policy.

1.2 Statement of the problem

Past research at Chancellor College by Hiddlestone (1991) on women's achievement in mathematics and science had since found that females who studied mathematics showed low achievement levels in mathematics and performed below their male counterparts in their first year. Similarly, Preliminary data for the development of this study on mathematics performance among first year students of similar course combination from 2003 to 2007 shows that the mean performance levels are in favour of male students. Moreover, the Grade Point Average (GPA) for first year mathematics students for 2009 and 2010 are also in favour of male students. This phenomenon of low performance among females in mathematics at tertiary level is not limited to Malawi. However a lot of countries (USA, Nigeria, Kenya etc), have been seeking plausible explanations for such low mathematics performance among female students.

Empirically, it has been proven that low academic performance leads to disengagement with the subject or failure (Steele, 2002). Notably, it was observed that some students that enroll for the natural science subjects (mathematics, chemistry and physics) at Chancellor College disengage with these subjects after first year as they progress with their studies (Nampota, *no date*). It is in this regard that researchers across countries have wanted to unearth the factors responsible for low achievement in one gender so that policies that are made account for gender differences in performance (OECD, 2009). This evidence therefore implies that without accounting for the low performance of female students in Mathematics, the National Science and Technology Policy at tertiary education, which seeks to increase the participation of females in natural Science subjects at tertiary level may not be fully productive.

In line with the same, the long-term plan to increase the participation rate in Higher Education (HE) in South Africa from 15% to 20% (Ntshoe, 2002,) highlights the need for universities to take a fresh look at all the factors that determine whether or not their students are successful`. Just as Killen & Fraser (2002) argued, there is little point in universities admitting students if there is not a reasonable probability that those students will be capable of successfully completing the programme in which they are permitted to enrol and it would be immoral

Regrettably, very little is known about factors that explain the women's low academic performance in mathematics in higher learning.

Based on Hiddlestone's study on performance among female students at chancellor college that was conducted around the 90's.(Huddleston; 1994) The researcher observed that Hiddlestone's study was very broad because the focus was on several sciences such as such as chemistry, physics, biology, computer science and mathematics. Therefore this study attempted to narrow down the focus to find out the issues specific to mathematics performance of those female students studying their first year at the college. This study was also relevant on the premise that, a cultural shift had occurred over the last decade which had seen more female students enrolling into STEM courses at tertiary levels, (PIF;2000) yet the performance had been low.

Besides, since studies that have been done on low achievement in Mathematics in school among females have focused on primary and secondary school, (Chamdimba; 2003) this study builds from such studies to extend the research to tertiary education. Therefore, the study sought to investigate the factors that determine academic performance in Mathematics among first year female students at Chancellor College.

1.3 Purpose of the study

The purpose of this study is to identify the factors that affect first year females' performance in mathematics at Chancellor College.

1.4 main research question

What are the factors that affect the academic performance of first year female students in mathematics?

1.5 Specific questions

a. What are the pre-college characteristics and experiences that affect female students' academic performance in mathematics?

b. What are the course contextual environment experiences that affect female students' academic performance in mathematics?
c. What are the peer environment experiences that affect female students' academic performance in mathematics?
d. To what extent do the identified factors affect the female students' performance in mathematics?

1.6 Significance of the study

The importance of the study lies in the knowledge it will generate. The information gained shall extend an understanding of the performance of female students in mathematics at tertiary level. Identification of the factors affecting female students' academic performance in mathematics at tertiary level is the first step in the solution to the problem of performance of females in mathematics in tertiary education. Practically, it is useful to understand factors that are responsible for females' academic performance at policy level in order to improve on the realization of the policy on participation of females in nontraditional fields at tertiary level. As alluded to by OECD, (2009) understanding what drives females' performance in mathematics and science can foster the design of effective educational policies to address equity concerns. Hopefully, this study will serve as an impetus for researchers at institutions of higher education to examine and address the topic of student performance more explicitly. Different universities, Faculties and departments might identify more strongly with certain factors thus encouraging the need for more directed studies, such as this research. Pinpointing the factors that students perceive as most important might help educators to create programs or improve teaching and curriculum to enhance undergraduates' success.

1.7 Definition of terms

Academic performance: Student's examination grades at the end of a particular semester or programme

Collaborative learning: Collaborative learning is an educational approach to teaching and learning that involves groups of learners working together to solve problems, learners challenge each other as they listen to different perspectives, and are required to articulate and defend their ideas. Therefore, the learners begin to create their own unique conceptual understanding and not rely solely on an expert's or a text's framework.

1.8 Summary of the chapter

In summary, the chapter has highlighted the importance of females' academic performance in mathematics. It has also shed some light on the world wide literature inconsistencies about low academic performance of college students in general and females' students in particular. This is followed by the statement of the problem of statement, purpose of the study and significance of the stud

CHAPTER 2

LITERATURE REVIEW

2.0 Chapter overview

A research has to take advantage of the information and the knowledge that had been accumulated previously. According to Koul (2009) research can never be undertaken in the isolation of the work that has already been done on the problems related to the study proposed by any researcher. It is in this view that the researcher critically reviews literature on college students' academic performance in general and mathematics in particular. This review is done through the lens of Reason (2009) theoretical framework which has been proposed for the study. It finally reviews the trends in females' mathematics performance in college for both developed and developing countries.

2.1 Theoretical Framework

This researcher made use a comprehensive model of influences on students' outcomes [learning and persistence] which was developed by Reason, (2009). The framework was developed based on research published for over 30 years in an effort to increase understanding of the multiple, interconnected factors that influence academic success and persistence among first-year college students.

In their review, Terenzin & Reason, (2008) indicated that most studies of college effects on students have adopted an overly narrow conceptual focus, concentrating on only a few areas affecting students' outcomes. As a result, there is a body of evidence that presents only a partial picture of forces at work. Reason (2009) observed that "single-paradigm research restricts the range of analytical vision and the depth and validity of understanding thereby limiting the usefulness of findings for guiding development of effective academic and non-academic programs, practices, and policies". After reviewing more than thirty years of research, Pascarella & Reason (1991,2005) concluded that multiple forces operate in multiple settings to influence student outcomes indirectly if not directly. Hence this model was meant to avoid the conceptual isolation. The framework extended and synthesized the most frequently adopted Astin's (1993) Inputs-Environment-Outcomes approach and Terenzini, Springer, Pascarella, & Nora's (1994) model of college effects on student outcomes. These conceptual frameworks hypothesize that students' pre-college characteristics influence their engagement in college. In addition, those engagements are themselves influenced by a variety of curricular, classroom, and out-of-class experiences and conditions. Pascallera & Reason (2005) suggest that all of these dynamics occur within, and are mediated by, an often-overlooked fourth domain, the institutional context. They therefore drew on the model for studying organizational effects on student outcomes proposed by

Berger & Milem (2000).The framework incorporates four sets of constructs, the wide array of influences on student outcomes indicated in the research literature: student pre-college characteristics and experiences, the organizational context, the student peer environment, and, finally, the individual student experience (Terenzini & Reason, 2008).

Although the schematic representation of the framework suggests the possibility that features of the organizational/academic department context may have direct influences on student outcomes, some recent research indicates that those influences are more likely to be indirect than direct. This theoretical framework is so far the most suitable because unlike other models, it is a model that was designed for first year college students. The model has drawn its strength from an extensive synthesis of research literature, to come up with constructs that comprehensively put in perspective the multiple interrelated forces that shape students outcomes. In a similar manner, literature reveals a wide array of influences on mathematics performance which include: age of a student, (Abubaker, 2009) math self-efficacy, (Vuong, Welty & Tracz, 2010) academic preparedness, (Klymchuk, Gruenwald & Javanoski, 2011) social economic status (Kyoshaba, 2009) andmany more. However not many studies have comprehensively focussed on the multiple and interrelated influences on mathematics performance. Therefore, this model assisted the researcher to conceptualise and articulate the specific factors and their intersections and overlaps within multiple contexts to influence mathematics performance. Besides, the proponents argue that the model specifies no particular educational outcome and appears to be flexible enough to guide study of a wide array of college students' outcomes (Reason, 2009).Therefore the researcher found this model relevant to guide the study on mathematics performance.

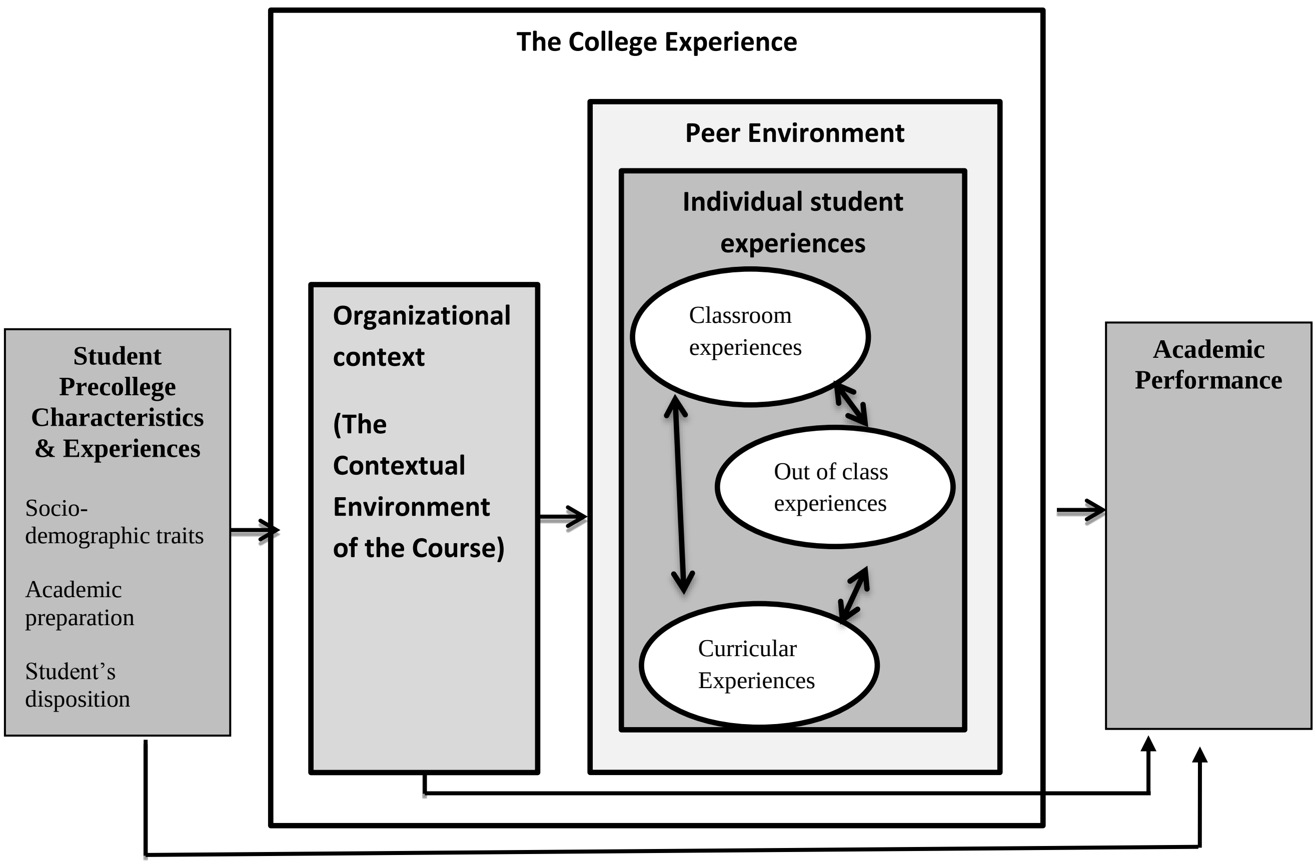

Figure 2. 1 A Comprehensive Model of Influences on Student Academic performance

Source: Reason (2009)

2.2. Academic performance defined

Observations show a tendency within the educational literature to omit an adequate definition of academic performance as it is deemed intuitive as to what the concept pertains to (Chamorro-Premuzic, 2005). However, Schuwirth & Van Der Vleuten, (2006) contend that, in order that an outcome variable can be effectively operationalized as a meaningful variable in research, it is essential that a concise, comprehensive definition is outlined. Therefore, as observed by Chamorro-Premuzic (2005), the lack of attention to operationalizing performance definition in the current literature is surprising considering its wide use as an outcome variable in educational research. Anderson & Krathwohl (2001) define academic performance as a demonstration of a student's level of competence and mastery of a subject through completion of multiple tests of competence in a particular domain of education. This is usually in form of student's examination's grades. Higher scores indicate better academic performance. In line with this, the study defines academic performance as the student's examination grades at the end of a particular semester or programme.

2.3 Student pre-college characteristics and experiences

2.3.1 Age

Age as a demographic trait, has been touted to have significant influence on performance in Mathematics (Abubakar & Adegboyega, 2012). However research findings on age are not consistent and sometimes contradictory. Some studies show congruency in findings of a direct relationship between age on mathematics performance (Hoskins, et al, 1997 cited in Cheesman, Simpson & Wint, 2006). While other findings show confounding inverse relationship between age and student grades (Clark & Ramsay, 1990 cited in Li, Chen, Duanmu, 2010; Barrow, Reilly & Woodfield, 2009; Sakho, 2003 in Nykadzoi, Matamande, Taderera & Mandimika, 2013). Yet other studies show that age's effect on performance is not significant. Moreover, several other studies show gender difference in mathematics performance among students of the same age (Tenzin, 2002 in Abubakar & Adegboyega, 2012).

Some studies have shown that younger students outperformed their older peers in Mathematics and overall scores at lower levels of schooling while older students perform better at a higher level than the younger ones (Tenzin, 2002 in Abubakar & Adegboyega, 2012).

Indeed researchers have brought mixed evidence in the literature of student's age and academic performance. Kyoshaba (2009) concluded that there is no significant relationship between age and academic performance in her study which found that different age groups scored slightly differently on academic performance with ages 21 – 25 years scoring highest and less than 20 years scoring lowest. She however found the differences not to be statistically significant

Leongson (2003) used Piaget's theory of cognitive development in an attempt to explain the poor performance in mathematics of 17-year-old college freshmen. He investigated whether a group of college freshmen performed at the expected level of formal thought (Students at formal operation stage are able to apply mental operations not only to concrete objects, but to objects, situations, ideas, and concepts that are not directly perceived). It was shown that the students were formal operational thinkers a stage which occurs by ages 15 or 16 according to Piaget's theory. However, it was revealed that there are certain logical operations that are not fully developed even at college level. For example, the study found that 50% of the students had inadequate understanding of the concept of ratio and proportion as they exhibited ambiguous reasoning patterns when interviewed.

2.3.2. Students' Socio Economic Status

Educational researchers have also been interested to examine whether students' socio-economic status (SES) could be a variable that explains students' academic performance at tertiary level. Sirin (2005 cited in Mlambo 2011), points out that a relationship between students' socio-economic status and academic performance, is contingent upon a number of factors such that it is nearly impossible to predict academic performance using socio-economic status. Other scholars argue that socio-economic status is most commonly determined by combining parent's educational level, occupation status and income level (Jeynes & William, 2002; McMillan, & Western, 2000). However, Social scientists commonly use either parent's income, occupation or education; while others adopt all three in the measure for SES (Magnuson & Duncan 2006), (Dills 2006 cited in Kyoshaba, 2009) cautions that in developing indicators appropriate for high education context, researchers should study each dimension of social economic status separately because education, occupation and income are moderately correlated therefore it is inappropriate to treat them interchangeably.

Empirical evidence on the relationship between students' socio-economic status and academic performance shows mixed results. It has been advanced that, on average, students from higher socio--economic backgrounds attain higher GPAs than do their respective counterparts (Dennis, Phinney & Chuateco, 2005;

LaForge & Cantrell, 2003; Robbin et al., 2004; Smith & Naylor, 2001 in Aromolaran, Oyeyinka & Oluseyi, 2013). This view is reinforced by Pishghadam & Zabhii (2011) who argue that parents' education level is the strongest predictor in forecasting students' achievement. Surprisingly, Pishghadam & Zabhii's (2011) study revealed that only mother's educational level was significantly and positively predictive of learners' university GPA. Additionally, Acharya & Joshi (2009, reported in Pishghadam & Zabhii, 2011)) found that the father's educational level bore no relationship with the university achievement of participants in Iran.

Essentially, scholars believe that a low social economic status negatively affects academic performance because it prevents students' access to vital resources and creates additional stress at home (Aromolaran, Oyeyinka & Oluseyi, 2013). This view is supported by other scholars who have advanced that parents with higher educational levels have greater success in providing their children with skills they need to be successful in an academic setting. It is further argued that educated parents transfer the value of education to their children and this in turn affect the aspiration level and their achievement. Still, other researchers advance that higher socioeconomic status may facilitate effective academic and social adaption to university settings (Acharya & Joshi, 2009 cited in Pishghadam & Zabhii, 2011).

Contrasting results from a study on educational and socio-economic background of undergraduates and academic performance at a Brazilian university show that students from a low socio-economic and educational homes performed relatively better than those coming from higher socio-economic and educational strata (Rothman, 2003 cited in Aromolaran, Oyeyinka & Oluseyi, 2013).

However, Harb & El-Shaarawi (2006) argue that family socio-economic background doesn't seem to have a significant influence on grades at university level. The authors (Harb & El-Shaarawi, 2006) claim that the influence of such variables tend to decrease along the school trajectory, such that at university level these factors were most probably already imbedded in basic and high school students' characteristics.

2.3.3 Academic Preparedness

Associated with the underperformance in mathematics, there is ample evidence in literature that suggests that the gap between high school and university education in mathematics likely influences first year performance in the subject (Klymchuk, Gruenwald & Javanoski, 2011). A couple of studies suggest that first year students encounter what is sometimes referred to as an 'abstraction shock'. (Tall, 2004, cited in Griese et al, 2011) That is to say, the level of mathematics encountered is advanced, it adds a formal world to the mathematics encountered at high school level. Hemmi (2008, cited in Jablonka, & Bergsten

2010) adds that Mathematics at university is presented in a comparatively advanced technical language, which students perceive as more cumbersome. In other words, there is a change in the type of mathematics which requires specific learning strategies that students may not have developed throughout high school time (Rach & Heinze, 2011 cited in Griese et al, 2011). As such the transition period from high school to university can be hard for many students. Even students with good marks in high school mathematics experience difficulties at university and sometimes fail the first year university mathematics courses (Klymchuk, Gruenwald & Javanoski, 2011).

A survey that was aimed at gaining perspectives of university lecturers from 24 countries on transition from high school to tertiary found that many university lecturers worldwide agree that there is a need to investigate the ways of reducing the gap.(Klymchuk, Gruenwald & Javanoski, 2011) Additionally, University lecturers worldwide feel that the difference is a direct result of where the emphasis is placed by the high school teachers (calculations and manipulations) and university lecturers (conceptual understanding and rigor) (Klymchuk, Gruenwald & Javanoski, 2011). In support to that Carrol (2011) asserts that in recent years, universities and colleges across countries such as UK, Ireland, Canada and Australia, have found that their students do not have sufficient mathematical preparation or the appropriate mathematical background to deal with their first year mathematics courses and because of this, universities and colleges have seen an increase in failure rates for these subjects (Rylands & Coady, 2009). Kaj&er & Lovric (2005 cited in Carrol, 2011) reported on the problems some of the mathematics lecturers were facing in Canada, identifying lack of mathematical preparation in their students, stating that the skills knowledge of the incoming students were well below what was expected of them. It is believed that this gap is not just limited to specific countries but is seemingly a worldwide phenomenon (James, Montelle & Williams, 2008)

Gill et al. (2010) recognised that although there may be similarities in the "Mathematics Problem" around the world, individual differences such as *"local conditions, practices and needs"* mean that researchers should examine the problem and contributory factors as it exists in their own country.

2.4 College experiences: Contextual environment of the course

2.4.1 Single sex-education

Within the proposed model, the assumption is that specific internal organizational structures, practices, and policies, are more likely, at least indirectly, (perhaps also directly) to influence student outcomes through the kinds of student experiences and values they promote or discourage (Terenzin

& Reason, 2005). In this connection institutional effects are more a function of what institutions do than of what they are.

Literature suggests that single sex classes are related to women's academic performance especially in the male dominated academic fields (Kouassi, 1999). While much has not been written about the effect of single sex education as an on students' academic performance at tertiary, there is also no scholarly consensus on the issue.

The argument is that mathematics is stereotyped as predominantly male-domain and studies have reported higher levels of stereotype threat among females in this field than in the female-dominated academic area. (Steele, James & Barnett, 2002). Therefore, females enrolled in an all-female class should be more willing to participate in discussion and feel less pressure when taking exams. Consequently, they should do better in courses given the absence of the negative stereotype caused by having males present (Booth, Cardona-Sosa, Nolen, 2013).

In relation to this, Booth and Nolen (2012,) show that all-female environments make females more competitive and less risk averse. This attribute is well associated with mathematics test scores which are shown to be influenced by competitive behaviour. (Niederle & Vesterlund, (2010). In line with the notion of competitiveness of females in all female environments, an experiment by

Booth, Cardona-Sosa, & Nolen (2013) found a considerable impact of single-sex schooling where females in all-female classes were over 7% more likely to pass their introductory economics course, score 8% higher on the course grade, and score 10% higher in their required courses a year after being assigned to a single-sex class than their counterparts assigned to coed classes. In Africa, countries that have women's only universities include Kenya, Ghana, Nigeria, Sudan and Zimbabwe (Bunyi, 2003). However, these are meant to increase enrolment of women in tertiary education.

Nevertheless, the above evidence has not been universally supported. Jackson (2012) shows that only females who have a strong preference to attend single-sex education show some benefit from single-sex education. Halpmen et al (2011) argue that sex segregation increases gender stereotyping and legitimizes institutional sexism. These scholars (Halpmen, Eliot, Bigler, Fabes, Hanish, Hyde, Liben & Martin, 2011) further states that there is no well-designed research showing that single-sex education improves students' academic performance

2.4.2 Academic and social integration

Some earlier studies have advanced a claim that there is a positive association between first year students' social and academic integration into an educational institution and academic performance (Adler et al., 2008 in Mudhovozi, 2012;

Astin, 1999 in Hlebec, Kogovšek & Ferligoj, 2011; Tinto, 2004; Beder's 1997). It has been observed that, students who seek and receive academic support improve their academic performance (Smith, Walter & Hoey, 1992 in Cuseo, 2005). In support to this, other scholars show that teacher support is positively related to academic achievement and academic support seeking, is a good predictor of academic achievement (Lam et al, 2012; Ofori and Charlton, 2012; Quomma & Greenberg, 1994 in Dzulkifli & Yasin, 2009).

In an attempt to explain the association between academic and social support with academic performance, researchers have argued that there is psychological distress that is associated with the transition to post-secondary education. The transition to university classroom requires an adjustment of academic habits and expectations for most students (Pascarella & Terenzini, 1991 in Mudhovozi, 2012). For example, Mudhovozi (2012) advances that first year students at the university experience more acute competition, larger classes, high standard and more frequent written work, different teaching styles etc. As such students need to respond to such a demanding academic situation.

Similarly, Beder's (1997 cited in Mudhovozi, 2012) study found that first year college students had difficulty adjusting to the different styles of teaching. Therefore, according to Dollete et al., 2004, in Dzulkifli & Yasin 2009) it is assumed that provision of social support serves as a buffer against the stressors that are encountered. Hence social support is thought to contribute to improved academic performance by decreasing the stress of academic life (Lakey & Cohen, 2000 in Macknnon, 2011). A study by Wentzel (1998 cited in Dzulkifli & Yasin, 2009) found that social support provides motivational influence on students' performance. It is astounding however to learn that male students adapt to the new university environment better than their female counterparts (Enochs & Roland 2006). In the same line, another study revealed that females rely on social support more than their male counterparts to adjust to the university life. (Mudhovozi, 2012)

This research evidence is however not conclusive for the reason that Africa as a continent has been given little scholarly attention on the social and academic adjustment of first year students. Comparatively, much attention is given to developed countries. (Cherian & Cherian 1998 in Mudhovozi, 2012). Given this scenario, the present study shall address this literature deficit in Africa and Malawi in particular.

2.5 Student college experiences: Peer environment- Individual student experiences

2.5.1 Mathematics Anxiety

As another students' school/college experience, mathematics anxiety is proven to directly connect to students' academic performance in college. It is advanced that mathematics 'anxiety' was first detected among undergraduate college students in the late 1950s by Dreger & Aiken (1957), cited in Karimi & Venkatesan, (2009). It is believed that high levels of anxiety impair performance. Several research findings indicate that test anxiety is a predictor of performance (Ashcraft & Ridley 2005). In agreement, a study by McNamara & Penner (undated) to investigate factors that influence student success in first year mathematics found that students with lower anxiety performed better in their first-year mathematics courses. This effect of anxiety is explained by Ashcroft & Kirk's (2001), whose study indicated that individuals with high mathematics anxiety experienced smaller working memory spans. The reduction in memory capacity resulted in longer reaction times and increased errors while performing computational functions (Quest & Nicole,2010). In relation to this, Karimi & Venkatesan (2009) further assert that mathematics anxiety causes problems in processing the incoming information as well as the previously learned information for problem solving.

The researchers (Karimi & Venkatesan, 2009) further argue that a feeling of tension and anxiety interfere with manipulation and solving the mathematical problems in academic situations and many students who suffer from mathematics anxiety have little confidence in their ability to do mathematics. Richardson & Suinn (1972) observed that anxiety has a debilitating effect on mathematical performance. In addition, Ganley & Vasilyeva (2011) assert that higher levels of anxiety may lead to lower levels of mathematics performance, which, in turn, may depress students' confidence and further increase their anxiety. However, confounding findings indicated that prior mathematics achievement had a stronger impact on anxiety than did anxiety on mathematics achievement. (Ma & Xu, 2004 in Ganley & Vasilyeva, 2011)

The effect of anxiety on mathematics performance is not conclusive in the literature because contrasting findings have indicated that mathematics anxiety has little to do with performance (Llabre & Suarez, 1985 cited in Nasser, 2004). A research by Pomerantz et al. (2002) in Ganley & Gasilyeva (2011) had shown that female students obtained higher grades despite being highly anxious about mathematics than their male counterparts. This finding is reinforced by Ganley & Vasilyeva’s (2011) study which found that males displayed less anxiety about mathematics than females, even when there was no sex difference in mathematics achievement.

2.5.2 Stereotype Threat

Research has also extended to examine the role stereotype threat plays in mathematics academic performance. It is stated that the term stereotype threat was first used by Steele & Aronson (1995) to explain the difference in test performance between Black and White college students when their race was emphasized. When race was not emphasized, however, Black students performed better and equivalently with White students. So what is stereotype threat? Steele & Aronson (1995), cited in Stroenesser & Good, (2009)) define stereotype threat as referring to being at risk of confirming, as a self-characteristic, a negative stereotype about one's social group.

Usually people are negatively or positively stereotyped according (but not limited) to ethnicity, gender, race, age, religious affiliation e.t.c. (Singletary, Ruggs & Hebl, (2009). The study by Steele & Aronson (1995) demonstrated that performance in academic context can be harmed by the awareness that one's behaviour might be viewed through the lens of racial stereotype (Stroessner & Good, 2009). Scholarly work contends that, the conditions that produce stereotype threat are ones in which a highlighted stereotype implicates the self through association with a relevant social category (Marx & Stapel, 2006**;** Marx, Stapel, & Muller, 2005 cited in Stroessner & Good, 2009) In addition to that, Hyde & Kling (2001, cited in Mcjunkin, 2009)) advance that stereotype threat sets up a mutually reinforcing system and the fear of confirming the stereotype leads to behaviour that confirms it. To explain this mutual reinforcement system, Singletary, Ruggs & Hebl (2009) (in this case related to Steele & Aronson experiment) clarifies; if you are white and you find the test difficult, you may only worry about failing the test. If you are black, however, you may worry about failing the test and reinforcing the racial stereotype. Therefore, struggling with a test becomes doubly threatening, because you are worried about not only failing the test but also about being personally reduced to a negative stereotype targeting your group in that domain.

Scholars observed that the concept of stereotype threat was quickly extended from the stereotypes about Blacks' intellectual inferiority to stereotypes about females' deficiencies in mathematics (Quinn & Spencer, 2001; Spencer, Steele, & Quinn, 1999 cited in Halpern, Benbow, Geary, Gur, Hyde & Gernsbacher, 2007). Mcjunkin (2009) attests to the fact that stereotype threat has been used as an explanation of poorer performance in research involving women's mathematics scores. Actually, past research with college students has suggested that to be impacted by stereotype threat, women must be identified with mathematics and take a difficult mathematics test in an evaluative situation in which their gender is made salient (Ganley, et al, 2013). Moreover researchers have demonstrated that when the stereotype is primed prior to taking a mathematics test, females perform worse on the test than in a situation in which the stereotype is not primed, whereas males perform equally in both conditions (Spencer, Steele, & Quinn, 1999; Steele, 1997 in Ganley, et al, 2013). Ganley et al., (2013) postulate that gender can be made salient by mentioning gender differences, marking ones's gender or taking the test in a mixed gender group.

In an experiment involving male and female college students, by Spencer et al. (1999), reported in Steele, (2003), females' mathematics test performance was worse than males' when the test was described as showing gender differences. Steele (2003) attributes the females' poor performance in the experiment by Spencer et al (1999) to female's own identification with societal stereotype that devalues them in the mathematics domain. Several researchers confirm that stereotype threat is a result of cultural factors specifically, stereotypes about female inferiority at mathematics (Halpern, et al, 2007).

Although researchers consider stereotype threat to be a well-established phenomenon in explaining the performance of females in mathematics, it is however suggested that claims that stereotype threat among college females is a robust phenomenon are exaggerated. (Stoet & Geary, 2012 in Ganley et al, 2013). Some scholars have raised concerns about the use of covariates and other statistical procedures used to demonstrate stereotype threat (Sackett et al. in

Halpern et al, 2007). In response to such concerns, Steele & Aronson (1995) counterargued that a large number of studies that have found evidence for stereotype threat do not rely on the use of covariates to demonstrate the effect. However, Quinn & Spencer (2001); Johns et al., (2005) cited in Halpern et al,(2007) assert that so far the size of the effect is unknown.

2.5.3 Self- efficacy

Self-efficacy has been defined as "people's judgments of their capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, cited in Vuong, Welty & Tracz, 2010). According to Social cognitive theory (Bandura, 1977, 1997 in Vuong, Welty & Tracz, 2010), self-efficacy beliefs powerfully influence the choices people make, the amount of effort they expend, and their level of persistence. From the foregoing, Solberg et al, (1993) cited in Vuong, Welty & Tracz (2010) operationally defined college self-efficacy as a student's degree of confidence in performing various college related tasks to produce a desired outcome, such as passing an examination. Pajares & Miller (1994 cited in Mamwenda, 2009) define Mathematics self-efficacy as a person's assessment of their capability to solve problems in Mathematics, and deal with Mathematics related tasks successfully and satisfactorily. It is argued that people associated with a high level of self-efficacy are characterised as pursuing a relatively high level of performance and do not easily get discouraged in the activities they have committed themselves to accomplish (Mamwenda, 2009). Confoundingly it is argued that, individuals who have low self-efficacy beliefs do not embrace difficult tasks because they are seen as personal threats. (Long et al, 2007).

A plethora of research exists on the relationship between self-efficacy and academic performance in different subjects and in Mathematics in particular. Most of these studies have confirmed a positive relationship (Vuong, Welty & Tracz, 2010; Mamwenda, 2009; Gore, 2006; Zajacova, Lynch & Espenshade, 2005; Bong, 2001; Zimmerman, 2000). However, other studies are not in support of the positive relationship between self-efficacy and academic performance (Saunders, Davis, William & Williams, 2004; Loo & Choy, 2013; Reynolds & Weigand, (2010), in Ogunmaking & Akomolafe, 2013).

Mamwenda (2009) examined the relationship between self-efficacy and academic performance in university-based Mathematics at first year level and found that there was a statistically significant correlation between self-efficacy and Mathematics performance for both university women and men students. In support to this, Schallert (2006, cited in Ogunmaking & Akomolafe, 2013) in his study, found that self-efficacy significantly predicted students' academic achievement in sciences. Furthermore, Pajares & Miller (1994, cited in Mamwenda, 2009) examined several variables as predictors of achievement in Mathematics and found that self-efficacy emerged as a better predictor than all the other variables. Besides, the results indicated that men had stronger self-efficacy than women and as such their performance was superior to that of women.

However, some empirical studies report contrary findings. For example, Reynolds & Weigand (2010), in Ogunmakin & Akomolafe, (2013) examined the relationships between self-efficacy and academic achievement with a sample of 164 undergraduate first year students. The researchers found that self-efficacy was not significantly related to academic achievements.

Robbins et al, (2004) argue that the role of academic self-efficacy as a predictor of academic performance is less certain in college. Kahn & Nauta (2001, cited in Robbins et al 2004) in their analyses to find the first-semester college performance predictors, they never found self-efficacy belief as a predictor of performance. Intriguingly, another study determined a negative relationship between self- efficacy and performance (Vancouver, Thompson, Tischner, & Putka, 2002 in Robbins et al, 2004) but the researchers argued that this finding was as a result of students' likelihood of committing logic errors because of overconfidence.

It has been observed that numerous studies have examined the relationship between self-efficacy and performance in Mathematics among college students in Western countries, and hardly any studies of this nature have been carried out in African countries (Mamwenda, 2009). This study, therefore shall be one of those studies in Africa to contribute to the scantily available literature.

Associated with the underperformance in mathematics, there is ample evidence in literature that suggests that the gap between high school and university education in mathematics likely influences first year performance in the subject (Klymchuk, Gruenwald & Javanoski, 2011). A couple of studies suggest that first year students encounter what is sometimes referred to as an 'abstraction shock'. (Tall, 2004, cited in Griese et al, 2011) That is to say, the level of mathematics encountered is advanced, it adds a formal world to the mathematics encountered at high school level. Hemmi (2008, cited in Jablonka, Agahi & Bergsten 2012) adds that Mathematics at university is presented in a comparatively advanced technical language, which students perceive as more cumbersome. In other words, there is a change in the type of mathematics which requires specific learning strategies that students may not have developed throughout high school time (Rach & Heinze, 2011 cited in Griese et al, 2011). As such the transition period from high school to university can be hard for many students. Even students with good marks in high school mathematics experience difficulties at university and sometimes fail the first year university mathematics courses (Klymchuk, Gruenwald & Javanoski, 2011). A survey that was aimed at gaining perspectives of university lecturers from 24 countries on transition from high school to tertiary found that many university lecturers worldwide agree that there is a need to investigate the ways of reducing the gap. Additionally, University lecturers worldwide feel that the difference is a direct result of where the emphasis is placed by the high school teachers (calculations and manipulations) and university lecturers (conceptual understanding and rigor) (Klymchuk, Gruenwald & Javanoski, 2011). In support to that Carrol (2011) asserts that in recent years, universities and colleges across countries such as UK, Ireland, Canada and Australia, have found that their students do not have sufficient mathematical preparation or the appropriate mathematical background to deal with their first year mathematics courses and because of this, universities and colleges have seen an increase in failure rates for these subjects (Rylands & Coady, 2009). Kajander & Lovric (2005 cited in Carrol, 2011) reported on the problems some of the mathematics lecturers were facing in Canada, identifying lack of mathematical preparation in their students, stating that the skills and knowledge of the incoming students were well below what was expected of them. It is believed that this gap is not just limited to specific countries but is seemingly a worldwide phenomenon (James, Montelle & Williams, 2008).

Gill et al. (2010) recognised that although there may be similarities in the Mathematics Problem around the world, individual differences such as *"local conditions, practices and needs"* mean that researchers should examine the problem and contributory factors as they exist in their own country.

2.6 Individual Experiences: Out of class experiences

2.6.1 Time Spent Studying

It is a common belief that better performing students are those who invest more of their time on academic related activities such as studying, reading, writing, doing homework or lab work, analyzing data, rehearsing, and other academic activities than those who spend less time on these activities (Mc Cormick & Nonis, Zulaf & Gortner, 1999). This belief is buttressed by some empirical evidence. For example, McFadden and Dart (1992, cited in Nonis et al, 2005) observed that total study time influenced expected course grade. Similarly, A longitudinal analysis of student performance on an assessment that was administered to the same students at the beginning of the first year and at the end of the second year, found that hours spent studying alone corresponded to improved performance (Arum, Roksa, & Velez, 2008 in Mc cormick, 2011). Besides, Ackerman and Gross (2003), cited in Nonis, Philhours, Syamil & Hudson (2005) have found that recently, students with less free time have a significantly higher GPA than those with more free time.

In line with this evidence, researchers are worried about the reduction of time spent on studying observed among college students (McCormick, 2011; Nonis et al. 2005)). Nonis et al.(2005) report that a survey conducted by the Higher Education Research Institute at UCLA’s Graduate School of Education and Information Studies found that only 34% of today’s entering freshmen have spent six or more hours per week outside of class on academic-related work. According to McComick (2011), in higher education of American colleges, a well-established rule of thumb holds that students should devote two hours of study time for every hour of class time. However, the National Survey of Student Engagement (NSSE) results indicated that, on average, the respondents only studied about one hour for each hour of class..

With the evidence of a positive correlation between study time and academic performance, it could be convincing to believe this literature as the universal truth. However, it can never be so when some research evidence gives contrary findings. For example, Zulauf & Gotner (1999) postulate that lack of a measure of quality of study time as a key variable in study time limits the ability to discover the underlying relationship. However, the scholars (Zulauf & Gotner) are quick to point out that quality of study time is a multi-attribute variable and thus difficult to measure. Irrespective of this assertion, Khron & O’Connor (2005 cited in Bugge & Wikan, 2013) assert that study time is negatively correlated with academic performance. And Darwin (2011 cited in Bugge and Wikan, 2013) found no effect of time spent studying on academic performance in a study of second year students. Besides, (Mouw & Khanna 1993 cited in Nonis et al, 2005)) did not find study habits to significantly improve the explanatory power of the first year cumulative GPA of college students. Bugge & Wikan (2013) attribute the lack of consistency in the findings to other intervening factors between time spent on study and performance.

2.7 Chapter summary

The literature review has shown that there has been quite a great effort to study factors that influence mathematics performance among college students around the world. The results have been irregular i.e. Similar, confounding as well as inconsistent hence inconclusive. Moreover not many studies took a pragmatic approach. Furthermore, some scholars (Gill et al. (2010)have pointed out that studying mathematics problem around the world should consider the individual country differences such as local conditions, practices and needs and therefore, researchers should examine the issue and contributory factors as it exists in their own country. Moreover, a lot of studies on mathematics performance among female students in college, have not focused of the students' first critical year. Therefore this study was an attempt to fill such empirical gaps in the literature.

CHAPTER 3

METHODOLOGY

3.0 Chapter overview

The chapter presents the methodology and design that the study used. It begins by explaining the philosophy that underlies the study, research paradigm, followed by the approach, which is mixed, thus a combination of qualitative and quantitative approaches. It proceeds to look at the design, sampling, data collection and finally, data analysis.

3.1 Research Paradigm

A theoretical paradigm or philosophical assumptions about the nature of reality are crucial to understanding the overall perspective from which the study is designed and carried out. Saunders (2009) propounds that a research philosophy is an over-arching term relating to the development of knowledge and the nature of that knowledge. Similarly, Guba & Lincoln (1994) assert that a paradigm can be defined as the “basic belief system or world view that guides the investigation”. The paradigm’s exploration in this research is necessary as it will affect the choice of ‘legitimate questions’ as well as the choice of research designs, methods and data analysis.

This research therefore, is guided by pragmatism. Pragmatism is a philosophical movement that began towards the end of the 19^{th} century (Maxy, 2003). It is an ontological and epistemological paradigm premised on the notion that both the meaning and the truth of any idea are functions of its practical outcome (Patton, 1990). It rejects the belief that the real world could be accessed solely by means of scientific method (Maxy, 2003, Morgan, 2007). Therefore, it stresses on the importance of a richer "modes of inquiry" according to which a researcher should not focus on a single method but instead test different methods of inquiry for effectiveness in achieving the intended goal (Maxy, 2003). The integration of methods from different paradigms is a powerful way of enhancing the credibility of findings (Peter & Gallivan, 2004).

Within this realm of Pragmatism the researcher investigated the knowledge/reality of factors that affect first year female students' academic performance in mathematics as is constructed by the targeted students, through interaction in focus group discussions FGDs and interviews as methods of data collection. On the other hand, the researcher attached numerical values to the constructs/variables (e.g self-efficacy) that were generated in order to confirm associations and determine predictive power of such constructs on math performance.

3.2 Approach

The study employed a mixed approach in which the researcher combined elements of qualitative and quantitative approaches. Its central premise is that the use of quantitative and qualitative approaches in combination provides a better understanding of research problems than either approach alone (Creswell & Plano-Clark, 2007). In addition, it initiates new lines of thinking through attention to surprises and paradoxes (Rossman and Wilson, 1991). A mixed approach in this study helped the researcher come to a more comprehensive understanding and corroboration of low academic mathematics performance of first year mathematics female students at Chancellor College. This approach as it is argued by Green (2005) is more defensible as it is credible and less biased since the different methods compensate for the other. Hence the researcher is able to develop stronger knowledge claims.

3.3 Research Design

A sequential exploratory mixed model design of combining both qualitative and quantitative approaches served as an overarching design for this study, with a case study design and a correlational design for qualitative and quantitative approaches respectively. The design is sequential as qualitative and quantitative data collection and analyses were implemented in two distinct phases (Creswell & Plano-Clark, 2007). It is exploratory as it “generates information about unknown aspects of a phenomenon” (Teddlie & Tashakkori, 2009). The qualitative (QUAL) component and quantitative (QUAN) component are often referred to as strands. In this design, the QUAL strand is considered exploratory, followed by further testing and verification during the QUAN phase. Thus, the researcher first qualitatively explored the research topic with the participants. The qualitative findings then guided the development of items and scales for a quantitative survey instrument. In the second data collection phase, the researcher implemented and validated this instrument quantitatively. In this design, the qualitative and quantitative methods are connected through the development of the instrument items. For example, Mak & Marshall (2004) carried out a study in which they initially qualitatively explored young adults' perceptions about the significance of the self to others in romantic relationships (that is, how they perceive that they matter to someone else). Based on their qualitative results, they developed an instrument and then implemented it during a second quantitative phase in their study. The figure below reveals a diagram of the sequential exploratory mixed methods design that was used in this study.

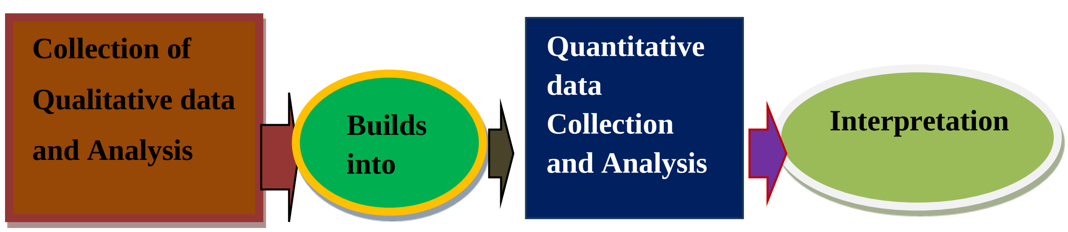

Figure 3. 1 Sequential exploratory mixed methods design from Source: Teddlie & Tashakkori (2009).

In a similar way, the first phase, a qualitative strand which is an exploratory part involved the researcher conducting focus group discussions (FGDs) and semi structured one on one interviews with female BSc and BEds first year students in order to explore the factors that affect their performance in Mathematics. Themes from this qualitative data were then developed into some instruments that tested and verified the relationship and strength of the relationship between the dependent variable, performance, with some independent variables sourced from the qualitative strand.

3.3.1 Population and Sampling

The study had targeted all first year female students who were studying mathematics in the programs of Bsc and Beds in 2013. This gave a population of N=72

The sample size for the qualitative phase was 21, which had constituted two groups of a 9 participant fgd and 3 interview respondents.

The researcher reached out to the participants through a nonprobablistic convenience sampling. As observed by, Dörnyei (2007) members in convenience sample are selected for the purpose of the study if they are within a geographical proximity, available at a certain time, easily accessible, or are willing to volunteer. With reference to this, (Dörnyei 2007) the participants were selected mainly based on their availability at some certain free time. As the participants were a combination of non-campus residents and campus residents, in addition to that, they were often busy attending lectures or other school assignments. It was not easy to get hold of them. Therefore, a convenience sampling was appropriate.

The population for the quantitative phase went down to N=51. Empirical evidence suggests that individuals in the qualitative stage of the data collection are typically not the same participants as those in the quantitative stage. (Creswell and Plano Clark, 2007). As is the case with quantitative research that sampling becomes sensible when a researcher cannot manage to obtain information from the entire population of the unit of analysis. Where possible, all researchers would collect data from the entire population. (Bryman, 2008). Therefore the researcher had an opportunity to use the entire population of the unit of analysis, an approach known as census.

3.3.2 Instruments for the Qualitative Strand

3.3.2.1 Focus Group Guide

For the researcher to appreciate and get a more in-depth understanding of the context and interactions that are expected to have a bearing on the female students' mathematics performance, the focus group discussions were the appropriate tool. As such a total of two, 2-hour FGDs were conducted in one of the quite rooms on college campus (audio visual Centre). This was to ensure that participants were comfortable, felt relaxed and inclined to speak. Due to the nature of the study and the participants' availability, the groups were organised according to program of study. A focus group guide was used to facilitate focus group discussions (FGDs) in order to collect primary data.

Although some scholars fear that a group setting may not be ideal to encourage free expression of individual opinions (Krueger, 2008), the researcher observed that FGDs brought about interactions between group members that indeed stimulated memories and ideas that would not have surfaced in an individual interview. For example, through the discussion, some participants were reminded of cases of mathematics stereotypes that occurred within the course of their mathematics journey. Indeed, FGDs are less threatening to many research participants, and this environment is helpful for participants to discuss perceptions, ideas, opinions, and thoughts (Krueger & Casey, 2000). In addition, the researcher was able to stimulate discussion so as to elicit a multiplicity of views and also provide an opportunity to explore shared beliefs just as it has been advocated by some scholars (Krueger & Casey, 2000). The FGDs were composed of 9 participants which fall within the range of 6-12 participants/ fgd as recommended by most researchers. (Onwuegbuzie, Jiao, & Bostick, 2004, Johnson & Christensen, 2004; Langford, Schoenfeld, & Izzo, 2002; Krueger, 2000; Baumgartner, Strong, & Hensley, 2002; Bernard, 1995; Morgan, 1997).

Embedded in the FGDs were questions and probes. There were three kinds of questions such as engagement questions that introduced participants and made them comfortable with the topic of discussion. For example, *how do you find college life as freshmen?* The second kind were exploration questions to get to the meat of the discussion such as: *What factors do you see as affecting your mathematics performance as female students*? These questions, through the lens of the theoretical framework adopted, explored factors that relate to pre- college characteristics, contextual environment of the course and other college experiences within the peer environment and the influence those factors have on mathematics performance. And finally, the exit question was asked to check if anything was missed in the discussion. As the purpose of the FGDs was to generate items for the next phase, the researcher backed by other researchers, (Saldana, 2009; Sandelowski, 2008; Saumure & Given, 2008) felt it was important to continue FGDs until the second FGD when the FGDs no longer generated new insights.

3.3.2.2 Interview Guide

With the aim to provide a rich and complex picture of the phenomenon being studied, more primary data was gathered from separate semi structured interviews with three other female BSc and Beds students that were purposefully selected based on programme. Patton, (1980) argued that triangulation rarely provides a clear path to a singular view of what is the case. Nonetheless, it still remains a useful strategy in research as literature suggests that the use of multi methods results in different images of understanding, thus increasing the potency of evaluation findings (Patton,1980).

Therefore, the semi-structured individual interviews were aimed at soliciting views on what are considered as factors that influence performance of the first year female students who study mathematics. The Semi-structured interview, though time consuming, were opted for, because the researcher was flexible to vary the order of questions depending on the situation, and could probe and explore the topic more discursively unlike in structured interviews (Gibson & Brown, 2009).

3.3.2.3 Secondary Data

A literature analysis of published studies that examine factors that affect mathematics academic performance of students in college was done not only to assess how much has been done in this area, but also to assess those factors that appear so often as determinants of mathematics students' academic performance in college. Those factors were categorized based on the "comprehensive model of influences on academic performance" that guided the study. The categories included:

1. *Student's pre college characteristics and experiences*
2. *Student's college experiences as regards the contextual environment of the course*
3. *Student's college experiences as regards the peer environment.*

These literature sources included journal articles and other published documents.

3.3.3 Data Collection Procedures

The researcher introduced herself and her study to the mathematics head of department and the participants. The introduction was done with an aim to seek approval prior to engagements with the participants in FGDs and interviews. Consent was also sought to access the participants' end of semester 1 mathematics scores. Those who had consented endorsed the consent with a signature. The participants were told assured of the safety of their mathematics scores.

3.3.4 Trustworthiness, validity and Reliability

To ensure the trustworthiness of the qualitative findings, the role of triangulation could not be ignored. (Gunawan, 2015). Several techniques for collecting data were used, which included fgds and interviews. Secondly, the researcher used multiple data sources which included gathering data from male students of the same class as that of the study participants through an fgd. In addition, a semi structured interview was conducted with a mathematics lecturer. The other data source was from a thorough review of literature. This triangulation assisted in the analysis where data were compared and areas of convergence and divergence were identified. All the FGDs and individual interviews were recorded except the lecturer's interview where permission was denied. Furthermore, the researcher started transcribing and coding the data on commencement of the FGDs and interviews. The FGDs were also audio recorded and repeatedly listened to during the analysis of data just to check and ensure that the interpretations indeed came from the data. The FGDs took place in one of the quite rooms and participants gave themselves pseudonyms in order to make them free and feel inclined to air out their opinions on the topic under discussion.

The questionnaire that was developed as an instrument of data collection in the quantitative stage was pre-tested among female students of first year that also study mathematics. This was done to ensure that it would be able to collect the intended data. Secondly, the scales used to measure constructs for multiple regression were generated from knowledge from both literature and what participants construed as factors that affect their performance.

3.4 Data processing and Interpretation

Emergent themes were drawn out based on the research questions, theoretical framework and literature. Data transcription continued later with close and repeated listening to the recordings. This enabled the researcher to focus on data and draw out the relevant features of the FGDs. In the course, different themes were developed from the transcribed data and represented by some codes that were also developed in the course of analysis. For examples, one theme under student's pre-college characteristics and experiences (based on the comprehensive model of influences on performance) include: academic preparedness. This form of qualitative data analysis is referred to as a thematic analysis (Gibson and Brown, 2009). Similarly, transcription of the semi-structured interviews with the lecturer and student participants continued and the same thematic analysis was employed.

3.5 The quantitative Strand

While the qualitative phase was completed, a quantitative phase commenced. The participants' accounts in the qualitative phase created the exploratory component of the sequential exploratory mixed-methods design. This quantitative phase was conducted to examine the extent to which some of the constructs generated affect mathematics performance.

3.5.1 Selection of variables

The number of variables to be included in the regression analysis was limited by the sample size. To make sure that the model used was sound, it was so important to limit the number of predictors for the model in relation to the available sample size. Literature is amassed with rules of thumbs on the number of predictors per case in a multiple regression (Green, 1991; Field, 2005; Maxon 2000). Which range from 10-15 subjects per predictor, 104+ k, >= 50 + 8(k). However, this study calculated the number of predictors using the G* power 3.1.9.2 (Faul, Erdfelder, Lang & Buchner, 2009) with a given the sample size of 51. The results of calculation determined that 3 predictor variables be used to achieve a power of 80 percent. The researcher selected two constructs that had dominated the FGDs in the qualitative phase (mathematics self-efficacy and workload) and one construct that has frequently been attributed to performance in literature, parent's level of education as an aspect of socioeconomic status. In total there were three independent variables (IV) that were regressed against the end first semester mathematics score as a dependent variable (DV).

3.6 Instrumentation

Self-administered questionnaires were used to collect data for this phase. Some of the scales included in the questionnaire measured mathematics self- efficacy, mathematics interest, workload and parent's level of education. The questionnaire. The questionnaires were self-administered on the basis that they are less expensive than interviews and ensure respondent's anonymity and privacy hence make them free to provide honest answers (Hussey, J and Hussey, R(1997).

3.6.1 Mathematics Self-efficacy scale

To examine students´ degree of self-efficacy in mathematics, a self-efficacy sub-scale of the MSEQ scale was adopted (Pintrich et al. 1991). Overall, 7 statements were used to measure students levels of mathematics self-efficacy. The statements also reflected how the participants had operationalised the concept of mathematics self-efficacy. The response scale consisted of a range between 0-4, where number 0 indicated not at all and 4 indicated strongly agree. Hence, a low value indicated a low degree of self-efficacy beliefs (Pintrich et al. 1991). The self-efficacy value for each student was established by calculating the mean value from 7 statements.

3.6.2 Mathematics workload pressure

Similarly, mathematics work load was measured by a 4 point Likert scale where students had to indicate the level of workload pressure. The number 0 indicated not at all while 4 indicated strong agreement.

3.7 Limitation of the study

The researcher failed to establish a better 10 year trend as data for 2008 was not available and also coupled with the fact that the system of issuing results shifted to GPA system. Although the study gave every individual in the unity of analysis to participate in the study, a big number (15) did not consent on access to their grades and 6 students despite giving their consent, they did not respond to the questionnaire. So in total, the sample went down to 49 but the initial population was 72 and this could have resulted an increase in the number of predictors as well.

CHAPTER 4

Results and discussion of findings

4.0 Qualitative data analysis

Below is the presentation of an analysis of the qualitative data through the lens that was proposed by Reason, (2009); a comprehensive model of influences on performance.

4.1 Students' pre college characteristics and experiences

Below is the presentation of an analysis of the qualitative data through the lens that was proposed by Reason, (2009); a comprehensive model of influences on performance.

4.1.1 Academic Background

Most female FGDs participants agreed that students' academic background has an influence on understanding and learning college mathematics. The participants often argued that students with a background in additional mathematics in their high school enjoy mathematics because additional mathematics lays a very good basis for most college mathematics. Similar sentiments were shared by the male students' who pointed out that:

the problem is that there is a gap between college mathematics and secondary school mathematics which makes it difficult to easily comprehend college mathematics…mmm there are some concepts(such as calculus) that are left out in the secondary school syllabus that would have acted as a basis here'. (Mike *male FGD*).

However the mathematics lecturer blames students' poor performance in mathematics on poor academic preparation of the students on some basic mathematics concepts. The lecturer had observed that students fail the very basic mathematics concepts (i.e. factorisation) which in this case cannot be blamed on the gap that exists between college mathematics and secondary school mathematics.

It was also hinted that unlike students from ordinary schools, those from high schools (ie Kamuzu Academy) show a lot of challenges with mathematics. This opinion was consistent in both the female FGDs and lecturer's interview. Within some understanding, participants assume that this is the case because in high schools and national schools, their learning is very dependent (spoon feeding type of learning) and everything is provided for as such it is not easy for them to adjust to the college learning style of independence.

The other thing…In most of the schools where we are coming from…we were used to be told and given all the necessary material but here you *are told go to the library and search for information on your own….so it is not easy (Yamie BSc).*

Participants claimed that they used to have mathematics exercise during lessons during their secondary school. In this regard, a lot of the female participants expressed a worry about the exclusion of mathematics exercise during lessons in college. It was argued that mathematics exercise were helpful to the students to gauge how much mathematics they understand before the next lesson and before sitting for a test or exam. To this end some suggested the inclusion of mathematics exercise during the lessons.

4.2 College experiences: Contextual Environment of the course

4.2.1 Academic integration - Extra academic help

The participants from male FGDs felt that they always look for extra help from their lectures but the male participants noted that most female students from their classes do not often seek out of class help from the mathematics lecturers. This sentiment was indeed verified during the female FGDs as most of the participants indicated that they were free to seek this extra help from among themselves and not from their lecturers. Various sorts of reasons were given by the participants ranging from lecturer being busy, for example, one male participant observed that lectures are busy and therefore they feel bothered to divide their attention, his remarks were;

th*e lecture is always busy…Sometimes you go to ask you find lecture is busy and at times shows you a strange face and you ask yourself… but am I going to ask…(George BSc)*.

However, the lecturer's interview reported that most students who come for help are usually not serious because they often appear when the exam is closer and are afraid of the exam. The female participants indicated that they get restrained by the lecturer's age and gender. For example, One participant (*BEds*) commented:

The lecturers are very young men and us as girls we are not so free to easily go with our questions…we normally see that there are some boys that are so free with them and they relate very well. (Zere BEds).

This comment was echoed by other two participants who said:

'*…..at least if there would be some older lecturers(BEds)', '….the only females at the department are secretaries…no mathematics female lecture…yeah…we would be free to go and ask…(Darlene BSc)'.*

Another female participant also shared that she does not manage to find a male company to go with to meet the lecturer. Her sentiment was;

..... I've never gone there ...cause I was told that when going there you've to go with a male friend so I usually don't find one (Mode BSc).

The participants felt that the reason for the male company could be just to reduce any suspicion of love affairs between the female students and the male lecturers. Similar remarks were shared by other two female participants who said;

'*The lecturers are very young men and as girls we are not so free to easily go with our questions…we normally see that there are some boys that are so free with them and they relate very well……at least if there would be some older lecturers (Mirabel BEds)'.*

More other comments were made on the attitude and responses that the participants get when they seek separate help from their mathematics lecturers. Some participant in their remarks, they said;

It happens that a lecturer tells you: 'we were together in class and I asked everyone to ask if they had any question and no one responded …so I prefer to ask friends (Madalo BEds)'.

'…this other time we went and when he came to class he started telling everybody that… 'do not come to me with minor problems…..' so we felt bad knowing he was referring to us.(Yvonnie BEds)'.

To the contrary, the lectures' interview indicated that some students are just too dependent and would want to be told everything without using their own reasoning skills. When some still manage to go to lecturers for questions and clarifications, others just completely stay away.

> '……*Am not comfortable and have never been courageous to go to a mathematics lecture and ask I just fear. Of course not that he cannot explain but I feel that I may ask things that he had taught and I missed so I fear that he may ask me to explain…. so I prefer to ask boys..(Mada BEds)'.*

4.3 The college experiences: Peer environment – Individual student experiences

4.3.1 Mathematics stereotype threat

Steele & Aronson (1995, cited in Stroenesser and Good, 2009) define stereotype threat as referring to being at risk of confirming, as a self-characteristic, a negative stereotype about one's social group. The FGDs and interviews revealed that female students are vulnerable to stereotype threat because mathematics is stereotyped as a subject for male students. One of the female FGD participants, said:

> *kungoti mathematics ndiyovuta and anthu amaitenga kuti ndiyoynera amuna*. (*It is just that mathematics is difficult and people believe that it should be for males*). Mada (*BEds*).

Most FGDs and interview participants asserted that society accepts the mathematics stereotype to be true mainly because mathematics classes are dominated by male students and mathematics performance always favours male students. Most female FGDs participants claimed that they face a mathematics stereotype threat which is perpetrated by other students both male and female. The female respondents reported that they are repeatedly told that most female students who were doing mathematics in their first year, had been withdrawn in the previous academic year. According to the respondents, this information is told to them just to imply that female students are not as capable to do well in mathematics.

Some female respondents also pointed out that classmates, friends, family and relatives have often discouraged them to go for mathematics as a major. In addition to that some classmates show some mathematics stereotype behaviour. For example, one of the participants conveyed:

> '*Usually anyamata amakuuzani kuti inu atsikana ndiye kwanu ndi ku homec and textile uko osati mathematics, physics kapena chemi'* (*usually*

boys would tell you that ladies belong to home economics and textiles, not in mathematics, chemistry and physics). (Zeres *BSc female*).

Although, most female participants claimed that they do not believe the mathematics stereotypes to be true, they expressed a worry that they have to fight the stereotype.

Outstandingly, the male FGDs participants felt that, the absence of a female mathematics lecturer is indicative that mathematics is usually for males. Some male respondents believed that female students' mathematics performance is affected because they do not have any female lecturer who can inspire or be a model for the female students. For example, one participant said:

> *komanso atsikana amakhala affected chifukwa ku dipatiment kulibeko munthu wamkazi.* (*and girls are affected because there is no female lecture in the mathematics department*). **(**O J *males FGDs*).

Some of the mathematics stereotypes are perpetrated by the participants' classmate and one participant narrated her case:

> *Tsiku lina mnyamata wina mondiyesa, anandipatsa samu ina yake yomwe amakhulupilira kuti ndiyovuta. Ankati ndiyese kusolva koma nditakhonza mnyamata uja anakhumudwa nkumati aaah! ndi bebi yomwe kusolva samuyi? I think ndiyophwerka. (One day, a certain male*

> *friend deliberately came to me with a mathematics problem which he assumed was difficult to solve. He gave it to me to try it. When I had managed to solve it, the guy was not happy and remarked by saying: aaah even a lady can solve this? I think it is an easy problem)(Mode Beds).*

4.3.2 Mathematics Interest

It was hinted that interest in mathematics is so important for the students' performance and persistence in the course. The FGDs and interviews revealed that lack of interest among participants is due the fact that they do not find mathematics exciting and enjoyable. Most of the participants reported that they do not enjoy mathematics. Similarly, an interview with a lecturer also hinted on the view that most female students seem not to have interest in mathematics hence they fail to put much effort on it. To this end Zeres (*BSc female*) commented:

> *Mmm almost everyone wished it were not compulsory in second year so that we get done with it.*

Several other participants who had been redirected to either BSc or BEds expressed a lack of interest in mathematics which emanates from the fact that the program they study was not their choice. Mervis (*BEds female*) murmured:

As for me...i was forced to come by my parents… because I didn't choose this programme and I don't find mathematics easy.

It was also pointed out that an interest in mathematics is also pinned to how appealing mathematics careers are. For example participants observed that most mathematics majors end up teaching at a secondary school. Therefore, they would rather put their efforts on courses that would lead them to other better careers. As was said:

People say…all mathematics majors end up being teachers…and I don't think I want to be a teacher… (BSc Effie).

Although she shares the view that mathematics majors end up teaching, she encourages herself on the hope that she would not become a teacher.

4.3.3 Mathematics self-efficacy

Self-efficacy has been defined as "people's judgments of their own capabilities to organize and execute courses of action required to attain designated types of performances" (Bandura, 1986, cited in Vuong, Welty & Tracz, 2010). It was revealed that a lot of female students have a low mathematics self-efficacy because they doubt their mathematics ability and lack of confidence in the mathematics activities. It was reported that in class, females appear to have put on their quite masks and hold back, allowing the males to participate more actively. What makes them hold back is usually the fact that they are not sure of their responses and are afraid to make mistakes. Unlike the male students who are so daring even to display their failure, females are more concerned with avoiding failure. As evidenced:

> *'Before I ask a question .....i ask myself…like…should I really ask or answer…will I get it right or wrong. So I have to debate before answering'.* (Matamando *BEds female*).

Female students feel that it is such an embarrassment to show their failure in front of the whole class. Some participants claimed that they are afraid to be ridiculed when they get the response wrong, however a lot more participants felt that their lack of confidence is not dependent on whether they are ridiculed or not. An interview with the lecturer hinted that students are cautioned against making demoralising comments on colleagues' responses.

> '*Sometimes you ask a male colleague in the course of a lecture, basi pena amngokuyankha kuti inu ndiye half down'*.(*he sometimes tells you that you are halfway left behind*) Yankho (*BEds female*).

Here, Yankho's hope for her confidence is dwindled farther by the remarks she got. John (males FGDs) also made a similar observation:

mtsikana amapezeka kuti funso akukufunsa iweyo mmalo mofunsa gulu. Ndiye iweyo umadzafunsa funso lija'. (*You find that a lady instead of asking the question to a class, she asks you (a boy) then you just ask it).*

4.4 Individual student experiences: Out of class experiences

4.4.1 Mathematics work load

According to (Kember, 2004) student workload refers to the number of working hours, which could consist of attending lectures, tutorials plus independent private study, preparation of examinations, projects etc. In line with this definition, most participants made it clear that excessive workload interferes with adequate application of concepts. It was hinted that the effects of excessive workload are usually noticeable especially when the students fail some simple mathematics questions in a test because of lack of preparation time. It appears that the participants' conceptions about mathematics being a very busy and challenging course in part has influenced the way they have judged their workload. From some two participants it was said:

> *The course is very busy….when you are busy practising class work, you also find that several tests are fast approaching, so you push the class work aside and try to concentrate on the tests but the work keeps piling up because you are learning new things as well. (Carol BSc).*

I find myself having a lot of things to do within a short period of time, so I find it difficult to prepare properly (Lisa BEds).

However the lecturer shared a contrary view as he argued that students are purposefully provided with time schedule for mathematics activities for the whole semester so that they can plan and manage their time properly, in this view the mathematics lecturer believes that students waste more time on the social media such as facebook and watching soccer than they invest in their studies. Nonetheless, participants claimed that they still face challenges because their mathematics activities plan are interfered with by the unplanned practices (tests and assignments) from other departments. Their arguments were also trying to make a call to other departments to provide a timeline of activities as well.

4.5 Individual student experiences: classroom experiences

4.5.1 Teaching and Learning strategies

4.5.1.1 Lecture method

It was evident that most FGDs participants described a typical mathematics lecture as involving students watching their lecturer explain how to solve problems on the board. The lecturer also throws questions randomly and gets feedback only from few individuals. The questions are usually handled by male students in the class. It was therefore observed that female students are particularly affected because unlike their male colleagues they seldom ask or answer questions during a mathematics lecture. However, the lecturer's interview revealed that, about 80% of the lesson time, he encourages collaborative learning, the lecturer was also quick to say that, he has no idea how other mathematics lectures deliver their lessons but his lessons employ collaborative learning.

This passive learning is exacerbated by the large volume of material that is delivered within a short time. It was asserted that even if the participants crave a better understanding of the material during a lecture, it is difficult to attain it because there is so much work taught and lecturers do not give very explicit explanations. As a result students are made to listen, take some short notes, and use the information later. As conveyed in one of the FGDs:

> '*The stuff is usually too much..so yah! timalemba akamaphunzitsa timakopa. Tikapita basi tikaone kuti tipanga bwanji (we copy down and see what we can do later).* (*Grace (BSc).*

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Similar sentiments were echoed in the male students' FGD where it was said:

> *The problem kuno ndi zoti zinthu mumathamangitsana ndi nthawi zinthu zimene mumapanga pa 1 hour zimakhala zambiri*. (*The problem here, is*

that you rush against time and the stuff that is done in an hour is so much), (*Mike).*

Principally, students often fail to grasp much, fail to synthesize and expand upon the material during the lecture and they sometimes barely end up learning by rote. To this end one of the FGD participants also commented:

umaona kuti apapa a lecturer knows the stuff koma cannot just explain bwinobwino…kungoti amatiika pa level yao. (You actually see that the lecturer knows the material but cannot just clearly explain. the problem is that he thinks we are on the same knowledge level with himself), (*Beauty BEds).*

Within her understanding, Beauty (BEds) concludes that the mathematics lecturer is not able to adjust his teaching strategy to the level of knowledge of the students. Based on the preceding discussion, it is understandable that most students reported that they do not find mathematics exciting and dynamic. Moreover, this happens to be one of the reasons why all the female FGDs participants reported not to have any ambitions to proceed with mathematics as a major.

4.5.1.2 Collaborative learning

It was consistently articulated in the FGDs that students benefit a lot from the peer environment. Due to the learning deficit faced during mathematics lectures, students resorted to independent collaborative learning where they find time outside class to discuss the material in groups or pairs. The participants made it clear that the groups and pairs have allowed students to have a greater understanding of the material taught in class. It was made clear that during group work or pairwork, they are very active and are able to verbalise their thoughts, share and correct mistakes. Therefore, they teach and learn from each other. To the same effect, one participant also hinted that:

> *When you discuss with friends you find that you begin to understand well which is not normally the case during a lecture*, (Carol (*BSc*).

In consistent to that, one of the participant in a separate interview said:

> *If I can't understand in class, I don't worry because I know we will go over the same in our discussions,* (Matamando *BEds*).

It is clear from Matamando's view point that she takes learning as a game of chance in the mathematics lecture and banks on out-of- class group discussions.

Apart from lecture as a teaching strategy, the respondents indicated that the mathematics department organises tutorials. Most FGDs participants commended tutorials which are designed to supplement the usual lectures. It was indicated that during tutorials all first year mathematics students who are taught mathematics by different lecturers converge in one place and mix in small groups. The students are assigned problem-solving exercises which typically last an hour. The lecturers and some best performing fourth year mathematics students are available to provide assistance and encouragement if group members are having difficulties. The respondents indicated that during tutorials, they freely participate in the groups and the mixed groups expose them to a variety of methods of solving mathematics problems as the group members are from different classes (BSc, BEds and Pas). In this regard, Lisa (*BEds female*) commented:

> *Tutorials are good …we discuss and easily ask questions without being ridiculed.*

Lisa was comparing a lecture and tutorial session and clearly hinted that in those small groups she opens up to ask questions. In agreement to this, the lecture's interview revealed that students that participate in tutorials are supposed to benefit more and do well in exams because most of mathematics test items originate from the problem exercise that are given during tutorials.

However, the lecturer pointed out that, despite having the same tutorial problem-exercises as mathematics test items, students continue to fail mathematics tests. From the lecturer's viewpoint, the students continue to fail mathematics test because they do not take tutorials seriously and are often absent. It was made clear during the lecture's interview that the attendance to tutorial sessions is not compulsory hence students attend on their discretion. In this regard, he mentioned that the mathematics department was making deliberations to make tutorials compulsory in order to encourage attendance.

In contrast, FGDs participants hinted that a lecturer or student assistants are mostly absent during tutorials. In this regard, they argued that due to the absence of the lecturers and student assistants to check their progress during tutorials, they often do not get to verify whether the solutions to the exercises are correct or not. As such any mistakes that they make during tutorials are imported to a mathematics test causing them to fail.

Against this backdrop FGDs participants suggested that solutions to the mathematics tutorial problems should be posted somewhere for students to verify their answers in cases where the student assistants and lecturers miss the tutorials. Jessica, (*BSc*)'s plea was:

> *Tutorials should be accompanied with solutions later because sometimes "mumasova zolakwika" ……. (We may have wrong solutions)*.

In addition to that, FGDs participants complained that time allocated for tutorials is short such that time runs out before they finish practising the exercise. One of the participants, Julio *(BSC male),* clearly indicated:

mumapezeka zoti mwasova zoyambilira pa list zomwe ziri zophweka and chifukwa cha nthawi zammusi zovutazo simunasove. (*Because of time we may only manage to solve the simpler ones on top of the list and the complex ones on the bottom are left out).*

4.5.1.3 The Pace of Learning

|The respondents claimed to have become aware of the difference in learning pace that exists between the female and male mathematics students. There was consistency in the comments that were made by both male and female respondents, particularly it was said that, during a mathematics lecture, it is usually the male students who grasp the concepts faster and quickly answer questions as most of the females are still processing. Effie (*BSc female*) pointed out:

> *I understand but slowly…you just get surprised when boys shout out the answers and you don't even know where the figures are coming from…at this time you are busy on the calculator… later on you just say ooh do we calculate it like this?*

In addition, most of the respondents believe that boys are naturally fast mathematics learners. Beauty (*BEds female*) put it:

You know…boys are naturally faster when it comes to grasping mathematical concepts...they process fast…it is natural.

To this effect, the female respondents complained that their mathematics lecturer does not even slow down to their pace but proceeds with the dominant male group whilst most of the female students are left behind. In evidence to this, Miss R (*BSc female*) complained:

When you are still in stage one on the board, the lecture is in stage four.

The female respondents claimed that they are often demoralized when the boys shout out answers before they figure out the correct answer.

In the same vein, most female respondents believed that their male colleagues naturally understand mathematics concepts more broadly than them. The judgment was based on that male students' explanations of the same material they had learnt in class would demonstrate a deeper understanding than theirs. Most female respondents claimed that when they ask mathematics questions from boys outside class, they get surprised at their explanations. Effie (BSc) commented:

'*You get surprised that is it the same staff we learnt?'*

On the other hand, the male colleagues pointed out that female students always ask reassurance questions. It is against this background therefore that the females often ask for reassurance as they solve a mathematics problem. In addition, Madalo (BEds) in a separate interview pointed out:

I believe boys know more than me…and I ask a lot from boys.

4.6 Discussion

4.6.1 Academic Background

Concerns about lack of academic preparedness for mathematics offered in first year at university were echoed by nearly all the participants during the FGDs. This finding is a clear indication that the conceptual understanding of mathematics that the participants have when they enter their first year is lower than that which is expected. Participants had indicated that, their observation was that those who have a background of additional mathematics in their secondary school at least show some competence in the first year mathematics. However only a few participants (2 out of 8) from the FGDs had an additional mathematics background. Additional mathematics is offered only in few secondary schools in Malawi and where it is offered, there are also few selected students who pursue it. It can be gathered therefore that the Malawi School Leaving Certificate ordinary mathematics syllabus does not provide adequate preparation for university mathematics as participants lamented that it is difficult to adjust to the expected required level of understanding and hence this reflects badly on their mathematics performance. This suggests the need for assessing the transition in mathematics and assess the gap that exist between secondary school mathematics and first year university mathematics. This finding is consistent with what other studies elsewhere found, (Abubaker, 2009; Barrow, Reilly & Woodfield, 2009; Sakho, 2003 in Nykadzoi, Matamande, Taderera and Mandimika, 2013).

From the findings, it is evident that students approach to learning mathematics is shaped by the approaches that were used in their secondary school (background). The findings reveal that most of the students are finding it difficult to become independent learners and also fail to adapt to the different learning style. Apart from that, the conceptual understanding of mathematics most students have appear to be lower to that of university level. James, Montelle & Williams, (2008) have observed that issue of mathematics gap between high school and university is a worldwide phenomenon.

The results also revealed that those that have a background in "additional mathematics" are often at an advantage because they are well positioned for the first year math in college. However, additional mathematics is only offered by few secondary schools in Malawi. This means that rolling out additional mathematics subject to all students would well prepare them for the next level.

4.6.2 Extra help

The study found out that the participants valued extra support on mathematics just to compensate for the needs that were not responded to during a normal lectures and other topics/areas that pose difficulties. The one way of seeking extra support which the participants mentioned was consulting their mathematics lecture at some separate times. A considerable amount of research in relation to this findings has shown that provision of extra academic help leads to the improvement in academic performance and persistence in the course. (Macgillivray & Croft, 2011).

Although extra support was highlighted, participants pointed out some challenges that hinder access to such support from their mathematics lecturers. In light of this, the study findings bring to the awareness of the mathematics lecturers and the department the value attached to extra help which participants have. In addition, the mathematics lecturers and the department can have an idea about some perceptions that participants have in relation to seeking extra help in mathematics. Moreover, the study found that seeking extra help from a female lecturer or a more adult mathematics lecture would encourage the female students to be free in seeking academic support. Their perception was that frequent interaction with the young male lecturers may facilitate a love affair between them or can lead to suspicion of a love affair. It could as well be noticed that some participants mistook seeking extra help with dependent learning, therefore efforts to provide effective means of providing extra help in mathematics need to consider the perceptions that the participants have.

4.6.3 Mathematics stereotype threat

The results on mathematics stereotype threat indeed indicate that the participants live in a threatening environment that is likely to impair their performance in mathematics. From the participants point of view, it is shown that the classroom environment, the department and the peer environment create, perpetuate, mathematics stereotypes that hinder them from releasing their mathematics potential. For example, the participants pointed out they are surrounded with people who do not believe mathematics is for them. Some of them were told by their parents at home not to opt for mathematics because it would be difficult for them. The male students in their class tell the participants to enrol in home economics because mathematics is not a course for ladies. Empirical evidence has suggested that stereotype threat is most likely to be experienced for individuals when they are challenged or when they are working with difficult questions. (Stroessner & Good, 2009). This could be true for the participants being studied who have already reported a lot of challenges they are facing with mathematics course.

However, some questions remain to be explored. For example, through what process does the stereotype threat among the participants lead to impairing performance? Some studies have suggested relationships between stereotype threat and anxiety, self- efficacy, interest, and self-concept (Usop, Sabri, Sam &

Wa, 2009). This may suggest that there are some mediating factors at play. However, the findings of this study cannot be ignored and can provide some direction when assisting the participants to improve their performance.

4.6.4 Mathematics interest.

The findings are a clear indication that students do not find a value in the course they are studying. They do not find that studying mathematics is of any importance

The findings reveal that interest as a factor that affect performance in mathematics was a problem among most participants. Interest in mathematics proves to be a mediator important not only in influencing the performance in mathematics but also in the persistence in the course. This was picked from some participants who purely demonstrated a dislike in the requirement that they should by compulsory pursue mathematics in the subsequent year (second year).

Similar findings are reported of a study that revealed a statistically significant correlation between individual interest and test results. Several scholars have advanced that an interest in a topic enhances learning which later leads to better performance.(Harackiewiz & Hulleman, 2010); (Nyman, 2016). From the findings of this study, the participants' interest is being paralyzed by the misconceptions that mathematics majors end up in the teaching profession. This indicates the lack of value attached to mathematics course. Although this study did not go further to test the effect of attaching a value on performance, some scholars have tested whether a discovery of value in the course would promote students interest, their results indicated that participants who received the task value manipulation reported higher levels of interest in mathematics than those in the control condition.(Harackiewiz & Hulleman, 2010). The results of this study may therefore means that a meaningful environment where students are able to discover the value in learning mathematics may positively affect their performance.

4.6.5 Mathematics self-efficacy

Considering the findings related to role of mathematics self-efficacy, it can be clearly observed that what students believe they can do in learning mathematics and solving mathematics problem plays an important role in their actual mathematics achievement. The female participants indicated that they doubt their mathematics capability and they lack confidence such for a question that they want to attempt to respond to during a lesson, they have to first confirm their response with the male students seated next by. This finding also suggests that the male students have a higher level of self-efficacy than that of their female counterparts.

It could as well be noted that mathematics self-efficacy determines how actively involved a student can get during the mathematics lecture. In essence, the participants own judgments about their own ability to successfully engage in specific mathematics activities. Most studies have associated self-efficacy with performance and a positive relationship has been found ((Pajares & Miller, 1994; Pajares & Kranzler, 1995; Pajares, 1996; Ghanbarzadeh, 2001; Kabiri, 2003). On the other hand, other studies found that students' achievement is a greatest source of self -efficacy. (Bandura 1986; Guthrie et al. 2007). The findings of this study imply that without any efforts to improve the mathematics self-efficacy levels among such students who display mathematics low-self efficacy levels, their performance will continue to suffer. However, more can as well be done to find out the appropriate strategies that can be used to improve mathematics self- efficacy levels among female students.

4.6.6 Mathematics Work load

The study has shown that participants take mathematics to be an intensive course which goes at a fast pace for them to easily catch up. As such they experience a lot of pressure which impairs thinking during a mathematics test. Research has shown workload to be the major source of stress among students. This is in congruence to the results of this study (Kaplan & Sadock, 2000). The results are however not conclusive because an interview with the lecture suggested that students spend so much time on social media (Facebook) instead of concentrating on academic work. In view of this, more research can be done to determine other underlying factors that interfere with mathematics workload.

4.6.7 Teaching and learning strategies and learning pace

The study's findings brings to light how important to the understanding of mathematical concepts collaborative learning is in comparison to traditional passive learning. The participants pointed out that most of the mathematics lectures involve a lecture method of teaching where, they do not learn much because they become so passive. Literature and many studies have repeatedly posed that mathematics is a subject which involves more logic and argumentation for learning (Bhowmick, 2016).

It never came out clearly in this study why lecturers mostly engage traditional means of teaching and learning. It can only be deduced from the participants' assertions that there is such an enormous work from the mathematics curriculum, therefore the possibility could be that the mathematics lecturer opt for the less time consuming teaching strategies in order to catch up with time. Beder's (1997 cited in Mudhovozi, 2012) found that students from high school find it so hard to adjust to styles of learning offered at university. In view of the same he suggested that some support needed to be provided to the students.

Despite the claims of passivity that is associated with mathematics lectures, the participants commended the tutorials which make use of collaborative learning. This just underscores how beneficial the participants find collaborative learning to be. It can as well be noticeable that tutorials that encourage mixed groups are so important for the female participants who have claimed that their pace of learning mathematics is slower. Most likely, such slow learners are able to learn and understand mathematics better. Moreover the groups make the participants free to talk and ask from colleagues. There is some evidence emerging that there are other positive effects from collaborative learning far deeper than improving performance as first envisioned. For example, it was mentioned that female participants are not ridiculed as it is the case during a lecture.

The findings of the study resonate well with several other studies that have also found that collaborative learning improves the performance of students in mathematics and other related subjects (Sofroniou & Poutos, 2016). The presence of mathematics peer educators and lecturers was not underrated by the participants. The support guidance and feedback offered by them could indeed contribute to the successful completion of the tasks by the group. Indeed the results of this study show a clear indication that the mathematics department does a commendable job of incorporating tutorials in the pedagogies. Promoting and improving on the weakness based on the findings would therefore be commendable too.

4.7 Quantitative results

A multiple regression was carried out to investigate whether Mathematics self-efficacy, Workload and Parents' level of education could significantly predict participants' math score (mathematics performance). With an adjusted R squared of 0.685, the results show that the model explains 68.5% of the variations in the dependent variable, math score. Overall, the model was also found to be a significant predictor of math score, $F(3,45) = 35.837$, $p = .000$.

Table 4. 1: Multiple regression results for math score

Constant	36.545 (0.000)
Workload	-3.757^{***} (0.003)
Self-efficacy	7.494^{***} (0.000)
Parents Education	-.207 (0.833)
R-Squared	0.705
Adjusted R-Squared	0.685
Number of observations	49

Standard errors reported in parentheses
*, **, *** indicates significance at 90%, 95% and 99% respectively

However not all the independent variables uniquely predict performance. According to the results, workload has a negative significant effect on math score. The negative coefficient indicates that a reduction in workload increases the mathematics score. A similar result on the influence of workload on academic performance among engineering students in Philippines had however shown that workload was moderated by other factors such as lifestyle, health just to mention some few.(Kurata, Y. B., Bano R.M.L.P., Matias, A.C. (2015) Similarly, mathematics self-efficacy has a positive significant effect on math score. That is to say, high levels of mathematics self-efficacy results in a increase in mathematics score Finally, parents' level of education was not found to be statistically significant. This means that there is lack of statistical evidence to suggest that parents' level education affects mathematics performance. In fact, literature suggests a positive relationship existing between level of education of parents and mathematics performance (Acharya & Joshi, 2009 cited in Pishghadam & Zabhii, 2011). The model takes the form of a statistical equation: $Y = \beta o + \beta 1X1+ \beta 2X2$. In this case,

Academic performance= 36.545 +7.49*SE-3.757*WL

CHAPTER 5

Conclusions and Implications

The participation of female students in STEM fields has drawn the attention of educationists across the globe. Evidence from previous studies indicate that these efforts are paralysed by academic performance which requires to be better understood. Studies that look at the factors that influence mathematics academic performance have brought inconsistent, irregular and confounding results. This study adapted a comprehensive model of influences on students' outcomes in an attempt to find out the factors that affect mathematics academic performance of first year female students who enrolled in BSc and Beds programs at Chancellor College. More importantly, the sequential exploratory mixed model design was used with the hope of providing a better insight into the factors at play to influence academic performance and those that can significantly influence the academic performance in mathematics.

Specifically, the study explored the students' pre- college characteristics and experiences, the College experiences both from the peer environment and the course contextual environment. Furthermore, it explored the extent to which some of the factors explain the academic performance in mathematics among the research participants.

The research findings have shown that those who came to college with a background of additional mathematics in the secondary education found it easier to understand their first year mathematics than those with a background in ordinary mathematics only. Secondly, participants who were selected from private high schools and national secondary schools where teaching and learning was very dependent, (spoon feeding) showed more challenges in learning the first year college mathematics, unlike those who got selected from conventional secondary schools and community day secondary schools where teaching and learning was more independent.

The findings also revealed that a supportive contextual environment where participants are able to seek extra help in mathematics can positively influence their mathematics performance. However, the participants found it so hard to seek mathematics academic help from the department largely because, they were not comfortable to do so with their young male lecturers for fear of being suspected of having a love affair.

Within their peer environment, the participants reported experiences of mathematics stereotypes that were perpetrated by their classmates and society at large, a low math-self efficacy and generally, lack of interest in mathematics. Reporting on some of the curricular experiences, participants indicated that they were always slower to grasp the content during a mathematics lecture than their male counterparts. The findings also revealed that collaborative approaches allows more learning and mathematics knowledge acquisition. Hence the participants commended the mathematics tutorials which employ more group work activities to teach and learn mathematics. Furthermore, the findings showed that participants always felt overloaded with too many assignments to do within short time frame.

Lastly a multiple regression analysis that was conducted to explore the extent to which workload, parents' level of education and mathematics self-efficacy influence mathematics performance, had shown that mathematics self-efficacy and workload were found to significantly explain mathematics performance. On the other hand, there was no statistical evidence to suggest that parents' level of education affect mathematics performance.

Indeed the findings from the study reaffirm and at some point fail to confirm results from previous research. For example, similar to some previous studies, mathematics self-efficacy and workload were found to influence mathematics academic performance. In fact this same study confirmed the two factors (mathematics self-efficacy and work load) to significantly contribute to mathematics academic performance. On the other hand, the results of this study failed to confirm a previous research result that suggested that parents' level of education as a SES factor can explain mathematics academic performance.

The practical implication of a finding that mathematics self-efficacy can explain performance could be counselling the first year female students in Beds and BSc programs and perhaps having an initial student instruction designed to positively impact on the mathematic self-efficacy.

5.2. Suggestions for future research

Although the findings of this study can be generalized to the Beds and BSc female students in their first year at Chancellor College, additional evidence will be required prior to generalizing the findings other programs and continuing students.

The qualitative strand brought out a good number of constructs/factors that affect mathematics performance. However, only three were selected as variables for multiple regression because of the limited sample. The recommended number of variables to be entered in a multiple regression analysis for S=51 or N=51 is restricted to 3. It could be possible that more other variables that were left out could explain academic performance in mathematics better. Therefore, this study could just be the first step to future studies that can extend to a larger population in similar or programs other than BSc and Beds. In addition, the other variables such as mathematics stereotypes can as well be investigated further using experimental designs in order to gain better understanding of their influence on the dependent variable, mathematics performance. Notably, previous research findings had shown that workload was moderated by other factors such as lifestyle, health and many more.(Kurata, Y. B., Bano R.M.L.P., Matias, A.C. (2015). However, this study did not find out the relationships between mathematics workload and its moderating factors. Therefore future studies should be able to address this issue in-depth

REFERENCES

Abubakar, R. B. and Eze, F. B. (2009). Female students' academic performance in Mathematics at Federal College of education (Technical), Omoku, Rivers State. *International Journal of Social and Policy Issues* 6 (1 & 2), 48-53

Abubakar, R. B. and Oguguo, B.I. (2011) Age and Gender as Predictors Of Academic Achievement of College Mathematics and Science Students *Asian Journal of Natural & Applied Sciences* Vol. 1. No. 2.

Abubakar, R. B. and Uboh,V.(2010).Breaking the gender barrier in enrolment and academic achievement of Science and Mathematics students. *Akoka Journal of Pure and Applied Science Education Ajopase* 10 (1), 203-213

Abubakar, R.B. and Eze, F, B. (2009). Female students' academic performance in mathematics at Federal College of Education (Technical), Omoku, Rivers State. *International Journal of Social and Policy Issues* 6(1&2), 48-53

Agwagah, U.N.V. & Harbour-Peters, V.F. (1994).Gender difference in Mathematics achievement. *Journal of Education and Psychology in Third world Africa* 1(1), 19-22

Ajayi, O. K., & Muriana, O. K. (2011). Parents‟ education, occupation and rea mother's age as predictors of students achievement in mathematics in some selected secondary schools in Ogun State, Nigeria. Academic Leadership Live: *The Online Journal, 9(1)* .Retrieved from http: //www.academicleadership.org/article/print/parents-education-occupation-andreal-mothers-age-as predictors-of-students ’achievement in mathematics

Alexander, A.H. (2010) *Effective Teaching Strategies for Alleviating Math Anxiety and Increasing Self-Efficacy in Secondary Student*. M.A thesis Submitted to the Faculty of The Evergreen State College, Washington

Amelink, C T. (2009) Literature Overview: Gender differences in Math Performance.SWE-AWE CASEE Overviews Retrieved on 19/05/2014 from http://www.AWEonline.org

Amelink, C T. (2012) Female Interest in Mathematics. Apply Research to Practice *(ARP)Resources*. Retrieved from http://www.engr.psu.edu/AWE/ARPResources.aspx

Anderson, L. W. & Krathwohl, D. R. (2001) *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Boston: Allyn & Bacon MA (Pearson Education Group)

Aromolaran, A D., Oyeyinka, I K., Benjamin O. E. (2013) Binary Logistic Regression of Students Academic Performance in Tertiary Institution in Nigeria by SocioDemographic and Economic Factors. *International Journal of Engineering Science and Innovative Technology (IJESIT)* Volume 2(4) pp. 590 – 596

Ashcraft, M. H., & Ridley, K. S. (2005). *Math anxiety and its cognitive* *consequences: A tutorial review*. New York, NY: Psychology Press.

Astin, A. W. (1993). *What matters in college? Four Critical Years revisited*. San Francisco: Jossey-Bass.

Bada R. A (2012) Age and gender as determinants of academic achievement in college mathematics. *Asian Journal of Natural & Applied Sciences* vol. 1. No. 2.

Bada, R. B. & Adegboyega, B. I. (2012) Gender differences in Academic and enrolment gaps Of College Chemistry Students. Int. *Journal of Research in Education (1&2), 12-16*

Bandura, A. (1986). *Social foundations of thought and action: A social cognition theory.* Englewood Cliffs, NJ: Prentice-Hall.

Barrow M, Reilly, B & Woodfield R (2009). The Determinants of Undergraduate Degree performance. How important is gender? *British EducationalResearchJournal*Retrievedfrom: http://pempowerdaphne.psy.u nipd.it/userfiles/file/pdf/Barrow_2009.pdf

Baumgartner, T. A., Strong, C. H., & Hensley, L. D. (2002). *Conducting and reading research in health and human performance* (3rd ed.). New York: McGraw-Hill.

Bedard K & Cho I (2007). *The Gender Test Score Gap across OECD Countries* Paris: OECD publishing.

Beder S (1997). *Addressing the Issues of Social and Academic Integration for*

First Year Students. Retrieved from <http://ultibase.rmit.edu.au>

Berger, J. B., & Milem, J. F. (2000). *Organizational behavior in higher Education and student outcomes. In J. C. Smart (Ed.), Higher education: Handbook of theory and research (Vol. XV, pp. 268–338).* New York: Agathon.

Bernard, H. R. (2005). *Research methods in anthropology: Qualitative and quantitative approaches.* Walnut Creek, CA: AltaMira.

Bharadwaj, P., Loken, K. & Neilson, C. (2011): *"Early Life Health Interventions and Academic Achievement,"* (Working paper. National Bureau of Economic Research.)

Bhowmik M. (2016) Impact of Collaborative Learning on Academic Achievement in Mathematics of Secondary Students in the School Hostel in Rural Area in India *British Journal of Education, Society & Behavioural Science* 14(1): 1-7, 2016,

Blake, L. (2006). *Exploring the relationship between academic self-efficacy and middle school students' performance on a high-stakes mathematics test. In Alatorre, S., Cortina, J.L., Sáiz, M., and Méndez, A. (Eds).* (Proceedings of the 28th annual meeting of the North American Chapter the International Group for the Psychology of Mathematics Education) (v.2, pp. 656). Mérida, México: Universidad Pedagógica Nacional

Bong, M. (2001). Role of self-efficacy and task-value in predicting college students ‘course performance and future enrolment intentions. *Contemporary Educational Psychology* 26(4): 553–570.

Booth, A. L, Cardona-Sosa, L & Nolen, P. (2013) Do Single-Sex Classes Affect Exam Scores? An Experiment in a Coeducational University IZA (Discussion Paper No. 7207)

Booth, A.L. & Nolen, P. J. (2012b) “Gender Differences in Rick Behaviour: Does Nurture Matter? *“The Economic Journal*, vol. 122, pp. F56-F78

Bridgeman, B. & Wendler, C. (1991). Gender differences in predictors of College Mathematics performance and in college Mathematics course grades. *Journal of Educational Psychology*, 83(2), 275-284.

Bryman, A. (2008) *Social Research Methods. 3rd edition*. Oxford: Oxford University Press. Bugge S & Wıkan G (2013) Student Level Factors Influencing Performance and Study Progress *the Online Journal of New Horizons in Education* Volume 3, Issue 2 pp 190-203

Carroll, C. (2011) *Evaluation of the University of Limerick Mathematics Learning Centre, University of Limerick*: BSc Dissertation, Retrieved from <http://www.mathcentre.ac.uk/resources/uploaded/evalmaths-l-centrelimerickcarrollgillpdf.pdf

Chamdimba, P. (2003). *An investigation of gender differences in participation And performance in mathematics amongst students at the Polytechnic. In*

Buffer and R.C. Lauphksch (Eds.) (Proceedings of the 12th annual conference of the Southern African Association for Research in Mathematics, Science and Technology Education) Durban: SAARMSTE.

Chamorro-Premuzic, T., & Furnham, A. (2005). *Personality and intellectual competence*. Mahwah: Lawrence Erlbaum Associates

Cheesman J. Simpson N. & Wint A. G. (2006). *Determinants of Students Performance at University*: *Reflections from the Caribbean*. Kingston, Jamaica: UWI Press

Cheryan S (2011). Understanding the Paradox in Math-Related Fields: Why Do Some Gender Gaps Remain While Others Do Not? *Springer Science and Business Media*. 66:184–190

Chidyaonga, F. A. (2003) (Case study prepared for a Regional Training Conference on Improving Tertiary Education in Sub-Saharan Africa:) Things That Work! Accra

Clark, E. E., & Ramsay, W. (1990). Problems of retention in tertiary education. *Education Research and Perspectives*, 17, 47-57

Clark, E. E., & Ramsay, W. (1990). Problems of retention in tertiary education. *Education Research and Perspectives*, 17, 47-57

Creswell J and Plano Clark V (2007) *Designing and Conducting Mixed Methods Research.* Thousand Oaks CA: Sage

Creswell, J. W. (2003). *Educational research: Planning, conducting, and* *evaluating quantitative and qualitative research*. Upper Saddle River, NJ: Pearson Education

Crotty, M. (2003). *The foundations of social research*. Thousand Oaks, CA: Sage.

Cuseo, J. B. (2005). *The sophomore-year experience*. Retrieved from http://soph-list@listserv.sc.edu

Das and Barua (2013) Employee retention: performance mathematics. An investigation through Application of Fuzzy *logic Journal of the Assam Academy of mathematics*, vol 2 pp 31-51

Datnow, Aand Park, V (2009), "Conceptualizing Policy Implementation", in Sykes, G.et al(eds), Handbook of Education Policy research, Routledge, Abingdon. Http://dx.doi.org/10.4329/9780203880968.ch28.

Dayıoglu, M. & Türüt-Asık, S. (2004). *Gender differences in academic performance in a large public University in Turkey*. (ERC Working Papers in Economics) Economic Research Center, Middle East Technical University

Dennis, J., Phinney, J., & Chuateco, L. (2005). The role of motivation, parental support, and peer support in the academic success of ethnic minority first-generation college students. *The Journal of College Student Development*, 46, 223-236.

Dörnyei, Z. (2007). *Research methods in applied linguistics*. New York: Oxford

University Press.

Dzulkifli, M. D. & Yasin, M.A.S.M. (2009). The effect of social support and Psychological problems on Students' academic performance. Proceedings of the 2nd International Conference of Teaching and Learning (ICTL 2009) INTI University College, Malaysia.

Else-Quest N. M., Hyde J. S. & Linn, M. C. (2010) Cross-National Patterns of Gender Differences in Mathematics: A Meta-Analysis Psychological *Bulletin* Vol. 136, No. 1, 103–1272010

Enochs, W. K. & Ronald, K. (2006). Social adjustment of college freshmen: The importance of gender and living environment. *College Student Journal*, 40(1): 63-72.

Faul, F., Erdfelder, E., Lang, G. & Buchner. A. (2009) Statistical power analyses using G*power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods* 41 (4)

Field, A P (2009) *Discovering statistics using Spss and sex and drugs and rock "n" roll (3rd edition)* London: Sage

Fraser W J & Killen R (2003) Factors influencing academic success or failure of first-year and senior university students:do education students and lecturers perceive things differently? *South African Journal of Education* Vol 23(4) 254 – 260

Gallivan, M. J. (1997). "*Value in Triangulation: A Comparison of Two*

Approaches for Combining Qualitative and Quantitative Methods,” Information Systems and Qualitative Research. London: Chapman and Hall

Ganley, C. M. & Vasilyeva, M. (2011) Sex differences in the relation between math performance, spatial skills, and attitudes. *Journal of Applied Developmental Psychology* 32, 235–242

Ganley, C. M., Mingle, L. A., Ryan, A. M., Ryan, K., Vasilyeva, M., & Perry, M. (2013). An Examination of Stereotype Threat Effects on Girls' Mathematics Performance. Developmental Psychology. *Journal of Experimental Child Psychology, 77(4), 337–358.*

Garcia, G. C. (2012) Students’ Beliefs toward Mathematics as Related to Their Performance in College Algebra international. *Peer Review Journal* vol 9 I 1..13)

Ghanbarzadeh, A. N. (2001). *Relationship between Attitude, self-efficacy, and Math performance with goal orientation of male and female high school students*. MA. Thesis, University of Thehran. Iran

Gilah, L & Fennema,E(1990) *Mathematics and Gender. New York:* Teachers College, Columbia University

Gill, O., Johnson, P., & O’Donoghue, J. (2008) *An audit of mathematics support provision in Irish third level institutions*. CEMTL: University of Limerick.

GOM. A Policy and Investment Framework for Education in Malawi 1995-2005 Lilongwe: (undated).

Gore, P. A. (2006). Academic self-efficacy as a predictor of college outcomes: Two incremental validity studies. *Journal of Career Assessment*, 14 (1), 92–115

Grassi, C. (2004). Gender based achievement, self-confidence and enrolment gaps:Mathematics at Trinity college.Retrieved from http://www.trincoll.edu/depts/educ/Research/Grassi.pdf

Green, S B (1991) How many subjects does it take to do a regression analysis. Multivirate. *Behavioral Research* 2(3), 499-510

Greene JC (2005) *Mixed Methods in Social Inquiry*.San Francisco: Jossey-Bass.

Griese, B., E. Glasmachers, J. Harterich, M. Kallweit & B. Roosken,(2011). *Engineering students and their learning of mathematics*. (Proceedings of the MAVI17 Conference Current State of Research on Mathematical Beliefs XVII, Professional School of Education) RUB, Bochum, pp: 85-96.

Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105-117). Thousand Oaks, CA: Sage.

Guthrie, J. T., & McCann, A. (1996). Idea circles: Peer collaborations for conceptual learning. In L. B. Gambrell & J. F. Almasi (Eds.), *Lively discussions! Fostering engaged reading* (pp. 87–105). Newark, DE: International Reading Association.

Halpern, D. F., Benbow, C. P., Geary, D. C., Gur, R. C., Hyde, J. S., &

Gernsbacher, M. A. (2007). The science of sex differences in science and mathematics. *Psychological Science in Public Interest*. 8 (1):1–51.

Halpmen, D., Eliot, L., Bigler, R., Fabes, R., Hanish, L., Hyde, J., Liben, L., Martin,C.(2011)"The Psuedoscience of Single-Sex Schooling,"*Behavioral Science*, vol. 333, 23 September, pp. 1706-1707

Harackiew, J. M. & Hulleman, C. H. (2010) The Importance of Interest: The Role of Achievement Goals and Task Values in Promoting the Development of Interest *Social and Personality Psychology Compass* 4/1: 42–52,

Harb, N. & El-Shaarwi, A. (2006). '*Factors Affecting Students' Performance'*. MPRA Paper No. 1362.

Hiddleston, P. 1991. *The Contribution of Girls Only Schools to University Selection and the Subsequent Achievement of Women in Mathematics and Science Subjects*. Zomba: Chancellor College.

Hlebec, V., Kogovšek T. & Ferligoj A. (2011) The influence of Social Support and Personal Networks on Doctoral Student Performance *Metodološki zvezki*, Vol. 8, No. 2, 157-171

Hussey, J and Hussey, R(1997) Business Research. London: mcmillanpress Ltd

Jablonka, E., & Bergsten, C. (2010). Theorising in mathematics education research: differences in modes and quality. *Nordic Studies in Mathematics Education*, 15(1), 25-52

Jackson, C. K. (2012) Single-sex schools, student achievement, and course selection: Evidence from rule-based student assignments in Trinidad and Tobago. *Journal of Public Economics*, vol. 96, pp. 173-187

James, A., Montelle, C., & Williams, P. (2008). From lessons to lectures: NCEA mathematics results and first-year mathematics performance. *International Journal of Mathematical Education in Science and Technology,* 39(8), 1037-1050

Jeynes, W. H. (2002). Examining the effects of parental absence on the academic achievement of adolescents: the challenge of controlling for family income. *Journal of Family and Economic Issues* 23(2).

Kabiri, M. (2003). *The role of math self-efficacy in mathematics achievement with regard to personal variables*. MA Thesis, Teacher Training University-Tehran

Kane, J. M. & Mertz, J. E. (2012) Debunking Myths about Gender and Mathematics Performance *Notices of the AMS.* Volume 59, Number 1

Kaplan, H. I. & Sadock, B. J. (2000). *Learning Theory: Synopsis of Psychiatry: Behavioral Sciences/Clinical Psychiatry*. Philadelphia: Lippincott Williams and Wilkins,

Karimi, A. & Venkatesan, S. (2009). Mathematics Anxiety, Mathematics Performance and Academic Hardiness in High School Students. *International Journal of Education and Science.* 1(1):33-37

Kiptum, J. K., Rono, P. K., Too, J. K., Bill, B. J. and Too, J. (2013) Effects of Students Gender On Mathematics Performance In Primary Schools In Keiyo South District, Kenya *International Journal Of Scientific & Technology Research Volume 2, Issue 6,*

Klymchuk, S., Gruenwald, N. & Jovanoski, Z.(2011) University lecturers' views on the transition from secondary to tertiary education in mathematics: *An international survey mathematics teaching-research*. Journal online Vol 5, N 1

Kouassi, F. S. (1999) *A Psychological Study of Mathematics Attitudes and Achievement among Female Ivorian Students* (Institute for Social Research University of Michigan Working Paper # 268)

Koul, L. (2009). *Methodology of educational research (4th ed.)*. New Delhi: Vikas Publishing House Ltd.

Krueger, R. A. & Casey, M. A. (2000). *Focus groups: A practical guide for Applied research (Third edition).* Thousand Oaks, CA: Sage.

Kurata, Y. B., Bano R.M.L.P., Matias, A.C. (2015) *Effects of workload on academic performance among working students in an undergraduate engineering program* (6th International Conference on Applied Human Factors and Ergonomics (AHFE 2015) and the Affiliated Conferences, AHFE 2015) Procedia Manufacturing 3 (2015) 3360 – 3367: Available online at www.sciencedirect.com

Kyoshaba, M. (2009*) Factors Affecting Academic Performance of Undergraduate Students At Uganda Christian University*. MA Dissertation Submitted Makerere University, Uganda.

LaForge, M. C., & Cantrell, S. (2003). Explanatory style and academic performance among college students beginning a major course of study. *Psychological Reports*, 92, 861–865.

Lam, S. F., et al (2012) Do girls and boys perceive themselves as equally engaged in school? The results of an international study from 12 countries. *Journal of School Psychology* 50. 77–94

Langford, B. E., Schoenfeld, G., & Izzo, G. (2002). Nominal grouping sessions vs. focus groups. *Qualitative Market Research*, 5, 58–70.

Leongsan, J.B. (2003). *Assessing the Mathematics Achievement of College Freshman using Piaget'a Logical Operation*, (Hawaii International Conference on Education) Waikiki, Hawaii,USA.

Loo, C. W. & Choy, J.L.F. (2013). Sources of Self-Efficacy Influencing Academic Performance of Engineering Students. *American Journal of Educational Research*, 1(3), 86-92s

Lorah, L. & Ndum, E. (2013) Trends in Achievement Gaps in First-Year College Courses for Racial/Ethnic, Income, and Gender Subgroups: A 12-Year Study ACT Research Report Series. Retrieved from https://files.eric.ed.gov/fulltext/ED546852.pdf

Lovric, M. (2005). Mathematics Review Manual. Retrieved from http://www.math.mcmaster.ca/lovric/rm.html

Lunenburg, (2011) Self-Efficacy in the Workplace: Implications for Motivation

And Performance *International Journal Of Management, Business, And Administration* Volume 14, Number 1,

Macgıllıvray, H. & Croft, A. C. (2011) Understanding evaluation of learning support in mathematics and statistics. *Int. J. Math. Educ. Sci. & Tech*., 42, 189–212.

Mackinnon, S. P. (2011). Perceived social support and academic achievement: Cross-lagged panel and bivariate growth curve analyses. *Journal of Youth and Adolescence. doi*: 10.1007/s10964-011-9691-1

MacNamara, D. & Penner, K. (2005). *First-year math students: using study skills and motivation to predict academic success (Kwantlen University College).*Retrievedfromhttp://www.mykwantlenpolytechnicuniversity.com/_shared/assets/Math_Retention_Study2878.pdf

Mak, L., & Marshall, S. (2004). Perceived mattering in young adults' romantic relationships. *Journal of Social and Personal Relationships*, 21, 469-486.

Marx, D. M. & Stapel, D. A. (2006). It's all in the timing: Measuring emotional reactions to stereotype threat before and after taking a test. *European Journal of Social Psychology.* 36, 687-698.

Marx, D.M., Stapel, D.A., & Muller, D. (2005). We can do it: The interplay of Construal orientation and social comparisons under threat. *Journal of Personality and Social Psychology*, 88, 432–466.

Mason, J. (2002). *Qualitative researching (2nd ed.).* London: Sage.

Maxcy, S. (2003) '*Pragmatic threads in mixed methods research in the social sciences: The search for multiple modes of inquiry and the end of the philosophy of formalism' in Tashakkori A & Teddlie C (Eds) Handbook of Mixed Methods in Social & Behavioral Research.* Thousand Oaks CA: Sage

Maxwell, (2000) Sample size and multiple regression analysis. *Psychological methods*, 5(4) 434-458

Mcjunkin L,(2009) effects of sterotype threat on undergraduate women's math performance: Participation pool vs classroom situations, *Emporia State Research Studies* 45, 27-31

McMillan, J. & Western, J. 2000. Measurement of Social-economic Status of Australian Higher Education Students. *Higher Edu.*, 39(2): 223 248

Mlambo, V. (2011). An analysis of some factors affecting student academic performance in an introductory biochemistry course at the University of the West Indies, *Caribbean Teaching Scholar*. 1(2), 79–92

Morgan, D. L. (1997). *Focus Groups as Qualitative Research. 2nd ed., Qualitative Research Methods Series 16*. Thousand Oaks, CA: Sage.

Mudhovozi, P. Social and Academic Adjustment of First-Year University Students. *J Soc Sci*, 33(2): 251-259 (2012)

Mwamwenda, T. S. (2009) "Self-Efficacy and Performance in Mathematics at An African University." *The Journal of Independent Teaching and Learning* 4 (23-28.

Nasser, F. M. (2004). Structural Model of the Effects of Cognitive and Affective Factors on the Achievement of Arabic-Speaking Pre-Service Teachers in Introductory Statistics. *Journal of Statistics Education*, 12, 1-28. Retrievedfrom:http://www.amstat.org.proxy.library.uu.nl/publications/jse/v12n1/nasser.html

National Research Council of Malawi. (2001) Science and Technology Policy For Malawi, Lilongwe

Niederle, & Vesterlund, (2010) Explaining the Gender Gap in Math Test Scores: The Role of Competition *Journal of Economic Perspectives*. Volume 24, Number 2. Pages 129-144

Nonis S. A, Gail I. & Hudson (2006) *Academic performance of college students; influence of time spent studying and working*. Heldref Publications

Nonis, S. A. & Hudson G.I. (2010). Performance of College Students: Impact of Study Time and Study Habits. *Journal of Education for Business* 85: 229-238.

Ntshoe ,I. & De Villiers P. (2008) "Steering the South African Higher Education Sector Towards Transformation". *Perspectives in Education,* Vol. 26, No. 4

Nyikahadzoi, L., Matamande, W., Taderera, E. & Mandimika, E. Determinants of students' academic performance in four selected accounting courses at University of Zimbabwe *Research in Higher Education Journal*. Retrieved from http://www.aabri.com/manuscripts/131526.pdf

Nyman, R. (2016). What makes a mathematical task interesting? *Educational Research and Reviews*, 11(16), 1509-1520.

Ogunmakin, A. E. & Akomolafe, M. J. (2013) Academic Self-Efficacy, Locus of Control and Academic Performance of Secondary School Students in Ondo State, Nigeria Mediterranean *Journal of Social Sciences MCSER Publishing, Rome-Italy* Vol 4 No 11

Onwuegbuzie, A. J., Jiao, Q. G. & Bostick, S. L. (2004). *Library Anxiety: Theory, Research and Applications.* Lanham, MD: Scarecrow Press.

Organization for Economic Cooperation and Development (2009). *Equally Prepared For Life? How 15-Year-Old Boys and Girls Perform in School programme: First Results from Pisa 2003*. Paris, France: OECD.

Oswald, D. L., & Harvey, R. D. (2000-2001). Hostile environments, stereotype threat, and math performance among undergraduate women. Current Psychology: Developmental, Learning, Personality, Social, *Journal of Educational Psychology* 19, (1) 338-356.

Pajares, F. & Kranzler, J. (1995). Self-efficacy beliefs and general mental ability in mathematical problem-solving. *Contemporary Educational Psychology* 20(4): 426–443.

Pajares, F. & Miller, M. (1994). Role of self-efficacy and self-concept beliefs in mathematical problem solving: A path analysis. *Journal of Educational*

Psychology, 86, 193-203.

Pascarella, E. T. & Terenzini, P. T. (2005). *How college affects students. Vol. 2: A third decade of research.* San Francisco: Jossey-Bass.

Pascarella, E. T. & Terenzini, P. T. (1991). *How college affects students: Findings and insights from twenty years of research.* San Francisco: Jossey-Bass.

Patton, M. Q. (1980). *Qualitative evaluation and research methods. (Second edition)* Newbury Park, CA: Sage.

Pintrich, P. R. (1991). Multiple goals, multiple pathways. The role of goal orientation In learning and achievement. *Journal of Educational Psychology*. 92, 544–555.

Pishghadam, R., Noghani, M. & Zabihi, R. (2011). *The construct validation of a questionnaire of social and cultural capital, and its application to foreign language learning*. Unpublished manuscript, Department of English Language and Literature, Ferdowsi University, Mashhad, Iran

Quinn, D. N. & Spencer, S. J. (2001). The interference of stereotype threat with women's generation of mathematical problem-solving strategies. *Journal of Social Issues*. 57, 55–71.

Ramli , N.A. M., & Awang, M. (2020) Critical Factors that contribute to the Implementation of the STEM Education Policy. *International Journal od Academic Research in Business and Social Sciences*, 10(1), 111-125

Reason, D. (2009) An Examination of Persistence Research Through the Lens of a Comprehensive Conceptual Framework. *Journal of College Student Development.* Volume 50, Number 6, , pp. 659-682 (Article)

Richardson, F. C. & Suinn, R. M. (1972). The Mathematics Anxiety Rating Scale: Psychometric data. *Journal of Counseling Psychology*, 19, 551-554

Robbins, S. B., Lauver, K., Le, H., Davis, D., Langley, R. & Carlstrom, A. (2004). Do psychosocial and study skill factors predict college outcomes? A meta-analysis. *Psychological Bulletin*, 130, 261–288.

Rose, H. and Betts, J. R. (2001) Math Matters: *The Links between High School Curriculum, College Graduation, and Earnings* San Francisco, CA: Public Policy Institute of California

Sakho, A. (2003). *Determinants Academic of performance of HEC-Lausanne Graduates, Macroeconomic modelling*. Retrievedfrom http://www.hec.unil.ch/modmacro/recueil/Sakho.pdf

Saldana, J. (2009). *The coding manual for qualitative researchers*. Thousand Oaks, CA: Sage

Sandelowski, M. (2008). Theoretical saturation. In L. M. Given (Ed.), *The Sage encyclopedia of qualitative methods* (Vol. 1, pp. 875–876). Thousand Oaks, CA: Sage.

Saunders, J., Davis, L., Williams, T. & Williams, J.H. (2004). Gender differences in self-perceptions and academic outcomes: A study of African

American High School Students. *Journal of Youth and Adolescents*. 33, 81-90.

Saunders, M., et al. (2007). *Research Methods for Business Students, 4th edition*, prentice Hall

Sax, L. J., Casandra, E. & Harper, R. (2005) (Paper presented at the Annual Meeting of the Association for Institutional Research) San Diego, CA

Schuwirth L.W.T. & Van Der Vleuten C.P.M. (2006) A plea for new psychometrical models in educational assessment. *Medical Education* 40:296–300.

Singh, P. (2008). *The unexpected rewards of qualitative research in assessment: A case example. The Qualitative Report, 13(2), 278–300*. Retrieved May 16, 2007, from http://www.nova.edu/ssss/QR/QR13-2/singh.pdf

Singletary, S.L., Ruggs, E.N., Hebl, M.R. & Davies, P.G. (2009). *Literature overview: Stereotype threat: Causes, effects, and remedies*. Retrieved from http://www.engr.psu.edu/awe/misc/ARPs/ARP_StereotypeThreat_ Overview_31909.pd

Sofroniou, A. & Poutos, K. (2016) Investigating the Effectiveness of Group Work In Mathematics. *Journal/Education* 6, 30

Spelke, E. S. (2005) Sex Differences in Intrinsic Aptitude for Mathematics and Science: A critical Review *American Psychologist* Vol. 60, No. 9, 950–958

Spencer, S. J., Steele C. M. & Quinn D. M. (1999). Stereotype threat and women's math performance. *Journal of Experimental Social Psychology* 35, 4-28

Steele, C. M. &Aronson, J. (1995). Contending with a stereotype: African-American intellectual test performance and stereotype threat. *Journal of Personality and Social Psychology*, 69 (5)797–811.

Steele, C. M. (2003). Stereotype Threat and the Intellectual Test Performance of African Americans. *Journal of Personality and Social Psychology,* 69(5) 797-811

Steele, J. (2003). Children's gender stereotypes about math: The role of stereotype stratification. *Journal of Applied Social Psychology*, 33, 2587–2606.

Steele, J., James, J. B. & Barnett, R. C. (2002). Learning in a man's world: Examining the perceptions of undergraduate women in male-dominated academic areas. *Psychology of Women Quarterly*, 26, 46-50.

Teddlie, C. & Tashakkori, A. (2009) *Foundations of Mixed Methods Research*. Thousand Oaks CA: Sage.

Terenzini, P. T. & Reason, R. D. (2005). *Parsing the first year of college: Rethinking the effects of college on students*. Paper presented at the Annual Conference of the Association for the Study of Higher Education) Philadelphia, PA.

Terenzini, P., Springer, L., Yaeger, P., Pascarella, E., & Nora, A. (1996). First-generation college students: Characteristics, experiences, and cognitive development. *Research in Higher Education*, 37, 1-22.

Tinto, V. (2004) Dropout from Higher Education: A Theoretical Synthesis of Recent Research *Review of Educational Research*.Vol. 45, No. 1, Pp.89-125

Tuminaro, J. and E.F. Redish E F (2005). Understanding students' poor Performance on mathematical problem solving in physics .Retrieved from http://physics.umd.edu/perg/papers/tuminaro/madison_proceedings.pdf

Usop, H.H., Hong, K.S., Sabri, N.A. & Tan, K.W. (2009) Factors causing Mathematics anxiety among undergraduate students. (Paper presented at Third International conference on Science and Mathematics Education, Penang, Malaysia:10-12November2009) Retrieved from http://www.recsam.edu.my/cosmed/cosmed09/AbstractsFullPapers2009/Abstract/Mathematics%20Parallel%20PDF/Full%20Paper/M11.pdf

Vuong, M., Brown–Welty, S. & Tracz, S. (2010) The Effects of Self-Efficacy On Academic Success of First-Generation College Sophomore Students. *Journal of College Student Development* 51(1), 50-64

Witt-Rose, D.L. (2003). *Students' self-efficacy in College Science: An investigation of gender, age & academic achievement*. Unpublished MSc. Dissertation of University of Wisconsin-stout http://www.uwstout.edu/static/lib/thesis/2003/2003:wittrosed.pdf

Woodrow, D. (2003) *Second International Handbook on Mathematical Education*:Kluwer Press

Zajacova, A. Lynch,S. M. & Espenshade, T. J. (2005) Self-Efficacy, Stress, And Academic Success In College *Research In Higher Education*, Vol. 46, No. 6

Zhu, Z. (2007) Gender differences in mathematical problem solving patterns: A review of literature *International Education Journal* 8 (2), 187-203.

Zimmerman, B. J. (2000). Self-efficacy: An essential motive to learn. *Contemporary Educational Psychology* 25(1): 82–91.

Zulauf, C.R. & Gortner, A. K. (1999) *Use of Time and Academic Performance Of College Students. Does Studying Matter?* (A paper selected for presentation American Agricultural Economic Association Annual meeting)

APPENDICES

Appendix A: Focus group discussion guide

Question 1

How would describe your academic life as freshmen/yearo?

Question 2

How would you describe your experiences in mathematics as ladies? (Probe where appropriate)

Question 3

How would you rate the teaching and learning practices?)

Question 4

How would you describe your peer environment in relation to the mathematics course?

Question 5

How would you describe the mathematics tests? (Probe where appropriate)

How can you compare the college experiences and the secondary school experiences?

Question 6

How would you generally describe your interaction with the mathematics department? (Probe appropriately)

Question7

Are there any other experiences in relation to mathematics as female students.

Appendix B: Semi Structured Interview Guide (Lecturer)

Question 1

How would you describe your mathematics teaching experience?

Question 3

Tell me more about how female students fare in mathematics?

Question 4

How can you rate your modes of instruction delivery to mathematics students?

Question 4

Would you tell me more about the challenges that female students face in mathematics?

Question 5

How readily available are you to the students? (probe…what about the female students?)

Question 6

Would you summarise the challenges that you face with mathematics course in general?

Question 7

Would you suggest ways of dealing with the challenges faced?

Appendix C: Semi Structured Interview Guide (Students)

Question 1: What was your first reaction when you got the news that you are enrolled for BEDS/BSC?

Question 2: If excited why? If not, why?

Question 3: What are your experiences with Mathematics lessons;

a) With peers?

b) With lecturers?

Question 4: How do you compare Mathematics in College and Mathematics in Secondary School?

Question 5: What curricular practices in Mathematics do you enjoy? Which ones do you not like?

Question 6: Is there anything more you would like to add on experiences in Mathematics course?

Appendix D: Questionnaire

STUDENTS' QUESTIONNAIRE

1. As part of the research on *determinants of performance in mathematics among females*, this questionnaire asks about your **honest opinion** on different items.
2. There is no right or wrong answer
3. Your answers are confidential

Please indicate your **level of agreement** with the following statements on a scale of 0-4

0 = Not at all, 1= Slightly Agree, 2= Moderately Agree, 3= Agree, 4= Strongly Agree

Mathematics-Workload

	I am always under pressure in mathematics because it has a heavy workload	0 ☐	1 ☐	2 ☐	3 ☐	4 ☐

Please indicate your **level of agreement** with the following statements on a scale of 0-4

0 = Not at all, 1= Slightly Agree, 2= Moderately Agree, 3= Agree, 4=Strongly Agree

Mathematics-Self efficacy

1	I believe I am the kind of person who is good at mathematics.	0☐	1☐	2☐	3☐	4☐
2	I believe I can do well on a mathematics test.	0☐	1☐	2☐	3☐	4☐
3	I feel confident enough to ask questions in my mathematics class	0☐	1☐	2☐	3☐	4☐
4	I believe I can get an "A" in a mathematics course	0☐	1☐	2☐	3☐	4☐
5	I believe I can understand the content taught in mathematics.	0☐	1☐	2☐	3☐	4☐
6	I feel that I will be able to do well in future mathematics courses	0☐	1☐	2☐	3☐	4☐
7	I believe I can handle more difficult mathematics	0☐	1☐	2☐	3☐	4☐

Demographic characteristics		
8	What is your father's/guardian highest level of education?	Cannot read/write……1 ☐ Primary certificate……2 ☐ Secondary certificate…3 ☐ College/ university certificate…………….4 ☐ Post-graduate certificate.....................5 ☐

Appendix E: Initial Coding

I find math boring *1- Math interest*
The stuff that we learn requires a background in additional mathematics and there no exercise during a lecture *5. Academic preparedness* *3. T/Strategy*
I ask myself again and again before I attempt to answer a question *2. Efficacy*
I understand better when I discuss with friends *3. T/L strategy*
We have too much pressure from frequent math tests *4. Workload*
Boys are just faster in picking mathematical concepts *5. Stereotype*
tutorials mix us with other students…we learn better *3. T/L strategy*
I feel I may not give a correct answer *2. Efficacy*
I have to confirm the answer from a male colleague *2. Efficacy*

Appendix F: Raw data for IV and DVs

Participant	Math score (DV)	WL (IV)	SE (IV)	Par Edu (IV)
1	39.0	4.0	4.0	3.0
2	42.0	4.0	4.6	3.0
3	47.0	3.0	3.6	1.0
4	45.0	3.0	2.4	3.0
5	45.0	4.0	2.9	4.0
6	52.0	2.0	3.0	5.0
7	39.0	4.0	2.0	5.0
8	50.0	3.0	3.6	4.0
9	50.0	2.0	3.0	5.0
10	43.0	4.0	2.7	5.0
11	40.0	3.0	2.0	4.0
12	63.0	2.0	4.0	4.0
13	48.0	4.0	2.9	2.0
14	46.0	2.0	2.3	5.0
15	56.0	2.0	4.1	3.0
16	44.0	3.0	2.4	4.0
17	50.0	3.0	2.9	4.0
18	48.0	3.0	3.3	4.0
19	40.0	4.0	2.4	5.0
20	41.0	4.0	2.9	3.0
21	66.0	2.0	4.4	2.0
22	41.0	3.0	3.6	3.0
23	21.0	4.0	1.4	4.0
24	52.0	1.0	4.0	3.0
25	72.0	2.0	4.4	2.0
26	66.0	2.0	3.3	4.0
27	47.0	3.0	2.9	4.0
28	56.0	2.0	3.6	4.0
29	40.0	4.0	2.9	3.0
30	65.0	2.0	4.6	3.0
31	71.0	0.0	4.6	5.0
32	57.0	1.0	4.6	5.0
33	53.0	2.0	3.7	3.0
34	30.0	2.0	1.7	5.0
35	62.0	2.0	4.6	5.0
36	52.0	2.0	4.0	5.0
37	49.0	3.0	3.3	4.0
38	61.0	2.0	4.6	4.0

39	59.0	0.0	4.6	3.0
40	35.0	3.0	1.9	4.0
41	74.0	2.0	4.0	4.0
42	39.0	3.0	1.9	5.0
43	53.0	3.0	3.1	2.0
44	70.0	2.0	4.4	5.0
45	56.0	3.0	3.3	2.0
46	59.0	2.0	2.7	4.0
47	37.0	4.0	2.0	5.0
48	34.0	4.0	2.4	4.0
49	58.0	2.0	3.6	3.0
50	39.0	4.0	2.9	3.0
51	42.0	4.0	4.6	3.0