

**ACADEMIC SELF-CONCEPT, MOTIVATION AND RESILIENCE AS
PREDICTORS OF MATHEMATICS ACHIEVEMENT AMONG
SECONDARY SCHOOL STUDENTS IN NAIROBI COUNTY,
KENYA**

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**A RESEARCH THESIS SUBMITTED IN PARTIAL FULFILMENT OF THE
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PHILOSOPHY (EDUCATIONAL PSYCHOLOGY) IN THE SCHOOL OF
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DECLARATION

I confirm that this research thesis is my original work and has not been presented in any other university for consideration. The thesis has been complemented by referenced sources duly acknowledged. Where text, data (including spoken words), graphics, pictures or tables have been borrowed from other sources, including the internet, these are specifically accredited and references cited in accordance with anti-plagiarism regulations.

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We confirm that the work reported in this thesis was carried out by the candidate under our supervision as university supervisors.

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DEDICATION

This thesis is dedicated to my late parents Martin Muiruri and Janet Wambui who introduced me to school, my husband Peter Gachigi and my children: Maggie, Celine and Sam for their understanding and tolerance during the period of my study.

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ABBREVIATIONS AND ACRONYMS

ASCQ	Academic Self-concept Questionnaire
AM	Academic Motivation
AMS	Academic Motivation Scale
AR	Academic Resilience
ASC	Academic Self-concept
CDE	County Director of Education
KCSE	Kenya Certificate of Secondary Education
KNEC	Kenya National Examinations Council
NACOSTI	National Commission for Science, Technology and Innovation
SDT	Self-Determination Theory
SMASSE	Strengthening of Mathematics and Science in Secondary Education
USA	United States of America

ABSTRACT

Mathematics is considered a key foundation for scientific knowledge required for the development of any nation. Poor mathematics achievement has been reported nationally. The purpose of this study was to establish whether academic self-concept, academic motivation and academic resilience singly and jointly predict mathematics achievement of secondary school students in Nairobi County, Kenya. The objectives of the study included establishing the extent to which: academic self-concept predicts mathematics achievement, academic motivation predicts mathematics achievement, academic resilience predicts mathematics achievement and determining the relative predictive values of academic self-concept, academic motivation and academic resilience on mathematics achievement, test for gender differences in academic self-concept, academic motivation, and academic resilience and to establish differences in academic self-concept, academic motivation, academic resilience and mathematics achievement among students in different categories of schools. The study was based on the theories of self-determination and resilience by Deci and Ryan, and Flach respectively. Predictive correlational research design was used in this study. The study comprised a population of 9641 form three students in public secondary schools in Nairobi County, Kenya. A sample of 500 respondents was drawn from the population, using purposive, stratified and simple random sampling. A questionnaire was used to measure the respondents' academic self-concept, academic motivation and academic resilience. The participants' mathematics achievement score used was the average score in form two second and third terms and form three first term (2016). A pilot study was conducted among 40 form three students from one co-educational day public secondary school in Nairobi County to establish the validity and reliability of the questionnaire. Descriptive and inferential statistics including simple and multiple linear regressions, ANOVA and t-test for independent samples and Tukey's HSD were used for data analysis. The hypotheses were tested at $\alpha=.05$. The results showed that: academic self-concept positively and significantly predicted mathematics achievement ($F(2,460) = 2.98, P<.05$); academic motivation and mathematics achievement were significantly related in some domains ($F(4, 458) = 8.01, P<.01$) and academic resilience positively and significantly predicted mathematics achievement ($F(1, 461) = 41.49, P<.01$). Further, the three variables working together positively and significantly predicted mathematics achievement ($F(3,459) = 13.88, P<.01$); there were no significant gender differences in the three predictor variables and mathematics achievement and the type of school significantly influenced academic resilience and mathematics achievement ($F(2, 460) = 6.71, P<.01$ and $F(2,460) = 71.91, P<.01$) respectively while it had no significant influence on academic motivation and academic self-concept ($F(2,460) = .16, P<.85$ and $F(2, 460) = .19, P<.83$) respectively. It is recommended that parents and other educational stakeholders work together to enhance the students' academic resilience since the findings indicated that it was the best predictor of mathematics achievement. A similar study should be carried in other counties in Kenya for the purpose of generalization of findings.

CHAPTER ONE

INTRODUCTION AND BACKGROUND TO THE STUDY

1.1 Introduction

This chapter provides the background to the study which highlights the achievement of mathematics at the global, regional and local perspective. This is followed by the statement of the problem, purpose and objectives of the study. The research hypotheses and significance of the study, delimitations and limitations are also covered. Additionally, assumptions, theoretical and conceptual framework and operational definitions of terms conclude the chapter.

1.2 Background to the Study

Mathematics finds its application in several fields and also forms the basis for most scientific subjects. Achievement in mathematics therefore is of great interest across all levels of education. Globally, a good performance in mathematics is valuable for students as well as a country's economic wellbeing.

Today, mathematics achievement in the USA schools, which was once the envy of the world has dropped significantly. According to Hanushek, Peterson and Woessmann (2010), the need to have many students excel in mathematics is not being met. Available research indicates that the number of high achievers in mathematics in most states is below that of the world's leading industrialized nations like Japan, China, and United Kingdom among others (Hanushek et al., 2010). This may be what

prompted former US president Obama to once say:

Whether it's improving our health or harnessing clean energy, protecting our security or succeeding in the global economy; our future depends on reaffirming America's role as the world's engine of scientific discovery and technological innovation. And that leadership today depends on how we educate our students today, especially in mathematics, science and technology. (Hanushek et al., 2010, p. 6.)

Unfortunately, for the USA, available data indicates that the number of high achieving students in mathematics is way below that of several leading developed nations (Hanushek et al., 2010).

South Africa is currently facing challenges in mathematics achievement. Continental studies indicate that the country has the worst educational outcomes compared to all middle-income countries that participate in cross-national assessments of educational achievements, especially in mathematics (McCarthy & Oliphant, 2013). Developing a mathematically skilled workforce in various fields may be difficult since poor achievement in mathematics is becoming rampant in most of the schools (Department of Education, 2005). A report from the Department of Education in South Africa reveals that only 3% of all students enrolled in institutions of higher learning undertake mathematics as an area of specialization (Moloi & Strauss, 2005). Further, the two report that in the labour market during the period of 2000-2005, only

9% of employed South Africans were in occupations that required mathematical competence. This is an indicator that there is a real challenge in mathematics performance in South African schools.

In Kenya, Mathematics is a compulsory subject in both primary and secondary schools. A good score in mathematics is also a pre-requisite for most courses in science-learning colleges and universities. This is in line with the notion that mathematics lays the foundation for scientific technical knowledge for industrial and technological advancement (Tella, 2007). Despite the perceived importance of mathematics, achievement of students in the subject at the final secondary school examination had not improved in the years of 2011, 2012 and 2013 (Githua, 2013). Nationally, the average mean grade for 2016 was D, a drop from D+ in 2014 and 2015. This is despite efforts by the Ministry of Education to improve quality of teaching mathematics through SMASSE and attempts to reduce teachers' shortage in Kenyan schools (Ndirangu, 2013). Statistics from the County Director's office, Nairobi County indicate that only 15% of the schools scored a mean grade of C+ and above in mathematics while 65% of the schools scored a mean grade of D+ and below in the years 2013-2016.

The KCSE mean scores in Mathematics for Nairobi County has been as follows; 2010, 3.80; 2011, 3.78; 2012, 4.12; 2013, 4.02; 2014, 3.89; 2015, 4.02 and 4.00, 2016 (KNEC, 2016). In comparison to other counties in 2016, Nairobi still lagged behind; west Pokot (5.10), Elgeiyo Marakwet (4.7), Siaya (4.6), Embu (4.3), Nandi

(4.3), Kakamega (4.2), Nakuru (4.2) and Laikipia (4.1) among others (KNEC, 2016). This underachievement has implications for the attainment of national educational goals including Vision 2030 because for a student to be enrolled in a science oriented course, one needs to have scored at least an average of C+ grade in mathematics.

Mathematics achievement is a function of many cognitive and non-cognitive aspects of one's personality. In the US, students' mathematics underachievement has been attributed to self-perception of ability, negative peer influence, type of school environment, level of mathematical resilience, cognitive ability, family support, and level of motivation among others (Bacon, 2011; Geary, 2011; US Department of Education, 2015). The role of motivation in achievement has been further examined by Reis and McCoach (2000). They conclude that there are many gifted underachieving students in the US and all they need to excel is motivation from their teachers. This is necessitated by the differences in their learning styles and the instructional methods used by different teachers. The extent of parental support is also a major determinant of the level of achievement. Parents need to recognize their children's strengths and encourage them to invest more in the same. Bacon (2011) observes that a negative self-concept may cause underachievement especially if parents fail to acknowledge their children's ability and give the necessary support.

In South Africa, learners' mathematical-related beliefs and low academic motivation are a cause of underachievement in mathematics (Sikhwari, 2014). It has been reported that most students have been made to believe that mathematics is a difficult

subject and as a result they do not find it necessary to put any extra effort to better their performance. Kenyan students who report low levels of academic motivation are also highly likely to present lower grades than students reporting higher levels of academic motivation (Mutai, 2007). Although low academic motivation is directly linked to a poor overall academic achievement, the same can be narrowed down to focus on the link between academic motivation and mathematics achievement.

Studies in Kenya have presented similar findings with low academic motivation (Mutai, 2007) and parental intervention (Bacon, 2011) being considered as some of the key determinants of general academic achievement. Social factors such as poor parental control, parental expectations and negative peer influence (Salami, 2000), (Bacon, 2011), low academic self-efficacy and a negative school climate (Kimani, Kara & Ngugi, 2013) among others have been reported to be causes of poor mathematics achievement. Though a lot of research has been carried out on the cognitive factors that determine academic achievement, it is still not clear how non-cognitive factors such as academic self- perceptions, academic motivation and academic resilience may predict mathematics achievement.

Academic self-concept refers to students' perceptions of their skills, capability, extent to which they find mathematics meaningful and interesting to learn (Liu & Wang, 2005). These authors have also pointed out that academic self-concept is a product of effort and confidence. Effort refers to the amount of physical and mental energy dedicated to the study of a subject while confidence refers to the feeling that a

student has in relation to his/her ability in a subject. Mathematics self-concept is therefore academic self-concept but with a bias towards mathematics. It is a product of a student's effort and confidence towards mathematics. Though some studies have highlighted the link between academic self-concept and achievement (Areepattamanil & Freeman, 2008; Erdogan & Sengul, 2014; Kwena, 2007; Osei, 2014; Sanchez & Roda, 2003), they have not specifically examined academic self-concept with a bias to mathematics.

Other studies in the area have found significant relationships between academic self-concept and gender on achievement in science subjects (Merger & Eikeland, 2006; Visi, 2015). Research done in the USA indicates that in a school setting, academic motivation is significantly correlated with academic performance (Awan, Noureen & Naz, 2011; Pintrich & Schunk, 2002). Such studies reveal that individuals who rate high in achievement motivation are high academic achievers and rate high in academic self-concept and academic resilience (Salami, 2000). This could be due to the fact that students with a high sense of academic self-concept set high academic goals, display greater persistence and intrinsic interest in their academic learning.

Academic motivation determines whether and to what extent individuals engage in a given pursuit. According to Deci and Ryan (2000) three types of academic motivation interact in most academic settings; intrinsic, extrinsic, and amotivation. Academic intrinsic motivation is the inner willingness for the student to learn because he/she finds it meaningful for him/herself. Such students engage in

mathematics tasks because they have interest and find them relevant. They feel that learning mathematics is important for their self-perceptions and are likely to have a high probability of success. Extrinsic motivation in tasks is focused on rewards such as teacher's praise, written feedback, grades, successful completion of work or other privileges. Such students will find relevance in mathematics tasks due to the rewards they receive. Other students manifest neither intrinsic nor extrinsic motivation. These ones are said to be unmotivated. Such students have been found to suffer from learner hopelessness or helplessness (Areepatamannil, 2014; Ormrod, 2008). Such students will show no interest in, satisfaction from or relevance of mathematics tasks.

A growing body of research in the western world has pointed to academic resilience as a key component of learning. Many learners experience a lot of stress while learning mathematics and view the subject as a difficult task. If learners are to do well in mathematics then they must develop mathematical resilience (Borman & Overman, 2004; Morales, 2008; Newman, 2004). They must have the initiative to solve mathematical problems and learn how to deal with mathematics anxiety. Students must exhibit academic resilience for them to excel in the academic domain; they must study hard to excel and cope with the school conditions that are different from the home environment.

Research shows that academically resilient students have the ability to deal effectively with academic setbacks, school stress and study pressure (Borman & Overman, 2004; Martin & Marsh, 2006 Newman, 2004). They believe that learning

mathematics is a product of effort and perseverance as opposed to ability only. This notion is echoed by Falcon (2010) who feels that ability must be coupled with hard work and tolerance for its results to be visible. Research on the relationship between academic resilience and mathematics achievement has not been sufficiently carried out in Africa. In a study by Khalaf (2014) among university students in Egypt, academic resilience and academic performance are found to be significantly related. Studies carried out in Kenya have found a positive correlation between teachers' qualification, experience, students' attitudes, type of school, gender, motivation, poor self-concepts and inadequate staff and mathematics achievement (Mbugua, Kibet, Muthaa & Nkaoke, 2012; Yara & Wanjohi, 2011).

Low mathematics achievement has been a challenge to the Kenyan schools. The studies focusing specifically on mathematics achievement are not sufficient because they have not covered all the possible predictors yet Salami (2000) reports of the importance of the three variables working together to enhance academic achievement. Joefel (2014) concurs that students in both the developed and developing nations have continually registered poor grades in mathematics and as much as some studies have been done in a bid to establish the causes of this trend, a solution has not been found. Available studies in Kenya have concentrated on the importance of academic self-concept, resilience and motivation as predictors of academic achievement singly. Even though some of the studies have focused on mathematics achievement, research on the contribution of the three variables to mathematics achievement has not been fully addressed in Kenya. It is against this

background that this study sought to investigate whether academic motivation, academic self-concept and academic resilience singly and collectively predict mathematics achievement of students in public secondary schools in Nairobi County, Kenya.

1.3 Statement of the Problem

In Kenya, low mathematics achievement has been reported in the KCSE exam over the years. In an attempt to respond to this, scholars have carried out several studies concerning the causes. Studies on the predictors of mathematics achievement have been carried out both globally and locally. In spite of these efforts, mathematics achievement remains poor. Mathematics achievement among students in Nairobi County has over a long period been below average. Statistics indicate that 65% of schools scored a mean grade of D+ and below in mathematics in the years 2013-2016 (KNEC, 2016). Consequently, many students do not qualify to undertake science and mathematics courses in higher institutions of learning which the country needs for technological advancement and achievement of Vision 2030.

Available literature reveals positive and significant correlations of academic self-concept, academic motivation and academic resilience and mathematics achievement. However, the available literature on how the variables under study jointly predict mathematics achievement is minimal and especially in Kenya where most of the literature focuses on explaining poor mathematics achievement in relation to factors such as negative peer influence, negative attitude, the school

climate, academic self-concept, academic motivation and academic resilience singly and how they predict academic achievement. These studies have been carried out in other parts of the world, among primary and university students and the extent to which these results may be generalized calls for empirical investigation. So far, very few studies have been conducted in Nairobi County investigating how the variables under study may interact to predict mathematics achievement. Consequently, the central problem of this study was to examine how academic self-concept, academic motivation and academic resilience predict mathematics achievement of secondary school students in Nairobi County. The results may provide an insight into ways of improving mathematics achievement so that more students may be admitted in science based courses and enable the country to achieve vision 2030.

1.4 Purpose of the Study

The purpose of the study was to investigate the extent to which academic self-concept, academic motivation and academic resilience predict mathematics achievement. The study also looked at possible differences in students' academic self-concept, academic motivation, academic resilience and mathematics achievement based on gender and type of school.

1.5 Objectives of the Study

The study was guided by the following objectives:

- i) Determine the extent to which academic self-concept predicts mathematics achievement of secondary school students in Nairobi County.

- ii) Establish the extent to which academic motivation predicts mathematics achievement of secondary school students in Nairobi County.
- iii) Establish the extent to which academic resilience predicts mathematics achievement of secondary school students in Nairobi County.
- iv) Determine the relative predictive values of academic self-concept, academic motivation and academic resilience on mathematics achievement of secondary school students in Nairobi County.
- v) Test for gender differences in academic self-concept, academic motivation and academic resilience of secondary school students in Nairobi County.
- vi) Establish if there are differences in academic self-concept, academic motivation, academic resilience and mathematics achievement among students in national, county and sub-county schools in Nairobi County.

1.6 Research Hypotheses

The study was guided by the following research hypothesis:

Ha₁ Academic self-concept predicts mathematics achievement of secondary school students in Nairobi County.

Ha₂ Academic motivation predicts mathematics achievement of secondary school students in Nairobi County.

Ha₃ Academic resilience predicts mathematics achievement of secondary school students in Nairobi County.

Ha₄ Academic self-concept, academic motivation and academic resilience predict mathematics achievement of secondary school students in Nairobi County.

Ha₅ There are gender differences in academic self-concept, academic motivation, academic resilience and mathematics achievement of secondary school students in Nairobi County.

Ha₆ There are differences in academic self-concept, academic motivation, academic resilience and mathematics achievement among students in national, county and sub-county schools in Nairobi County.

1.7 Assumptions of the Study

This study was based on a number of assumptions. Firstly, the study assumed that Deci and Ryan's self-determination theory and Flach's resilience theory were appropriate for the study. Secondly, the researcher made the assumption that the students valued and prepared for mathematics examinations which reflected their ability. It was further assumed that a student's average score over a period of three consecutive terms was a suitable measure of mathematics achievement. In addition to this, it was assumed that students' achievement in mathematics may be predicted by the academic self-concept, academic motivation and academic resilience. Moreover, it was assumed that mathematics examinations set by mathematics teachers were appropriate in determining whether the variables under study predicted mathematics achievement. Finally, that teachers' evaluation of students' mathematics achievement was objective.

1.8 Limitations of the Study

The population of the study comprised of form three students in public secondary schools in Nairobi County and therefore the results may not be generalized to other students in other counties. Another limitation was contributed by the fact that there could have been other defining factors such as school environmental conditions, staffing and school ownership that may make generalization of results among students in other counties and in private schools inappropriate. Other factors such as age may have affected generalization of the study findings to students in other levels of education. To cater for this, the researcher included the age variable in the demographic section of the research instrument. The research instruments were based on self-reporting of experiences which may have been prone to biases. To cater for this, the researcher assured the participants of confidentiality. Mathematics achievement was based on teacher evaluations over a period of three consecutive terms which may have been inconsistent due to factors such as teacher attrition. The researcher however, obtained the mean score for three consecutive terms in an attempt to eliminate bias and inconsistencies.

1.9 Delimitations of the Study

Although mathematics achievement may be influenced by many factors like students' intellectual ability, negative peer influence, school climate among others, this study only focused on three variables, that is, academic motivation, academic self-concept and academic resilience. Additionally, poor achievement is not only reported in mathematics but in several other subjects. The study however focused on

mathematics because it is compulsory in the two basic levels of education and lays a foundation for most science and science related courses at the tertiary level thus making it compulsory for entry into these courses. A questionnaire was used in the study which included close-ended Likert scale responses instead of open-ended responses which could have gathered more information. Further, the study singled out students to participate in the study while leaving out others like teachers and school administrators who may have had an understanding of causes of low mathematics achievement.

1.10 Significance of the Study

The findings from this study may add to existing literature on the role of academic motivation, academic self-concept and academic resilience in predicting mathematics achievement. The Ministry of Education may use the findings to develop policies that may promote improvement on students' self-concept, motivation and academic resilience in mathematics.

Furthermore, the findings may be an eye opener for school administrators and parents to see the need to create an appropriate school environment that nurtures the appropriate academic self -concepts, drive to achieve and the ability to handle school challenges.

Moreover, findings from this study might give rise to a better way of comprehending students' academic motivation and academic self-concept. Students may realize the

importance of the appropriate academic motivation, academic self-concept and academic resilience in enhancing mathematics achievement. Improved achievement in mathematics will enhance students' chances of pursuing science related courses at the university and in middle level colleges. Lastly, the findings may be useful to teachers who may realize the need to enhance students' academic motivation and academic self-concept.

1.11 Theoretical Framework and Conceptual Framework

The study was guided by two theories; Self-determination Theory (Deci & Ryan, 2000) and Flach's Theory of Resilience (Flach, 1989).

1.11.1 Self-determination Theory (Deci & Ryan, 2000)

The Self-determination Theory (SDT) highlights the importance of the psychological need for autonomy in a student's behaviour. According to the theory, educational outcomes such as academic achievement rest on the drivers of task motivation. Students whose task motivation is self-determined are highly likely to report greater levels of academic attainment as opposed to those whose task motivation is controlled. The theory proposes three types of motivation reflecting different levels of self-determination; intrinsic, extrinsic and amotivation. Intrinsic motivation is the most self-determined form of motivation and it occurs when an individual develops an internal desire to follow up an activity for the joy and satisfaction acquired from it. Students who are intrinsically driven to achieve may most likely rate high in academic achievement and are likely to persist in the event of academic challenges.

This is reflected in a student's perceived probability of success, the level of interest and confidence in learning. Extrinsic motivation involves putting effort in an activity because of the positive consequences rather than for its intrinsic qualities and it is shaped by factors like rewards and punishments. Students will find learning tasks relevant because of the rewards and feedback that they receive. Amotivation refers to the absence of motivation or lack of interest in learning. A student who is amotivated has no reason to attend school and suffers from learned helplessness. The theory asserts that individuals act based on their thoughts, goals, beliefs and values, and that people's levels of motivation, their feelings and their behaviours are based more on what they believe rather than what is absolutely true.

Applied to this study, the theory suggests that a student's motivational orientations for the academic domain may determine the perceived probability of success in mathematics, the amount of interest dedicated in learning mathematics and the level of satisfaction following feedback after mathematics exams. More precisely, when students' motivation is controlled, or when they lack any kind of motivation, they are more likely to lose interest in the academic domain, lack confidence and fail to associate mathematics with any relevant outcomes. The study aimed at establishing the level of motivation among students in the population of study and how it may predict their mathematics achievement. This theory was suitable for this study because it addressed the link between academic motivation, academic self-concept and mathematics achievement.

1.11.2 Flach's Theory of Resilience (Flach, 1989)

The theory states that resilience is made up of the psychological strengths to successfully go about change. The theory is based on the law of disruption and re-integration which means that the act of falling out of place or being disturbed by change is an important part of learning to cope with stressful events in life. Disruption removes individuals from their own personal homeostasis. Since people are unique, they have different levels of disruption they can manage.

Disruption is an unpleasant experience and even painful and as such, individuals are forced to adapt to meet the new challenges or develop coping mechanisms. Re-integration depends on the traits that an individual possesses. Some of these traits include academic self-perceptions, drive to excel academically and the ability to handle school challenges and negative feedback in mathematics.

In the context of this study, disruption in the life of a student may be caused by academic setbacks, negative feedback from teachers, study pressure and any other challenge in the school setting. These challenges may interfere with a student's personal homeostasis. Different students will manage the disruption differently. Those who are strong or academically resilient will discover new coping mechanisms and re-organize their perspective on school life. Such students may try to regain their equilibrium by using various problem-solving skills. This may enable them to survive and excel even in the face of challenges. A student may thrive in challenging situations depending on the relationship between his/her personal factors and the type

of environment in which s/he is in. This theory was suitable for this study since it addressed the link between academic resilience and mathematics achievement. It is important to note that two theories were used in the study because the three variables were used in predicting mathematics achievement though they are explained in different theories. Therefore, the two theories were applicable in the study.

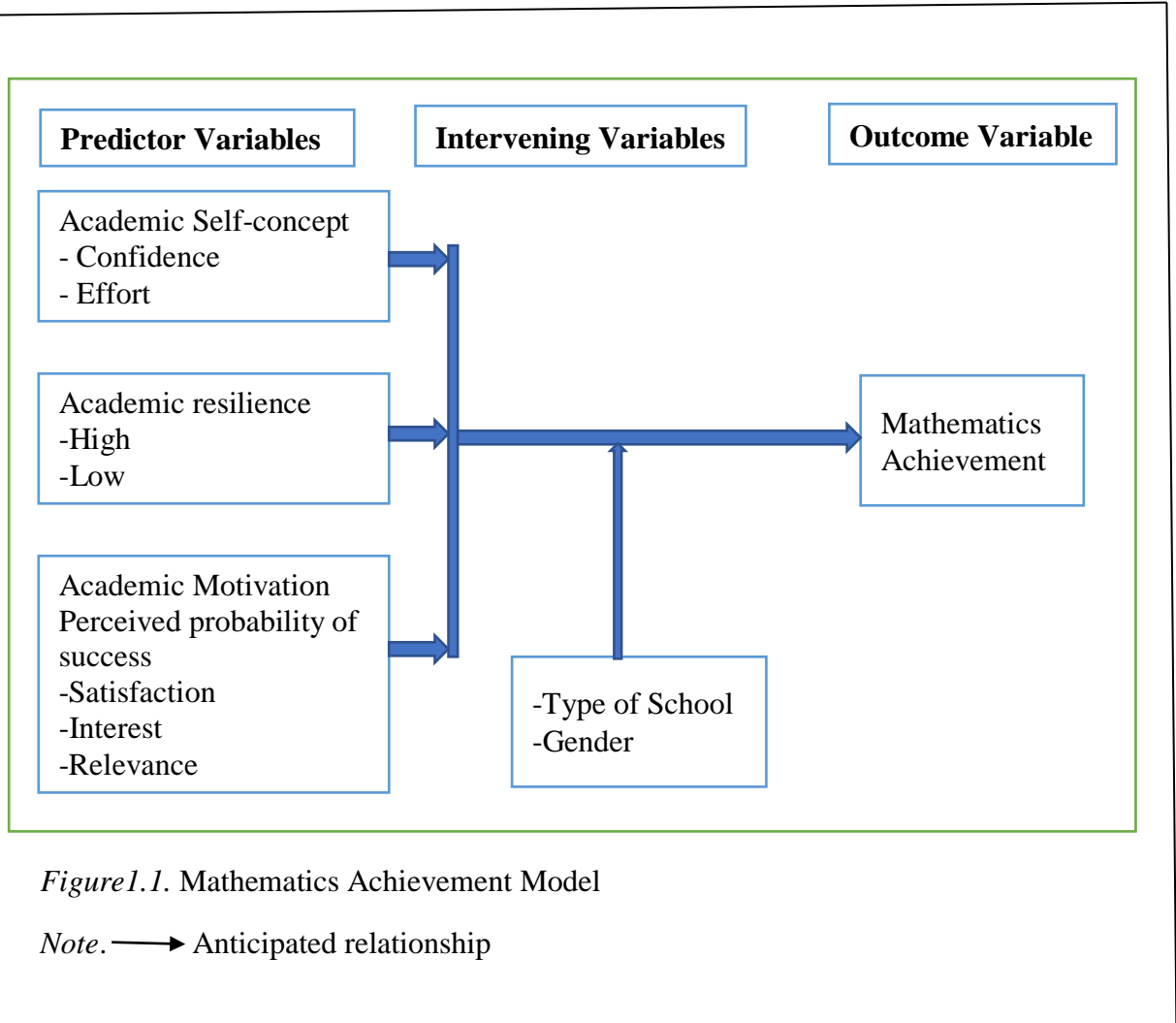
1.12 The Conceptual Framework

In this study, the predictor variables were academic motivation, academic self-concept and academic resilience. It was hypothesized that academic self-concept, academic motivation and academic resilience may influence mathematics achievement. Further, students who have a high level of academic self-concept may express a lot of confidence while solving mathematical problems and also put a lot of effort while preparing for mathematics exams. In addition, those students whose motivation is self-determined are likely to portray a high perceived probability of success, show satisfaction and interest in mathematics and also find the learning and high achievement in mathematics relevant for them. In the event of negative feedback from teachers or pressure to get better grades in mathematics, the academically resilient students may bounce back and press on for better grades.

Academic self-concept, academic motivation and academic resilience may jointly work together to influence mathematics achievement. Students may possess a high level of academic self-concept, be academically motivated, but without the appropriate level of academic resilience, mathematics achievement may not be high. Therefore, the three variables should be present for better mathematics achievement. On the same note, differences in gender and type of school could also contribute to

differences in the influence of the predictor variables and mathematics achievement.

The relationship between and among the variables is as shown in Figure 1.1



Source, Researcher (2016)

1.13 Operational Definition of Terms

Academic motivation: A student's desire/drive to excel that is reflected in the level of approach and interest regarding mathematics. In the study, it was measured at the interval scale as a total score of all the subsets of the domains of academic motivation.

Academic resilience: This is the students' ability to acknowledge and positively cope with a drop in mathematics achievement, negative feedback, and study pressure in the school setting over time. In the study it was measured at the interval scale as the total score of the items in the academic resilience questionnaire at the interval level.

Academic self-concept: This refers to a student's perception of his/her academic ability in mathematics. In the study, it was measured at the interval scale as the total score of the two domains of confidence and effort.

Confidence: This refers to the feeling that a student has in relation to his/her ability in mathematics. In this study, it was measured as a subset of academic self-concept.

Effort: This refers to the amount of physical and mental energy dedicated to the study of mathematics. In this study, it was measured as a subset of academic self-concept.

Interest in learning mathematics: This is the drive or desire to engage in mathematical tasks. In this study, it was measured as one of the sub-sets of academic motivation.

Mathematics achievement: This refers to the mean grade obtained in mathematics over the period of form two end of term 2 and 3 and form three end of term one (2016) in mathematics examination.

Perceived probability of success: This is the extent to which students expect to succeed in learning mathematics. In this study, it was the mean score of the responses on the ten items measuring the construct as a domain of academic motivation.

Relevance: This is the degree to which learners view mathematics content as significant and useful for them. This was measured as a domain of academic motivation and was the mean score of the eight items measuring the construct.

Satisfaction: This is the learners' psychological perception in a mathematics learning situation resulting from the provision of rewards and feedback. This was given as the mean score of the six items measuring the construct in the academic motivation questionnaire.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter reviews literature on the relationship between academic self-concept and mathematics achievement, the relationship between academic motivation and mathematics achievement, the relationship between academic resilience and mathematics achievement and the predictive levels of academic self-concept, academic motivation and academic resilience in mathematics achievement. Differences across gender and type of school in the predictor and outcome variables are also reviewed.

2.2 Prediction of Academic Self-concept on Mathematics Achievement

Academic self-concept may or may not predict mathematics achievement. Studies on the connection between academic self-concept and mathematics achievement report contradictory findings. On the one hand, some studies report positive correlation while others have found no correlation. For instance, in a study among 245 pupils in junior school in Spain by Sanchez and Roda (2003), academic self-perceptions, mathematics performance and verbal ability were found to be positively correlated. Data were collected using the self-description questionnaire testing their scholastic performance through marks assigned by their teachers. The students' performance was derived from teacher evaluations. Data were analysed using Pearson Product Moment Correlation co-efficient.

A number of factors influence self-concept. These factors may influence a student's achievement in various subjects. Ishak, Jamaluddin and Chen (2010) studied students' self-concept among high school adolescents in Malaysia. Data were collected from 1168 students, 618 males and 558 females who had been randomly selected. A 17-item questionnaire adapted from various self-concept scales was used to measure the students' self-concept. Data were analysed using SPSS and exploratory analysis was carried out to determine the factors influencing the self-concept. Findings indicated that some external factors affected their self-concept which later led to an improvement in achievement in all other subjects. These findings also revealed that students with a high self-concept felt that with proper effort, they could excel in their studies while those with low self-concepts had doubts in their academic abilities. The current study considered the prediction of mathematics achievement based on the interaction of other constructs other than self-concept alone and drew a sample from a different context; form three students in Nairobi County.

In another study, Ajogbeye (2010) investigated mathematics achievement among secondary school students in Ekiti, Nigeria. The study aimed at investigating self-concept as a predictor of mathematics achievement of secondary school students. The sample comprised of 205 girls and 245 boys who had been randomly selected from eight public schools. Multiple regression analyses were computed at .05 significant levels. The findings indicated a positive and significant relationship between academic self-concept and mathematics achievement. Further analysis revealed that self-concept measures could moderately predict mathematics

achievement. This study looked at self-concept only whereas the current study investigated additional factors that combine to predict mathematics achievement. These were academic motivation and academic resilience.

Related findings were reported by Osei (2014) using a sample of 120 high school students from four schools; two urban and two rural schools in Ghana. This sample was selected using stratified random sampling technique. Data were collected using the school motivation inventory and the self-concept scale. Data analysis was performed using percentages and Pearson product moment correlation. The results indicated that a large number of students are highly motivated, have a high self-concept and perform well in mathematics. Further analysis showed that students with high self-concept perform better in the mathematics achievement test and aim to pursue mathematics related courses upon admission to higher institutions of learning. The current study used a sample of secondary school students in a different environment so as to determine the prediction of academic self-concept on mathematics achievement. This is because the environment may lead to differences in the academic self-concept.

The relationship between mathematics achievement and the self-concept may have reciprocal effects. For instance, Martin and Koller (2004) carried out a study using a longitudinal survey which involved seventh grade Germany students to investigate the relationship between self-concept and mathematics achievement. The total sample comprised of 4047 high school students. Data were gathered using the self-

concept questionnaire and subjected to a multiple regression analysis. Their findings correlate to the reciprocal effects model that earlier self-concept and earlier achievement have significant effects on latter self-concept. Further findings indicated positive reciprocal relationships between mathematics achievement and mathematics self-concept and negative implications on German self-concept, while achievement in German means positive effect on German self-concept but negatively impact on mathematics self-concept. It was thus necessary to establish if the reciprocal effects of academic self-concept and mathematics achievement applied in the area of study.

Interestingly, Tsung and Chin (2008) established that a student may have a high self-concept in one subject leading to high scores in that subject but negatively affect achievement in another subject. The two conducted a study on the connection between students' academic self-concept and academic achievement. They used a sample of 5690 Taiwanese eighth graders participating in a programme. They came up with a model which indicated that students who rated high in academic self-concepts allocate plenty of time and energy in the subject they perform best. Consequently, the time spent studying other subjects decrease and they end up performing poorly in those subjects which might in turn affect their self-concepts in those subjects. Data for this study were analysed through structural equation modelling. The current study was different because it focused on self-concept and one subject that is, mathematics and a comparative analysis of how that affects other concepts such as academic resilience and academic motivation.

Mathematics self-concept may be an important factor in the achievement of the subject. This may be influenced by the grade level. Research reports no relevant relationships between the two. One such study that employed a relational design to understand the relationship between students' mathematical self-concept and their grade level among 281 primary school students in Turkey, Erdogan and Sengul (2014) found no statistical correlation between mathematical self-concept, grade level and mathematics achievement. Data were collected using the self-description questionnaire by Marsh (1992) which was adapted into Turkish. Data analysis was done using ANOVA and independent sample t-test. Further analysis revealed that as grade level increases, the mathematics self-concept level decreases. The current study used a different questionnaire to measure the academic self-concept (Liu, Wang and Parkins, 2005) and the correlational research design.

Similar findings are reported by Osei (2014) in his research from data gathered from the trends in international mathematics and science studies. Data were collected from 1900 students in East Asian countries where science and mathematics achievement at student and school levels and self-concept at the student level were the variables under investigation. Confirmatory factor analysis was used to examine the measurement model while multilevel path analysis was used to verify the hypothesized influences of the variables at different levels. Although academic self-concept has been reported to be positively correlated to mathematics achievement, it does not seem consistent with the results presented by these East Asian students from Taiwan, Japan and South Korea in this study. Further the same study revealed that students who have high academic achievement express low self-concepts.

Additionally, the results indicated that although the relationship between mathematics/science school achievement and mathematics/science self-concepts were negative, the relationship was not significant. This study was carried out with samples drawn from primary schools. The current study drew samples from secondary school students, used a different method of data analysis and explored additional factors that may predict mathematics achievement.

The findings by Osei (2014) are echoed by Zahra, Arif and Yousuf (2010) in their study in which they sought to investigate whether categories of self-concept among students correlate to their academic achievement. In this study, a sample of 1500 female university students in Islamabad was used. The sample was selected using two stage cluster sampling technique while data were collected using questionnaires. The self-descriptive questionnaire by Marsh (1992) was used to collect data on self-concept. Factor analysis and Kendalls-Tau-b revealed that physical and social self-concepts were not related to academic achievement but the connection between academic self-concept and academic achievement in all subjects was found to be significant, but with a weak correlation. The current study drew samples from secondary school students, used both male and female participants and focused on academic self-concept and mathematics achievement.

Though these studies provide significant findings, they were carried out in Western and Asian countries while others give contradictory findings concerning the connections between academic self-perceptions and mathematics achievement. It was thus important to establish the nature of the relationship in another context among

secondary school students in Nairobi County and focus on mathematics which had been reported as having registered low achievement in consecutive years.

In Kenya, studies have found a positive correlation between academic self-concept and achievement. For instance, the relationship has been reported from students in special schools. Murugami (2002) conducted a similar study in which she examined the relationship between students' beliefs of control over their school experiences and their self-concepts. The sample comprised of 162 secondary school students drawn from 3 special schools in Central province. The semantic differential scale was used to measure self-concept. Multiple regression analysis revealed that students with special needs have positive perceptions of themselves which make them put a lot of effort in their studies. The results further revealed a significant positive correlation between academic achievement and self-concept. The current study obtained students participants from regular schools and the study locality was different- that is Nairobi County.

Further, the grade level of study may also be an important factor in the relationship between mathematics achievement and academic self-concept. This is reported by Kwena (2007) in a study on factors that influence academic performance among primary school pupils in Bondo District. Kwena found the relationship between academic self-concept and academic achievement to be significant and positive. The sample consisted of 972 pupils (497 males and 475 females). The study focused on three classes (6-8). Data for academic self-concept were collected using academic self-concept ladders while questionnaires were used for other factors. This study was

carried out among primary school students from a rural set up and considered academic achievement in all subjects. This limited the possibility of generalization of results to students in secondary schools as well as to primary school pupils in an urban environment. The present study drew a sample from high school students in an urban setting and explored other factors like academic motivation and academic resilience that independently predict mathematics achievement of secondary school students in Nairobi County.

Similarly, in a study by Macharia (2011) using a sample of 150 students, a positive and significant correlation was reported. The study examined the factors that influence academic self-concept and academic achievement among secondary school day students in Gatundu Division. Data were collected using Kumar's academic self-concept scale (1998). The study was carried out among day secondary school students. Data analysed through descriptive statistics revealed that the students had a low academic self-concept which subsequently lowered their academic achievement. This study focused on day secondary school students only and did not consider other factors that may influence academic achievement. Generalization of the results may not be appropriate since the study was carried out in one Division. The current study therefore, focused on students from all categories of public secondary schools and a larger sample was used. In addition, this study used a different instrument to measure students' mathematics self-concept.

Though these studies provide valuable data on the relationship between academic self-concept and achievement, they have not specifically narrowed down to

mathematical self-concept and mathematics achievement. Similarly, the studies do not focus on other factors that predict academic achievement for instance academic motivation and academic resilience which were considered in the current study. The studies focus on general academic achievement while the current study focused on achievement in mathematics since students may perform differently in different subjects. This created a need to investigate whether there was a relationship between mathematics self-concept, academic motivation, students' ability to withstand school challenges and mathematics achievement of secondary school students.

2.3 Prediction of Academic Motivation on Mathematics Achievement

It is important to determine whether academic motivation predicts mathematics achievement. Research done on the interaction between academic motivation and mathematics achievement reports mixed findings. Areepatamannil (2014) carried out a study to examine relationships between academic motivation and mathematics achievement among 363 Indian adolescents in India and 355 Indian adolescent immigrants in Canada. Data were collected using the academic motivation scale, high school version. Hierarchical multiple regression analysis did not reveal any statistically significant relationship between the three types of motivation and mathematics achievement. Contrastingly, both intrinsic and extrinsic motivations were significantly correlated to mathematics achievement. Interestingly, while intrinsic motivation was found to have a significant negative relationship with mathematics achievement, amotivation and performance in Mathematics were not statistically significantly related while extrinsic motivation was found to have a

significant positive relationship. The study focused on the three types of motivation and their influence on mathematics achievement. The current study however, looked at the predictive value of each of the four different domains that was used to measure academic motivation as well as their predictive value when they act collectively.

In a different location, George (2012) carried out a study to establish the relationship between academic motivation, academic self-concept and academic achievement in mathematics and English. The study adopted a correlational research design using a sample of 311 Ugandan high school students selected through census sampling technique. Data were gathered through the use of a standardized self-administered close ended structured questionnaire for all the variables. Multiple regression analysis established a significant negative relationship between academic motivation and academic achievement; all indicators of academic motivation that is, mastery, performance and social support revealed a significant negative relationship. This contradicts earlier studies already discussed that reveal a positive relationship between academic motivation and academic performance. This necessitated a similar study to establish the nature of the relationship between academic motivation and mathematics achievement.

The relationship between academic motivation and mathematics achievement may be positive. In a study to investigate the role of parental support in academic motivation and persistence in mathematics, Shukla, Tombari, Toland and Fred (2015) found a positive correlation between parental support and persistence in mathematics. In their

study, the sample comprised of 1534 ninth grade students attending three ethnically different schools in the US; 53.60% White, 20.20% African American, 9.20% Hispanic/Latino, 3.60% Asian/Pacific Islander, 50.00% American Indian, and 6.80% Other. Gender distribution was as follows: 40.00% of the sample was male, 37.50% of the sample was female, and 22.50% of the sample did not indicate their gender. The age of participants ranged from 13 to 18 years with 94.40% of the sample being either 14 or 15 years of age at the time of the survey. Data were collected using the academic motivation scale. Structural equation modelling revealed a significant and positive relationship between students' parental support, academic motivation and persistence for mathematics in the classroom. The researchers concluded that encouraging students to be persistent in learning mathematics may eventually raise their mathematics grades.

In a study by Maria, Monteiro and Peixoto (2012), the relationship between motivation and attitudes towards mathematics was found to be positive and significant. The three in their study investigated how some different but interrelated variables such as home background, motivation and social and emotional support could explain students' attitude towards mathematics. The sample consisted of 1719 Portuguese students; 869 boys and 850 girls from fifth to twelfth grade. Data were collected using the intrinsic motivation inventory to assess the determinants of intrinsic motivation. The results revealed that generally, students hold positive feelings towards mathematics. A hierarchical analysis using structural equation modelling showed that variables related to motivation were the main predictors of

students' attitudes towards mathematics. Further analysis revealed that younger students were more motivated as compared to older colleagues. Similarly, students with low marks presented lower scores in motivation. The current study sought to establish the relationship of the four domains of academic motivation singly and jointly and mathematics achievement.

Both intrinsic and extrinsic motivation may impact on mathematics achievement. In India, Ayub (2010) investigated the relationship between intrinsic and extrinsic motivation on the mathematics achievement of college students. The sample comprised of 200 students (100 males and 100 females) obtained through random sampling. The age of the respondents ranged between 18-21 years from middle and high class social categories. Data on mathematics achievement were gathered using a researcher-constructed questionnaire. Results of regression analysis performed on the data showed that motivation and academic achievement in mathematics were significantly related and that both intrinsic and extrinsic motivation count in mathematics achievement. The current study sought to establish whether these findings would be applicable in a different environment and level of education. It also focused on other variables that may singly or in combination with academic self-concept and academic resilience predict mathematics achievement.

The study by Salami (2000) examined achievement motivation and academic engagement of students in the Nigerian classroom. In the study, the sample comprised of 540 high school students aged between 13-15 years from four urban schools in Nigeria who filled in an achievement motivation and academic

engagement questionnaire. Analysis of variance and t-test revealed a significant relationship between achievement motivation and students' academic achievement in all subjects. The results also indicated that students who rated highly on the achievement motivation scale had higher scores as compared to those who rated lowly. This study focused on all subjects as opposed to the current study that focused on a single subject that is, mathematics to enhance precision while making it possible for generalization of findings.

Tella (2007) reported similar findings after carrying out a study on the impact of motivation in students' academic achievement and learning outcomes among secondary school students in Nigeria. In the research, an ex post facto design was used with a sample of 450 students drawn from ten public secondary schools using random sampling. Motivation towards academic performance questionnaire was used to collect data. Data were analysed using t-test and ANOVA while hypothesis were tested at $\alpha = .05$ significance level. Findings of the study revealed differences in academic achievement based on motivation levels. High academic motivation was found to be positively correlated to high academic achievement. This study investigated academic motivation only while the current study investigated academic motivation and other factors that predict mathematics achievement. Additionally, while the reviewed studies focused on general academic achievement, the present one emphasized on mathematics achievement. This is due to the fact that students may exhibit varying levels of motivation towards different academic subjects hence the significance of motivation as a predictor of achievement was captured using a single subject.

Studies in Kenya show that intrinsic motivation and academic achievement are highly correlated. Mutai (2007) studied factors that contribute to learning and performance in mathematics. The study adopted a descriptive survey design. The sample comprised of 359 students from six secondary schools in Bureti District. Data were analysed using percentages and Pearson product moment correlation. The findings revealed that students underperform in mathematics due to lack of confidence, motivation and interest in the ability to learn and excel in mathematics. Strangely, 56.00% of the students strongly agreed that they loved learning mathematics, 49.00% of the students agreed they would prefer to pursue mathematics related courses after school while 70.00% agreed that mathematics was very useful in day to day life (Mutai, 2007). It was necessary to establish the factors that may contribute to mathematics achievement in a different location which in this case was Nairobi County.

In another study on the link between academic motivation, self-regulated learning and academic achievement, Mutweleli (2014) reported that intrinsic motivation had the highest predictive value on academic achievement. The sample consisted of 938 high school students. An ex post-facto research design was adopted. Data were collected using the high school academic version for academic motivation and the self-regulation questionnaires. Of the domains of academic motivation used in the study, intrinsic motivation towards achievement was found to have the highest predictive value of academic achievement while organizing strategy for self-regulation had the highest predictive value of academic achievement.

In conclusion, though the above two studies show the relationship between motivation and achievement, they did not include academic resilience and academic self-concept which have also been reported to predict mathematics achievement. Further, the studies focused on general academic achievement. It was therefore necessary to refine the relationship further by focusing on a single subject. The current study narrowed down the scope of investigation to examine whether academic motivation predicted mathematics achievement.

2.4 Prediction of Academic Resilience on Mathematics Achievement

Academic resilience has been reported to be paramount in students' academic achievement. Lee (2009) established the impact of resilience on the academic achievement of at-risk students in the upward bound programme in Georgia. The sample consisted of 200 (100 males and 100 females) participants who were all at-risk students from both rural and urban communities in Georgia. The study adopted a descriptive design and data were analysed using Pearson product moment correlation coefficient. The findings revealed that the at-risk students were highly resilient which positively related to their GPAs. Urban participants were found to be slightly more resilient than their rural counterparts. This study concentrated on at-risk students and did not focus on other factors that may also influence academic achievement. The current study focused on students from all socio-economic backgrounds and specifically targeted mathematics achievement since students perform differently in different subjects depending on their perceptions of the particular subject.

This relationship is also examined by Falcon (2010), who investigated the link between students' ability to withstand school pressure and challenges and academic achievement among 150 (70 males and 80 females) Latino high school students from a low socio-economic background in Chicago. This sample had been drawn from students in ninth, tenth, eleventh and twelfth grade. The study adopted a quantitative cross-sectional design. Data were collected using the Resilience scale for children and adolescents and analysed using Pearson product moment correlation. The results revealed a significant relationship between academic resilience and mathematics achievement. This study was carried out in the western world and thus, it was necessary to carry out a similar study in a developing country, such as Kenya so as to establish the nature of students' academic resilience where academic setbacks might be different due to unavailability of support systems in schools unlike in the western world.

In a study to examine institutional factors that affect mathematical achievement of African American females, Chatman (2011) adopted a single embedded descriptive case study focusing on a middle school which had a population of 400 students. This sample was selected using a purposeful criterion based selection. Data were collected using individual students' grades records, observations and interviews. The findings established that factors such as persistence and confidence were essential for better performance in mathematics. The current study adopted a different research design and considered other factors that also predict mathematics achievement in a different contextual environment.

Further, Zhaomin (2014), in a study of the relationship between academic resilience and mathematics achievement, examined black and Hispanic sixth, seventh and eighth grade students who attended an inner city middle school. The sample comprised of 398 students. Data were analysed through confirmatory factor analysis. Results indicated that the resilient students scored above the 90th percentile on standardized achievement tests over a two-year period. The students who had poor coping skills from the same group scored at or below the 10th percentile on the same mathematics achievement tests over the same period. The resilient students were found to be much more motivated and satisfied with their mathematics classes as compared to their non-resilient counterparts. The findings were based on students from a single school using standardized testing over a period of time. The current study however established the influence of resilience on mathematics achievement among students across different types of schools basing achievement on the regular evaluations per school.

In a similar study Zhaomin (2014), evaluated a model for academic resilience in mathematics and examined its relationship with students' performance. The study adopted a longitudinal approach using 2398 ninth graders selected from the lowest socio-economic status among Hispanic, African and American whites. Data were collected using the academic resilience questionnaire. The study purposed to establish the relationship between students' personal efficacy, coping skills and educational aspirations. Structural equation modelling suggested that academic resilience as represented by the three attributes significantly explained differences in

students' mathematics performance with self-efficacy and coping skills but not educational aspirations. This study explored just three factors that predicted mathematics achievement while there are many others. The current study examined academic resilience, academic self-concept and academic motivation as factors that predict mathematics achievement.

Ricketts (2015) carried out a study to investigate the relationship between academic resilience in students' perceptions in mathematics. The participants were 237 males and 279 females from a low-income urban school in the South Eastern United States. The study used the Rasch analysis where students were exposed to a pre-test and a post-test in mathematics. The participants completed the Academic Resilience in Mathematics Scale. The results indicated that there were significant differences between self-perceptions of academic resilience and mathematics achievement. Academic resilience was positively correlated with both pre-test scores and post-test scores indicating that academic resilience is a predictor of achievement in mathematics. The study was conducted among students from low-income urban schools and it focused only on academic resilience. It was therefore worthy investigating the role of academic resilience on mathematics achievement among economically diversified group of learners.

The study by Florez and Fernada (2015) investigated factors affecting academic resilience in middle school. This study explored risk and protective factors and their effect on academic outcomes. A sample of 6 students was drawn from a public

school in Colombia located in a marginalized and impoverished part of the city. Data were collected using document analysis and interviews with teachers and parents. Statistical analysis revealed that protective factors may be attributed to family guidance, support and meaningful involvement which when offered boosts academic performance. This was reported from the western world using students from a low socio-economic background and the sample comprising of six students only. This limits the generalization of the results. The current study was carried out in a different environment using students from all economic backgrounds and used a larger sample for the purpose of generalization of the results.

The relationship between individual resilience factors and their influence on academic success for Bermudian foster care adolescents is examined by Zuil (2016). In the study, resilience was measured using the resilience scale and the sample consisted of 51 students who attended public schools. Achievement scores and GPA were used to measure students' level of academic success. A non-experimental correlational design was used while data were analysed using multiple regression. Findings indicated a statistically significant positive relationship between resilience and reading achievement but no relationship between resilience and GPA and resilience and mathematics achievement. Based on earlier reports, this is contradictory and therefore called for investigation to establish if the relationship between mathematics achievement and academic resilience would be negative or positive in the population of study and possibly use the findings to recommend some measures to boost students' academic resilience.

Further, Khadijah and Mahmud (2007) carried out a study to determine the prediction of academic achievement from certain aspects of the classroom environment and resilience among female high school students in Tehran. The sample comprised of 374 students who had been randomly selected. Multiple regression analysis revealed that resilience and the level of perceived challenge significantly predicted students' academic achievement. It was necessary to focus on achievement in one subject so that educators may exactly understand how and where to assist students who report low grades in mathematics.

Research on academic resilience in Africa is sparse. A study by Khalaf (2014), using a sample of 100 university students in Egypt, indicated a statistically significant relationship between academic resilience and academic achievement. Data were collected using the academic resilience scale by Martin and Marsh (2006). Gender differences were found with males outdoing the females in levels of academic resilience. The minimal samples employed in these studies limited the generalizability of the findings since they used respondents from low socio-economic status. It was therefore necessary to establish whether academic resilience influenced mathematics achievement among a mainstream sample of secondary school students in Nairobi County.

In their study, Mwangi, Ireri, Kinai and Okatcha (2015) examined the relationship between academic resilience and academic achievement among secondary school students in Kiambu County, Kenya. The study adopted a correlational design and the

sample comprised of 390 form three students from public schools. Data were collected using a youth development module for measuring resilience. Findings using multiple regression analysis indicated a correlation between students' resilience and their academic performance which is positive and significant. The study focused on general achievement and resilience in three core subjects while the current study specifically investigated academic resilience and how it relates to mathematics achievement. Other variables that predict mathematics achievement were also included in the study.

2.5 Predictive Levels of Academic Self-concept, Academic Motivation and Academic Resilience on Mathematics Achievement

Studies on the inter-relationships among academic motivation, academic self-concept, resilience and academic achievement have provided inconsistent findings. However, students who underachieve have been found to have lower academic self-concepts, are not self-driven to excel, have poor self-management skills, are not goal driven and lack academic resilience as compared to high achievers. In the study by Ahmed and Bruinsma (2006) on the link between academic self-perceptions and students' motivation among 181 university students from Asia and Europe, academic self-concept and intrinsic motivation were found to be positively correlated. Data were collected using questionnaires for self-esteem, academic self-concept, academic motivation and academic achievement and analysed using structural equation modelling. Findings indicated a positive and significant relationship between motivation and academic self-concept. This study was conducted on university

students and it was therefore worth investigating if the same findings would be reported among secondary school students. Moreover, findings from the current study helped to determine whether academic self-concept and motivation was influenced by the level of schooling.

Further, Areepattamanil and Freeman (2008) carried out a study to examine the impact of psychological indicators such as academic self-concept and academic motivation on the academic achievement of immigrant and non-immigrant adolescents in Toronto secondary school students in Canada. The sample comprised of 573 students drawn through random sampling. Descriptive analysis revealed that, students who had relocated, performed better in mathematics, rated highly in the self-concept scale and did better in intrinsic and extrinsic motivations than the non-immigrants. Further, mathematics self-concept had a strong and significant correlation with mathematics GPA for both immigrant and non-immigrant adolescents. The findings also indicated that the environment may determine mathematics self-concept. It was thus necessary to establish the role of academic self-concept in mathematics achievement in a different environment which in this study was Nairobi County, Kenya.

Contradictory findings on the link between self-perceptions and mathematics achievement have been reported. The study by Ochse (2003) on 645 university students in China found that, students with low self-concepts achieved higher marks than those who overestimated themselves and had a higher self-concept. Data were collected using the self-concept questionnaire and analysed using multiple regression

analysis. This study examined interrelationships between students' self-beliefs, their expectations for success and academic excellence and found a negative relationship as opposed to earlier reports of a positive relationship. These contradictory findings called for further research using secondary school student samples from a developing country which was, in this case Kenya.

In another study, Arif and Yousuf (2010) examined the relationship between self-concept and academic achievement of female degree students from a university in Islamabad. Data were collected from 1500 students drawn using the two-stage cluster sampling technique. The self-description questionnaire was used to collect data on self-concept. Factor analysis and Kendalls-Tau-b revealed that physical and social self-concepts were not related to academic achievement while a significant but weak correlation was found between academic self-concept and academic achievement in all subjects. The current study investigated the nature of the relationship between academic self-concept and mathematics achievement using male and female secondary school students to determine whether there existed any significant gender differences in the predictor variables.

Additionally, Marzie and Mahsa (2014) examined the role of academic self-concept and academic motivation on students' academic achievement. The sample consisted of 300 first grade boys and girls from six public high schools in Iran. Academic motivation was measured using the academic motivation scale high school version. A Pearson correlation and hierarchical multiple regression analysis revealed a significant and positive correlation between academic self-concept and academic

motivation collectively and mathematics achievement. However, there was no correlation between academic motivation and mathematics achievement. It was considered worth to establish the nature of the relationship in a different location.

The study by Visi (2015) examined the relationship between students' academic self-concept, motivation and academic achievement using students from Payami Noor University in Iran. The sample consisted of 200 students selected using the multi-stage cluster sampling technique. Data were collected using the Herman Questionnaire of Achievement Motivation and the Delavar Questionnaire of Academic Self-concept. Descriptive statistics revealed a significant correlation between academic self-concept, academic motivation and academic achievement. This study also revealed a significant relationship between academic self-concept, academic motivation and academic achievement. However, the study was conducted using a sample of university students. The current study examined the relationships among the variables using samples drawn from secondary school students in Nairobi County. The study also considered academic resilience as a predictor of mathematics achievement in the population of study.

The relationship between mathematics and English achievement and students' self-concept is reported by Sikhwari (2014) in a cross-sectional study using University students in South Africa. This study examined the relationship between motivation, self-concept and academic achievement. The sample consisted of 193 (83 males and 110 female) participants gathered randomly from four departments in the University. The study adopted a cross-sectional survey design. Data were collected using a

researcher constructed questionnaire. Using the Pearson's product moment correlation, the data revealed a significant correlation between students' academic self-perceptions, desire to excel and overall academic performance. This study used a sample from university students while the current study drew its sample from secondary school students. Additionally, the study focused on academic self-concept and motivation while the current study considered the prediction of academic resilience on mathematics achievement.

To explore the relationship among academic motivation, academic self-concept and mathematics achievement further, Coetzee and Berg (2014) examined whether academic self-perception and the drive to excel among students undertaking a building and construction course at a University in South Africa could predict their academic achievement. The sample comprised of 318 male and female students selected through the use of non-probability convenience sampling technique. Data were collected using the self-description questionnaire by Marsh (1992) and the academic motivation scale by Vallerand, Pelletier, Blais, Brier, Senecal and Vallierers (1992). A non-experimental research design using descriptive survey was used. Multiple regression analysis revealed a significant correlation between academic self-concept, motivation and academic achievement based on the year of study. Again, these are findings from a sample of university students. Thus it was necessary to investigate the nature of the relationship using a sample of secondary school students.

Though cited studies provide necessary data concerning the interplay of academic motivation, self-concept and resilience, majority were carried out in other countries whose samples have diverse cultures. It was thus found necessary to carry out a similar study using a different sampling approach, students from a different environment and a larger sample of secondary school students to establish the nature of this relationship and find out the differences in mathematics performance.

2.6 Gender Differences in Academic Self-concept, Academic Motivation

Academic Resilience and Mathematics Achievement

Research on the link between academic self-concept, academic motivation, academic resilience and gender is inconsistent. Some studies have reported gender differences amongst the variables while others have reported no gender differences. The study by Agrawal and Kumar (2015) examined academic achievement and self-concept in relation to gender and type of school among students. Data were collected using a sample of 400 students (200 boys and 200 girls) drawn from rural and urban areas in East and North-East Delhi, India aged between 15-16 years. The academic motivation scale was used to collect data. Through the use of descriptive statistics, Pearson product moment correlation and t-test for independent samples, it was revealed that there was no statistical difference in the self-concept in terms of gender. Urban students were found to have better self-concepts as compared to rural students. In relation to this study, it was considered worth investigating gender differences in the population of study which was drawn from a different environment.

On the one hand, gender is positively associated with academic self-concept and achievement as reported by Visi (2015) who noted that males' mathematical self-concept produced higher mathematics achievement scores and that females' high level of self-concept led to higher verbal achievement. The sample had been gathered through multi-stage clustered sampling. Data were collected using the Delavar questionnaire of academic self-concept. The study adopted a descriptive correlational design. The results revealed that higher achieving girls expressed more confidence and future goals as compared to higher achieving boys.

In Africa, Cockburn and Cornelius (2000), in their study among 300 (150 boys and 150 girls) high school students in Swaziland, established that there was a significant relationship between gender and students' level of academic self-concept. The study adopted a correlational study design. Data were collected using a self-administered questionnaire and analysed using Pearson's correlation. The results indicated that boys outperformed girls in mathematics while girls outperformed boys in verbal skills. The current study sought to establish whether there were any significant gender differences in academic self-concept using a different analytical procedure and statistical test.

In a related study, Muchera, Dixon and Hartley (2010) investigated the perceptions of self-concept and actual academic performance in mathematics and English among high school students in Kenya. The sample comprised of 1990 (983 boys and 1007 girls) students from 1 boys high school and 1 girls high school aged between 14-18

years. The study adopted a correlational study design. The Pearson product moment correlation and t-test for independent samples revealed gender and grade differences in performance and academic self-concept. Girls performed better in mathematics while boys rated themselves higher in the self-concept measures. Again, this is contradictory since several research studies report boys performing better in mathematics as compared to girls. The contradictory results made the area worth investigating.

In a similar study, Makworo, Wasanga and Olely (2014) examined psycho-social factors that affect girls' academic performance in secondary schools in Kenya, Kisii County, Kenya. A descriptive survey design and a psycho-social skills instrument were used to collect data from a sample of 120 girls and 84 boys who had been randomly selected. Descriptive statistical analysis revealed that girls had a negative attitude towards school whereas 51% of the girls portrayed a negative academic self-concept which in turn affected their achievement in all subjects including mathematics. Though boys were respondents in this study their results were reported. This made it necessary to carry out a study that would compare both boys and girls on the basis of their academic self-concept and also in terms of their academic motivation and academic resilience.

In a different locality, Tsung and Chin (2008) sought to find out whether there are gender differences in academic self-concept, self-esteem and academic motivation of high ability Chinese adolescents. The study compared students from two schools: a

regular and a key school, using a sample of 208 tenth grade students randomly selected from both schools aged between 12-16 years. Data were collected through self-report in questionnaires. The Pearson product moment correlation and t-test for independent samples revealed that boys from the regular schools had higher verbal self-concept. Contrastingly, findings from the key school revealed no differences between boys' and girls' mathematics self-concept. It was thus found necessary to establish whether gender differences existed in mathematics self-concept using students from Africa, Kenya and more so in different categories of schools in the population of study.

In a similar study, Ghazvini (2011) examined gender differences in various cognitive and motivational variables like locus of control, academic self-concept and learning strategies of high school students in Tehran. The sample consisted of 363 college students in year 1-3 who had been randomly selected. Data were collected using questionnaires for all the variables. Statistical analysis and independent t-test samples revealed that girls had a higher self-concept and internal locus of control in literature while boys had a higher self-concept in mathematics. These results were worth further investigating using a different population of study to establish if gender differences existed in mathematics achievement for boys and girls.

Further, Matovu (2012) examined academic self-concept and academic achievement of university students. The sample consisted of 394 male and female university students drawn from different years and faculties in a public university in Malaysia. Data were gathered using a questionnaire by Liu and Wang (2005) for academic self-

concept and analysed using MANOVA. The findings indicated a significant relationship between gender, academic self-concept and academic achievement across the faculties of arts and sciences. A Post hoc analysis further revealed significant differences in the interaction of gender, departments and years of study between the faculties of Arts and Sciences. Hence, it was worth establishing if gender differences existed in the variables under study using a sample of secondary school students.

In a study conducted in Nigeria by Mnyandu (2001) on the effects of gender and mathematics ability on academic performance of students, it was established that there were no significant difference in the performance of male and female students in chemistry. The sample consisted of 200 (100 boys and 100 girls) high school students who had been randomly selected. Data were collected through the use of questionnaires and analysis of teacher evaluations. The study concluded that gender did not have any significant effect on the academic performance of students. These contradictory findings called for further investigations. The current study used a different population to establish whether gender differences in mathematics achievement existed.

Studies on gender differences in academic motivation remain inconclusive. In their study Bugler, McGeon and Thompson (2015) examined gender differences in academic motivation of adolescents and their interactions in the classroom. The sample consisted of 750 students (384 boys and 366 girls) aged between 11-16 years from the UK drawn from five secondary schools. The students completed a

questionnaire on academic motivation. Statistical regression analysis and t-test for independent samples revealed that girls had higher academic motivation as compared to boys. Further analysis indicated that girls' motivation was a better predictor of their classroom behaviour. The current study focused on other variables that predict mathematics achievement together with academic motivation while considering the different sub sets of academic motivation independently and also collectively.

Rusillo and Pedro (2004) in their study of 285 females and 236 males in Spain found that male students had greater extrinsic motivation and were more likely to seek positive judgments and avoid negative ones as compared to female students. The two investigated the role of motivation on academic achievement. The age of the participants ranged between 14-18 years. Data were gathered using the academic motivation scale high score version and t-test independent samples used to test for gender differences. However, the two groups did not show significant differences in the levels of their intrinsic motivation. The current study focused on four domains that measure academic motivation other than just intrinsic motivation. In addition to this, the current study employed a one subject approach to enhance precision.

Contrastingly, Amrai, Motlagh and Zalani (2011) in their study of 146 males and 172 females in high school students in Saudi Arabia found significant gender differences with females performing better than males in language and in mathematics. The three studied the effects of gender on academic achievement. Data were collected using the academic motivation questionnaire for high school students by Vallerand et al. (1992). The results revealed that girls portrayed a higher academic motivation as compared to boys. It was thus necessary to establish whether

gender differences in academic motivation and mathematics existed in the population of study.

Further, Koseoglu (2013) in his study of 729 males and 721 female students from a university in Istanbul, Turkey found that girls had lower levels of extrinsic motivation and performed better in language arts as compared to boys. The study adopted the exploratory study design. Data were gathered using a researcher-constructed questionnaire for academic motivation and analysed using Pearson product moment correlation and t-test for independent samples. Further, the study did not find any gender differences in students' academic self-perceptions, intrinsic motivation and performance in mathematics. This study used a sample of university students making it necessary to establish whether the results were valid for other levels of education. This necessitated the current study using a sample of secondary school students.

The study by Shekar and Devi (2012) examined gender related differences across academic majors on achievement motivation among college students. The sample consisted of 80 undergraduate students of various colleges in India. T-test analysis reveals significant gender differences in achievement motivation of college students. This sample was drawn from college students unlike the current one that was drawn from high students considering the fact that academic motivation may change with age. These contradictory positions in the literature called for further research to establish whether there were gender differences in motivation and mathematics achievement.

Besides, Marzie and Mahsa (2014) examined the links among academic self-perceptions, drive to excel and students' academic achievement in a correlational study. The sample consisted of 300 (150 boys and 150 girls) year one boys and girls high school students from Iran. Academic motivation was measured using a scale by Vallerand et al. (1992) high school version for academic motivation. Statistical regression analysis revealed no relationship between academic motivation and academic achievement while the relationship between academic self-concept and academic achievement was reported to be significant and positive. There were no significant gender differences reported in the variables under investigation. The current study focused on mathematics achievement because when looking at overall academic achievement it may be difficult to point out which of the subjects brought the mean score down for each student. Using one subject, precision was more defined thus the factors and their roles were easily established. Further, the influence of academic resilience on mathematics achievement was considered.

Gender differences are also reported by Lee (2016), who established why female students are top in a class. This study was conducted by Leeds Metropolitan University in the UK. The sample consisted of 1534 students aged between 16-18 years. Preliminary regression analysis showed that the relationship between resilience and academic performance was similar across all academic levels. Further independent t-test analysis revealed that there were gender differences in favour of males and that female students with high resilience levels are likely to perform better than their peers. This being a sample of university students, it was worth to carry out investigations using a sample of secondary school students to establish if any

significant gender differences existed.

The study by Mousavi and Askari (2010) on a sample comprising of 276 male and female students of Shiraz University in Persia indicated a significant relationship between academic resilience and academic achievement in favour of girls in English but not in mathematics. Data were collected using a self-constructed questionnaire for academic resilience and analysed through independent t-test samples. Findings indicated that boys rated high in academic resilience in mathematics while girls were better in the languages. Thus, it was necessary to establish if gender differences existed if any in the population of study. In addition, Zuil (2016) revealed age and gender effects on resilience in children and adolescents. He carried out a survey among 1109 male and 1163 female students in a public school in Bermuda to assess students' self-perceptions of resilience. Data were collected using the California Kids Survey Resilience Scale. Statistical independent t-test analysis revealed that female students had higher levels of help-seeking behaviours, more positive connections with parents and likely to be more resilient as compared to their male counterparts. The current study aimed at establishing whether academic resilience influenced mathematics achievement. It also investigated gender differences in academic resilience.

Results of a study by Khalaf (2014) revealed significant gender differences in favour of males. This study was undertaken to establish the validity of the academic resilience scale. The sample comprised of 100 fourth year students (57 males and 43 females) from Minia University in Egypt. Data were collected using the academic

resilience scale by Martin and Marsh (2006). The findings revealed that boys rated higher than girls in the domain of academic resilience. The participants in this study made it necessary to establish the case among other levels of education. In this study, the participants were secondary school students.

Similarly, Abukari and Laser (2013) examined differences in risk and protective factors for academic outcomes of Ghanaian youths. The sample consisted of 276 youth from four colleges aged between 16-19 years. Data were collected using researcher constructed questionnaires. T-test and regression analysis revealed significant gender differences in resilience. Female students who were resilient performed better academically as compared to the males. The current study aimed to find out if gender differences existed in the population of study and focused on one subject which was mathematics. Further, the sample was drawn from students of all socio-economic backgrounds.

2.7 Influence of Type of School on Academic Self-concept, Academic Motivation, Academic Resilience and Mathematics Achievement

Research reveals that the type of school has a significant influence on academic self-concept, academic motivation and academic resilience. In their study, Zahra, Arif and Yousuf (2010) sought to examine the relationship between students' academic self-concept and certain variables such as type of school, gender and family background. The sample comprised of 396 high school students (198 boys and 198 girls) in Bangladesh obtained through random sampling technique. Data were collected using a researcher-constructed questionnaire. Analysis of variance revealed

that students attending vocational high schools had a lower self-concept as compared to students attending other schools. This study did not consider other variables that may influence performance in different categories of schools such as academic motivation and academic resilience. The current study examined these variables.

Srivastara and Joshi (2011) studied the effect of school and area on academic self-concept and academic achievement. The sample consisted of 400 adolescents (200 boys and 200 girls) in different types of schools both rural and urban schools in India. The Indian adaptation of Marsh self-description questionnaire was used to collect data while students' average marks were obtained from school records. The study adopted a 2*2 factorial design and MANOVA analysis which revealed that academic self-concept and academic achievement of the adolescents were higher in high facility schools as compared to the low facility schools. Further, urban adolescents had higher achievement as compared to their rural counterparts. It was necessary to find out students' level of self-concept in the different categories of schools that were in the current study.

Fin and Zahari (2013) carried out a study among 1167 secondary school students aged 16 years (611 males and 556 females) drawn from urban and rural schools in Malaysia. The study explored the effect of type of school on students' academic self-concept. A researcher-constructed questionnaire was used to collect data which was analysed through structural equation modelling. The findings indicated that the type of school had a significant and positive effect on students' academic self-concept and that schools that involve students in decision making enable them to have high self-

evaluations because of recognition. These findings may not be generalized to different categories of schools. This made it necessary to establish the influence in national, county and sub-county schools in Nairobi, Kenya. Again, academic motivation and resilience did not comprise variables as was the case in the current study.

In a related study, Kumari (2013) sought to determine whether self-concept plays a role in the academic achievement of students in secondary schools in India. The sample consisted of 321 students aged between 15-17 years drawn from different categories of schools. Data were collected using the self-concept inventory by Sharma (1967). Analysis of variance revealed that students belonging to central board schools were better in their self-concept and academic achievement compared to students from other boards. This was worth investigating further since schools were categorized in different ways in the current study.

In Kenya, Mburu (2013) provided data in support of the relationship between type of school and academic self-concept and performance. The study with a sample of 358 students (180 girls and 178 boys) from public and private schools from Kericho and Kipkelion districts showed that girls do better in subjects like mathematics and science when boys are not in class. The study adopted a descriptive research design and researcher-administered questionnaires were used to collect data. A Chi square and Pearson product moment correlation revealed that the school environment plays a significant role on students' mathematics achievement. This study was carried out in the rural areas and thus, it was necessary to find out if the type of school may

influence academic achievement in an urban set up which was characterised by many distractors of academic achievement.

Differences in academic motivation by type of school have been found in some studies. Fabio (2008) in a study using 618 high school students (309 boys 309 girls) in Italy found significant differences across gender and type of school. The study examined motivation in school persistence. The study was carried out to test the validity of the academic motivation scale. The sample was drawn from one general high school and one vocational high school. Data were collected using the Italian version of the academic motivation scale while students' performance was obtained from self-reported grades. It was found necessary to find out if there were differences in academic motivation across national schools, county schools and sub-county schools in Kenya.

Karaguren (2015) found that the school type and parental educational levels were positively related with academic motivation on a sample of 336 Turkish high school students (168 boys and 168 girls). This study investigated the effects of demographic factors such as type of school on academic motivation. The academic motivation scale was used to collect data on academic motivation. Correlation analysis revealed that the type of school was positively related to academic motivation. It was worth investigating if the type of school had any significant effect in academic motivation in the population of study.

Studies on academic resilience show that a positive school environment fosters academic resilience. Falcon (2010) in a study of 150 (80 boys and 70 girls) students aged between 13-19 years from low socio-economic backgrounds found significant relationships in school types and academic resilience. The study investigated school factors that promote academic resilience in urban Latino high school students using a cross-sectional design. The sample was drawn from three categories of schools. Data on academic resilience were collected using the resiliency scale for children and adolescents and analysed through the use of multiple regression. Results revealed that the type of school is significantly related to academic resilience.

The relationship between academic motivation and academic performance was investigated by Momanyi, Too and Simiyu (2011) in their study among secondary school students in Nakuru, Kenya. The sample consisted of 489 students (245 boys 244 girls) obtained using stratified random sampling technique. Data were collected using the students' academic motivation questionnaire and analysed using Pearson correlation and ANOVA. The findings indicated that the type of school strongly contributed to academic motivation and academic achievement. Interestingly some students in day schools rated highly in the academic motivation scale resulting to higher academic performance. The current study examined students in three categories of schools (national, county and sub-county) to establish if differences existed in students' academic motivation.

In their study, Mwangi, Ileri, Kinai and Okatcha (2015) examined the relationship between academic resilience and achievement in three core subjects among secondary school students in Kiambu County, Kenya. Data were gathered from 390 form three students from 10 public secondary schools in the county. The study used a descriptive correlational design while data were collected using the resilience and youth development module. The Pearson correlation coefficient established that in schools that emphasize on good grades, there is very stiff competition. In such schools, students must learn how to survive setbacks and thrive in the face of academic setbacks. The study used a different categorization of schools (boys or girls boarding). The current study sought to establish whether the results were similar or different when using a different categorization of schools. Though these findings provide data on differences in academic self-concept, academic motivation and resilience by type of school, the focus has been on the influence of only one variable. This necessitated this study that established how an interaction of the three variables predicted mathematics achievement.

2.8 Summary of Review of Related Literature and Gap Identification

From the literature review, it is clear that academic self-concept is a sub-component of general self-concept which positively correlates with mathematics achievement. Some studies report positive relationships between academic self-concept and mathematics achievement while others report negative relationships using a sample of college students or primary school pupils. This called for further investigation using a sample of secondary school students in order to explain the hypothesized prediction between the two.

Academic motivation has also been reported to positively predict mathematics in some studies while in others a negative relationship has been reported. Equally, most of those studies were carried out in the western world and their findings are inconclusive. Therefore, there was need to conduct a study in a different environment so as to gather more conclusive findings.

Academic resilience has been reported as positively related to mathematics achievement. These studies have mostly been carried out in the western world and in most instances using a sample from low economic socio-backgrounds. Studies in Africa have not fully addressed this relationship hence the need for the current study.

Moreover, most of the studies have addressed the predictor variables singly and focused on general academic achievement. There was need to study how the three predictor variables work together and influence mathematics achievement.

Significant differences have been reported to exist in the levels of academic self-concept, academic motivation and academic resilience based on gender and type of school. It was thus necessary to find out if gender differences existed in the predictor and outcome variables in the population of study so as to have more conclusive findings. These contradictory findings called for further investigation. This may guide in suggesting ways of improving the poor grades in mathematics that have been reported in the population of study as well as across the country. Lastly, other studies adopted the qualitative approach. This necessitated the current study which adopted the quantitative method of data analysis.

CHAPTER THREE

RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter describes how the study was conducted. Further, it outlines the research design, location of the study, target population and sample selection. The research instruments have also been described, as well as their administration during piloting. The validity, reliability, logistical and ethical considerations and actual data collection have also been presented. Finally, the data analysis techniques have been outlined.

3.2 Research Design

The study employed a predictive correlational research design. This design was used due to its appropriateness in the measurement of two or more variables and the relationship between or among those variables (Stangor, 2011). Further, the design was suitable for the study because the researcher was interested in predicting the outcome of mathematics achievement using certain variables (academic self-concept, academic motivation and academic resilience) as predictors. Other features that made the design useful for this study are: that it involves the measurement of variance on the outcome variable relative to variance on the predictor variable(s), there was no manipulation of the variables or subjects under study; the study was conducted in the subjects' natural environment, that is, on a normal school day, with no pre-preparations and achievement was measured using the normal students' evaluation tests. It was presumed that the outcome variable was determined to some extent by

the predictor variables thus the study drew conclusions based on the predictive levels of each of the predictor variables on the outcome variable (Creswell, 2012). In this case, the link among students' academic self-concept, academic motivation, academic resilience and mathematics achievement was investigated.

3.2.1 Research Variables

The predictor variables were academic motivation, academic self-concept and academic resilience. The three were measured on the interval scale. The outcome variable; students' mathematics achievement was measured at the interval scale. Gender and type of school were the intervening variables. The type of school was considered as national, county or sub-county while gender was considered to be either male or female. The two were measured at the nominal level.

3.2.2 Location of the Study

The study was conducted in Nairobi County. The location was chosen because most of the schools had recorded low achievement in mathematics in the years 2012-2016 (CDE, 2016). Additionally, Nairobi County had many schools from all the three public school strata, and Nairobi, being a metropolitan county provided a sample that catered adequately for all the socio-economic and socio-cultural diversity in Kenya. Being a major urban centre in the country it was assumed it had students who were likely to experience various socio-economic problems and facing several distracters of mathematics achievement, thus this made it a strategic location for assessing the predictor variables in relation to mathematics achievement. Other researchers

reported poor academic achievement in all subjects among secondary school students in the same location. This was an indication that the problem persisted in spite of the efforts put in place to try and improve the situation. This created a need to establish the causes (Githua, 2013; Mutweleli, 2014). This poor mathematics achievement was hypothesized to be due to low academic self-concept, academic motivation and academic resilience. Nairobi County was therefore found to be the most appropriate location for the study.

3.3 Target Population

The study targeted 9641 form three students in public secondary schools in Nairobi County. Nairobi County has a total number of 79 public schools. Form three students were selected for the sample because they had already spent three years in school and so they were likely to have developed a well-defined academic self-concept. They were also likely to have registered a level of academic motivation and academic resilience based on previous performance as they prepared for KCSE examination. Further, form three students were preferred because they had already selected subjects and registered for KCSE examination and were also expected to be seriously settled in their studies. Data from the CDEs office in Nairobi in year 2014, indicated that there was a total of 9641 (5541 boys and 4100 girls) form three students in Nairobi County.

3.4 Sampling Techniques and Sample Size

Sampling was done using the following sampling techniques.

3.4.1 Sampling Techniques

Three types of sampling procedures were used: purposeful, stratified and simple random sampling. Purposeful sampling was used to select Nairobi County because of the reported poor mathematics achievement. Stratified sampling was used to classify schools into national, county and sub-county strata. This was based on the need to obtain a representative sample of all the sub-groups in the population as supported by Stangor (2011). Proportionate random sampling was used to pick two national schools, four county schools and seven sub county schools. Also, simple random sampling was used to select two national schools, four county and seven sub-county schools using the lottery method by the gender criterion. Simple random sampling was further used to select the students who participated in the study. In total, 13 schools participated in the study.

3.4.2 Sample Size

The sample size was arrived at using the formula by Yamane (1967) cited in Israel (1992), that is; $n = N / (1 + N(e)^2)$, where n is the desired sample, ' N ' is the total population and ' e ' is the margin of error which was set at .05. Using the formula, a total of 384 respondents were obtained as the base sample. Thirty per cent of this sample was added to compensate for non-response. A total of 500 respondents were sampled. Proportionate stratified sampling was employed to select respondents in the national, county and sub-county schools to ensure that the size of the sample drawn

from each stratum was proportionate to the relative size of that stratum in the population as proposed by Stangor (2011). This was calculated based on the total number of students per strata relative to the total number of students in public secondary schools in Nairobi County and the sample size. The number of students per strata was given by $n_1/N*n$ where n_1 was the population size of the particular strata, N was the total population and n was the sample size. The sample size is presented in Table 3.1.

Table 3.1

Sample Frame

School category	Number of schools	Total Population	Sample size
National	2	735	39
County	4	2805	146
Sub- County	7	6101	315
Total	13	9641	500

Source: Nairobi CDE's Office (2016)

After obtaining the sample size for each stratum, it was necessary to establish the proportion of boys and girls in each of them. This was done using the proportionality percentages of boys and girls in the target population. The sample sizes by gender per stratum are shown in Table 3.2

Table 3.2

Sample Size by Gender per Stratum

School category	Boys	Girls	Sample size
National	23	16	39
County	84	62	146
Sub- County	181	134	315
Total	288	212	500

3.5 Research Instruments

The data for this study were collected using questionnaires and academic records. Questionnaires were preferred because they saved the researcher's time, were easy to administer and collected substantial information (Stangor, 2011).

3.5.1 Questionnaire for Students

The questionnaire consisted of four sections: Section I included demographic data (Appendix B); that is, gender, name and the type of school. Section II comprised the Academic self-concept Scale (Appendix C) which measured the student's academic self-concept while section III comprised the Academic Motivation Questionnaire (Appendix D) which measured the students' academic motivation. Section IV was the Academic Resilience Scale (Appendix E) which measured the students' academic

resilience. The items in the sub-scales were ranked uniformly on a five-point likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. Each subscale consisted of different items. Reverse coding was used for items measuring negative traits so as to ensure that the positive trait was scored highly. The reason for this was because the measure of each variable was based on the total value of all the individual item scores.

(b) Academic Self-concept Scale (ASCQ) by Liu, Wang and Parkins (2005)

The level of Academic self-concept was measured using the Academic Self-Concept Questionnaire (ASCQ) by Liu, Wang and Parkins (2005). The scale (see Appendix C) was adopted and modified to suit the study because it specifically sought to measure mathematics. For example, item three was changed from ‘I am capable of assisting my classmates in their schoolwork to ‘I am capable of assisting my classmates in their mathematics schoolwork’. Item fourteen was changed from ‘I often feel like dropping out of school because of my performance’ to ‘I often feel like dropping out of school because of my poor performance in mathematics.’ The questionnaire consisted of 20 items under two domains. These were academic confidence and academic effort. Items under odd numbers measured confidence while those bearing even numbers measured effort. The items in the sub-scales were ranked uniformly on a five-point likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. The minimum possible score was 20 while the maximum possible score was 100.

a) Academic Motivation Scale by Githua and Mwangi (2003)

The level of academic motivation of the students was measured using a scale adopted from Githua and Mwangi (2003) which was minimally adjusted to fit the current level of students and study location. For example item five was adjusted from ‘find it difficult to solve problems alone’ to ‘I find it difficult to solve mathematics problems alone’ while item nineteen was adjusted from ‘I am contented with the way in which mathematics is taught during mathematics lessons’ to ‘I am contented in the way in which mathematics is taught.’ The scale had been used to measure the motivation to learn mathematics among students in Nairobi and Rift valley provinces. The scale consisted of 28 items (see Appendix D). It was divided into four sub-scales reflecting perceived probability of success, interest in learning mathematics, satisfaction in mathematics and relevance of mathematics. The items in the sub-scales were ranked uniformly on a five-point likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. The minimum possible score was 28 while the maximum possible score was 140.

(c) Academic Resilience Scale by Marsh and Martin (2006)

The academic resilience scale for high school students was developed by Marsh and Martin (2006). The scale (see Appendix E) had 9 items measuring the student’s levels of self-belief, persistence, composure and commitment. The scale was adopted and modified to suit the current study. For example, item 4 was changed from ‘I think am good at dealing with school pressure’ to ‘I think am good at dealing with mathematics work pressure’, item 9 was changed from ‘I plan to get a good grade in math’ to ‘I plan to get a good grade in math at KCSE’. The items in the sub-scales

were ranked uniformly on a five-point likert scale ranging from 1 = *strongly disagree* to 5 = *strongly agree*. The minimum possible score was 9 while the maximum possible score was 45.

3.5.2 Academic Records

Mathematics achievement records of the participants were obtained from school term examinations records. The mean scores in mathematics at the end of two terms in form two and first term of form three (2016) were obtained. The scores were then converted to T-scores for purposes of comparison (see Appendix G).

3.6 Pilot Study

The research instrument was piloted on a random sample of 40 form three students (20 boys and 20 girls) from one public secondary school in Nairobi County. This school was not included in the current study when drawing a sample. Piloting was done to determine their validity and reliability. This assisted in refining the questionnaires before applying them in the actual research. Piloting was also done in order to pre-test the questionnaire for the purpose of ensuring clarity of instructions, identifying any problems with administration of the instrument as well as problems in the way the students responded to the questions. It was also used to establish the appropriate duration of filling in the questionnaire. This assisted in the administration of the questionnaire.

3.6.1 Validity of the Study Instruments

To cater for content validity, the questionnaire was examined by the supervisors and other research experts who examined the items critically and gave feedback in form of suggestions for modifications, insertions and deletions. Secondary school teachers were also consulted. This was due to their knowledge of what is appropriate for students at the different levels of education. The researcher then modified the items using the suggestions put forward by these experts. Validity was further enhanced by factoring the pilot study results, for example, the appropriate timing for the questionnaire was specified as thirty minutes and some items in the questionnaire had to be rephrased for the purpose of clarity. These included, in the demographics where the use of percentages instead of grades was found to be more appropriate. Item eleven of the ASC questionnaire was changed from ‘whatever I learn in mathematics escapes very fast’ to ‘I have difficulty retaining whatever I learn during mathematics lessons.’ Thus, input after the pilot study improved the questionnaire making it clearer.

3.6.2 Reliability of the Study Instruments

To ensure the reliability of the questionnaire, the items were tested for internal consistency using Cronbach Alpha and the coefficients obtained per sub-scale used to compute the overall instrument reliability. The calculated Cronbach reliability of the whole instrument was given as .82 that is; .89 for ASC (Liu, Wang and Parkins (2005), .80 for AM (Githua and Mwangi (2003) and .74 for AR (Marsh and Martin

(2006). The reliability of the whole instrument was computed as .78; that is; .76 for ASC, .82 for AM and .82 for AR. After the pilot study, the reliability coefficients per sub-scales were computed and the results are shown in Table 3.3.

Table 3.3

Reliability Coefficients of the Academic Self- concept, Academic Motivation and Academic Resilience Scales

Sub-Scale	Domain	Reliability coefficient
Academic Motivation Scale	Perceived Probability of success	.83
	Interest in learning mathematics	.77
	Satisfaction	.75
Academic Self- Concept Scale	Relevance	.69
	Effort	.84
Academic Resilience Scale	Confidence	.79
	Overall instrument	.82
Reliability		.78

Source. Reseacher, 2016

The overall Cronbach reliability coefficient of .78 in Table 3.3 was considered suitable for the study since it was within the recommended range of reliability coefficients (Creswell, 2012).

3.7 Data Collection Techniques

Having obtained a research permit from the relevant authorities, the researcher visited the sampled schools and explained to the principals the purpose of the study. This helped to prepare for the administration of the instruments. The researcher considered using questionnaires as they helped eliminate peer influence in the

responses which would have otherwise distorted the findings. The researcher with the help of the teachers administered the questionnaires to the students. The students were supervised by the researcher and some teachers as they filled in the questionnaires. Questionnaires were preferred since it was assumed they saved the students' school time as compared to other methods like interviewing. The questionnaires were administered after classes during the agreed day and time. The researcher, after being introduced to the students, explained how the questionnaire was to be filled in. Those who had difficulties were assisted by the researcher. The respondents were allowed 30 minutes within which they filled the questionnaire. The researcher was able to administer the questionnaire in two sampled schools in one day. Achievement records to obtain the participants' mathematics scores were obtained from the class teachers.

3.8 Data Analysis

Data collected were coded and entered analysed using SPSS. Both descriptive and inferential statistics were used. Data were presented in tabular form. The following null hypotheses were tested at $\alpha = .05$.

H₀₁ Academic self-concept does not significantly predict mathematics achievement.

Statistical test: Multiple linear regression analysis. This was used because academic self-concept was considered at two levels which were distinct and not related - that is effort and confidence.

H₀₂ Academic motivation does not significantly predict mathematics achievement.

Statistical test: Multiple linear regression analysis. This was used because

academic motivation was examined at four levels which were: perceived probability of success, satisfaction, relevance and interest which were distinct.

H₀₃ Academic resilience does not significantly predict mathematics achievement. The researcher used simple linear regression analysis because academic resilience was examined at one level (high/low).

H₀₄ Academic self-concept, academic motivation and academic resilience do not significantly predict mathematics achievement.

Statistical test: Multiple linear regression analysis. This was used because there were three predictor variables which were in the same model.

H₀₅ There are no significant gender differences in academic self-concept, academic motivation, academic resilience and mathematics achievement. Statistical test: t-test for independent samples. T-test was appropriate because it is a test used to determine differences between two distinct groups, in this case, male and female that were mutually exclusive and so did not influence each other.

H₀₆ There are no significant differences in academic self-concept, academic motivation, academic resilience and mathematics achievement between students in national, county and sub-county schools. Statistical test: One Way ANOVA. This test was used because there were three categories of independent variables; national, county and sub-county. The dependent variables (academic self-concept, academic motivation, academic resilience and mathematics achievement) in the test were independent of each other.

3.9 Logistical and Ethical Considerations

In adhering to the ethical and logical requirements, the following was done:

3.9.1 Logistical Considerations

The researcher obtained research approval from the Graduate School of Kenyatta University. A Research permit was then obtained from the National Commission for Science, Technology and Innovation (NACOSTI) and the County Director of Education, Nairobi County. This was followed by the researcher visiting the sampled schools to notify the administrators of the need to carry out the study in their respective schools.

3.9.2 Ethical Considerations

During data collection, the researcher sought from the participants informed consent (see Appendix A). The researcher assured the participants of confidentiality and anonymity of their participation. The researcher also made the participation in the study voluntary.

CHAPTER FOUR

PRESENTATION OF FINDINGS, INTERPRETATION AND DISCUSSION

4.1 Introduction

In this chapter the findings of the study, interpretation and discussion of results are presented. The chapter is divided into three sections: introduction; general and demographic information; presentation and interpretation as well as discussion of results. The chapter is organized in the order of objectives as follows:

- i. Determine the extent to which academic self-concept predicts mathematics achievement of secondary school students in Nairobi County.
- ii. Investigate the extent to which academic motivation predicts mathematics achievement of secondary school students in Nairobi County.
- iii. Establish the extent to which academic resilience predicts mathematics achievement of secondary school students in Nairobi County.
- iv. Determine the relative predictive levels of academic self-concept, academic motivation and academic resilience on mathematics achievement of secondary school students in Nairobi County.
- v. Test for gender differences in academic self-concept, academic motivation, academic resilience and mathematics achievement of secondary school students in Nairobi County.
- vi. Find out whether there are differences in academic self-concept, academic motivation, academic resilience and mathematics achievement among students in national, county and sub-county secondary schools in Nairobi County.

4.2 General and Demographic Information

This section gives a general overview of the return rate of questionnaires and the final sample used in the study. The general and demographic information for the sample is also presented in this section.

4.2.1 General Information and Return Rate

The researcher visited all schools sampled for the study and administered the questionnaires in person. An initial return rate of 100% of the questionnaires was reported because the researcher collected them immediately after administration. However, the usable responses were 92.60% of the initial sample as 7.40% of the responses were rendered invalid. These responses were either incomplete or because the respondents did not have three consistent mathematics exam results. The return rate is shown in Table 4.1.

Table 4.1

Return Rate

Type of School	Gender		
	Male	Female	Total
National	23(4.60)	16(3.20)	39(7.80)
County	84(16.80)	61(12.20)	145(29.00)
Sub-county	143(28.60)	136(27.20)	279(55.80)
Invalid			37(7.40)
Total	250(50.00)	213(42.60)	500(100.00)

Note. N=463; () = % of the total.

Table 4.1 shows the return rate of the questionnaires from the different school types. There were 39 valid responses from the sampled national schools, 145 from the sampled county schools and 279 from the sampled sub- county schools. Thirty seven responses were rendered invalid. As a result, the actual sample used for the study constituted 463 students instead of the 500 students initially sampled. Most of the invalid questionnaires were in the sub-county schools which could be attributed to absenteeism and missing of some mathematics examinations. The actual sample used in the study is shown in Table 4.2.

Table 4.2

Actual Sample used in the Study

Type of School	Gender		
	Male	Female	Total
National	23(4.97)	16(3.46)	39(8.42)
County	84(18.14)	61(13.17)	145(31.32)
Sub-county	143(30.89)	136(29.37)	279(60.26)
Total	250(54.00)	213(46.00)	463(100.00)

Note. $N=463$; () =% of the total.

4.2.2 Demographic Data

The sampled schools were classified into national, county and sub-county strata. Thirty nine respondents (8.4% of the entire population) were drawn from two national schools in Nairobi County. Thirty nine respondents accounting for 8.42%

of the entire sample; with the four county schools selected contributing 31.32% of the sample. This was equivalent to 145 students. Seven sub-county schools contributed 279 students accounting for 60.26% of the sample. In total, the sample consisted of 250 (54.00) male and 213 (46.00%) female students from 13 public secondary schools in Nairobi County, Kenya. The students' age distribution is shown in Table 4.3.

Table 4.3

Students' Age Distribution

Age	Boys	Girls	Total
16.00	54(21.60)	98(46.01)	152(32.80)
17.00	101(40.40)	85(39.90)	186(40.20)
18.00	76(30.40)	24(11.27)	100(21.60)
Over 18	19(7.60)	6(2.82)	25(5.40)
Total	250(100.00)	213(100.00)	463(100.00)

Note. N=463; () =% of the total.

Table 4.3 shows that the majority of the students were aged between 16 and 18 years, with only 19 (7.60) boys and 6 (2.82) girls being over 18 years. There were 54 (21.60) boys and 98 (46.01) girls aged 16 years, 101(40.40) boys and 85 (39.90) girls aged 17 years and 76 (30.40) boys and 24 (11.27) girls were 18 years. In total, 32.80% of the students were 16 years, 40.20% were 17 years and 21.60% were aged 18 years. Of the sample only 5.40% of the students were more than 18 years old. This means that the ages of the students ranged within the recommended age of form

three students in Nairobi County 17 (40) since fewer students were above 18 (21.6) years. There was no student aged below 16 years.

4.3 Results of the Study

Results of the study were presented in line with study objectives. Descriptive statistics were used to describe the various aspects of the study variables followed by inferential statistics describing the relationships between variables and test hypotheses. As a preliminary however, mathematics achievement for the respondents has been described prior to consideration of the study objectives. The relationship between mathematics achievement and age of respondent has also been explored in this section.

4.3.1 Mathematics Achievement

Respondents' mathematics mean scores for three consecutive terms were transformed into T-scores for comparison across the sample. The respondents were divided into three groups. This was done according to their mathematics scores; below average mathematics achievement (44 and below), average (between 45 and 59), and above average (60 and above). This was arrived at from the mean scores of the participants' mathematics scores for three consecutive terms that was from two second and third term and from three (2016) first term. The distribution across the three levels is shown in Table 4.4

Table 4.4

Description of Mathematics Achievement

Level of Achievement	Frequency	<i>M</i>	<i>SD</i>
Below average mathematics achievement	187(40.39)	38.18	3.49
Average mathematics achievement	207(44.71)	52.82	3.34
Above average mathematics achievement	69(14.90)	61.31	6.09
Total	463(100.00)		

Note. $N = 463$; () = % of the total; M = Mean.

Results in Table 4.4 show that the majority of the students (85.10%) scored an average and below in mathematics and that only 14.90% of the students had an above average score in mathematics. These results indicate that 40.39% scored below average while 44.71% scored an average. This confirms the low mathematics achievement in Nairobi County as reported by Githua and Mwangi (2003) and Mutweleli (2014). The results of the participants' mathematics achievement were further analysed to determine the level of mathematics achievement using the T-score value. The mathematics achievement score was transformed into T- scores using a mean of 50 and a standard deviation of 10. The results are presented in Table 4.4.1

Table 4.4.1

Summary Statistics for Participants Mathematics Achievement T-Scores

T-Scores	Values
Mean	50
Standard deviation	10
Skewness	.08
Standard error of skewness	.11
Minimum	32.14
Maximum	70.65

Note. $N = 463$

Further analysis was done to investigate the differences in mathematics achievement based on respondents' gender and type of school. Results are presented in Tables 4.5 and 4.6.

Table 4.5

Participants' Mathematics Achievement by Gender

Gender	Below Average	Average	Above Average	Total
Male	97(38.80)	114(45.60)	39(15.60)	250(100.00)
Female	90(42.30)	93(43.70)	30(14.10)	213(100.00)
Total	187(40.39)	207(44.71)	69(14.90)	463(100.00)

Note. $N = 463$; () = % of the total.

Table 4.5 reveals that a higher percentage of girls (42.30%) than boys (38.80%) scored below average in mathematics while there were higher percentages of boys than girls in the higher levels of mathematics achievement. There were 45.60% of boys and 43.70% of girls who scored an average while 15.60% of boys and 14.10% of girls scored above average. The difference in mathematics achievement between boys and girls was minimal. The results demonstrate what research has established that boys always outperform girls in mathematics while majority of the students score an average and below (Yara & Wanjohi, 2011). The distribution of mathematics achievement across different school types is shown in Table 4.6.

Table 4.6

Mathematics Achievement by Type of School

Type of School	Below Average	Average	Above Average	Total
National	0(0.00)	9(23.08)	30(76.92)	39(100.00)
County	49(33.80)	77(53.10)	19(13.10)	145(100.00)
Sub County	138(49.46)	121(43.37)	20(7.17)	279(100.00)
Total	187(40.39)	207(44.71)	69(14.90)	463(100.00)

Note. $N = 463$.

Data from Table 4.6 shows that out of the total sample from the national schools stratum 76.92% of the students scored above average while none scored below average. Twenty three point zero eight % of students from the national schools scored an average. In contrast, majority (49.46%) of students from sub-county

schools scored below average and only 7.17% of the students scored above average. In total, 43.37% students from the sub-county schools scored an average in the mathematics examination. Finally, 33.80% and 13.10% of students from the county schools scored below and above average respectively. Majority of students (53.10%) from this stratum scored an average.

The study sought to explore whether the age of students had any relationship with the students' mathematics achievement and the results indicated a negative linear relationship which was statistically significant, $R = -.11$, $p = .02$. Having established that a linear relationship exists between age and mathematics achievement, further analysis was done to explore the extent to which age predicts achievement in mathematics. The results are shown in Table 4.7.

Table 4.7

Age as a Predictor of Mathematics Achievement

	<i>Sum of squares</i>	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>Sig.</i>
Regression	465.66	1	465.66	5.15	.02
Residual	41677.94	461	90.41		
Total	42143.60	462			

Note. $N = 463$.

Table 4.7 shows that the regression equation was statistically significant, $F(1,461) = 5.15$, $p = .02$. Age accounts for up to 11% of variance in mathematics achievement as $R^2 = .11$.

4.3.2 Prediction of Academic Self-concept on Mathematics

Achievement

The first objective sought to determine whether academic self-concept predicts mathematics achievement. To establish this, respondents' academic self-concept scores were analysed. Academic self-concept was measured as the total score of two subscales in the Academic Self-concept Questionnaire; confidence and effort. This was then followed by hypothesis testing and a discussion of the findings.

i. Description of Respondents' Academic Self-concept

The study sought to examine students' academic self-concept scores based on gender and type of school attended. The total scores of each sub-scale were computed and respondents divided into groups of low and high confidence and effort respectively based on the median of each sub-scale. The findings were presented in Table 4.8 and Table 4.9.

Table 4.8

Descriptive Statistics of Domains of Academic Self-concept by Gender

	Effort		Confidence	
	Low	High	Low	High
Male	198(79.20)	52(20.80)	115(46.00)	135(54.00)
Female	163(76.50)	50(23.50)	103(48.40)	110 (51.60)
Total	361(77.97)	102(22.03)	218(47.08)	245(52.92)

Note. N= 463.

Table 4.8 shows that a higher percentage of both boys and girls reported high confidence 54.00% and 51.60% respectively while a lesser percentage reported low confidence, 46.00% of boys and 48.40% of girls. Contrastingly, a higher percentage of both boys and girls reported low effort, 79.20% of boys and 76.50% of girls while 20.80% of boys and 23.50% of girls reported high effort. Cumulatively, 47.08% of students reported low confidence, 52.92% reported high confidence while 77.97% and 22.03% reported low and high effort respectively. The implication of these findings is that both boys and girls may have been confident that they would achieve highly in mathematics. However, due to the negative feedback from mathematics exams, the effort they put in may have been too little. This ended up lowering their grades even further. Table 4.9 shows the distribution of students' scores in the two domains of academic self-concept as per the type of school attended.

Table 4.9

Descriptive Statistics of Domains of Academic Self-concept by Type of School

ToS	Confidence		Effort	
	Low	High	Low	High
National	17(43.60)	22(56.40)	31(79.50)	8(20.50)
County	63(43.40)	82(56.60)	121(83.40)	24(16.60)
Sub-county	138(49.50)	141(50.50)	209(74.90)	70(25.10)
Total	218(47.08)	245(52.92)	361(77.97)	102(22.03)

Note: N=463; () % of the total; ToS= Type of School.

Table 4.9 indicates that 43.60% students in national schools, 43.40% in county school and 49.50% sub county schools reported low confidence while 56.40% of students in national schools, 56.60% and 50.50% of students in county and sub county schools respectively reported high confidence. Generally, majority of the students, 52.92%, reported high confidence across the schools with 47.08% reporting low confidence. On the other hand, however, more students reported lower effort 361 (77.97) than high effort 102 (22.03). The trend was consistent across the schools with 79.50%, 83.40% and 74.90% of students in national, county and sub-county schools in that order reporting low effort. It was noted that 20.50%, 16.60% and 25.10% of students in national, county and sub-county schools respectively reported high effort. The implication is that even though students may possess a high level of confidence in their mathematics achievement, they may not achieve if they do not put the effort required. It is therefore important for students to be motivated to increase efforts in solving mathematical problems in order to raise their mathematics grades. The participants' academic self-concept domain scores were then summed up to generate a single measure of academic self-concept. A descriptive analysis of academic self-concept revealed that the distribution across the sample had an academic self-concept mean score of 66.91(5.81).

For comparison, respondents were divided into two groups based on the median of the academic self-concept score, that is, low and high academic self-concept respectively. The findings were computed and presented in Table 4.10.

Table 4.10

Descriptive Statistics of Academic Self-concept by Gender

Gender	Academic Self-concept		Total
	Low	High	
Male	134(53.60)	116(46.40)	250(54.00)
Female	115(54.00)	98(46.00)	213(46.00)
Total	249(53.78)	214(46.22)	463(100.00)

Note. $N = 463$; () % of the total.

From Table 4.10 it is clear that 53.60% of boys and 54.00% of girls reported low academic self-concept while 46.40% and 46.00% reported high academic self-concept. In total, 249 (53.78) students reported low academic self-concept with 214 (46.22) reporting high academic self-concept. The implication of this is that if majority of the students reported low academic self-concept, their motivation to excel in mathematics may also be questionable and this may be a good explanation for the consistent low mathematics achievement in Nairobi County. The proportion of students in each level of academic self-concept per school category is shown in Table 4.11

Table 4.11

Descriptive Statistics of Academic Self-concept by Type of School

Type of school	Academic Self-concept		Total
	Low	High	
National	22(56.4)	17(43.60)	39(100.00)
County	80(55.20)	65(44.80)	145(100.00)
Sub-county	147(52.70)	132(47.30)	279(100.00)
Total	249(53.78)	214(46.22)	463(100.00)

Note. N= 463; () % of the total.

Table 4.11 indicates that more students reported low academic self-concept. In the national school category, 56.40% and 43.60% of students exhibited low and high levels of academic self-concept respectively. In the county and sub-county schools' categories 55.20% and 52.70% reported low academic self-concept with 44.80% and 47.30% reporting high academic self-concept respectively. This is expected because if mathematics achievement is low, students are also likely to possess a low mathematics self-concept. The levels of domains of academic self-concept were cross-tabulated against levels of mathematics achievement as shown in Table 4.12

Table 4.12

Mathematics Achievement per Domains of Academic Self Concept

Domain		Below average	Average	Above Average
Effort	Low	139(38.50)	167(46.26)	55(15.24)
	High	48(47.06)	40(39.21)	14(13.73)
Confidence	Low	91(41.74)	105(48.17)	22(10.09)
	High	96(39.18)	102(41.64)	47(19.18)
ASC	Low	99(39.76)	119(47.79)	31(12.45)
	High	88(41.12)	88(41.12)	38(17.76)

Note. $N= 463$; () % of the total; ASC=Academic Self Concept.

Table 4.12 shows that 38.50%, 46.26% and 15.24% of students who had reported low effort scored below average, average and above average in mathematics. Of those who had reported high effort, 47.07% scored below average, 39.21% scored average and only 13.73% scored above average. Majority of the students who had reported low confidence (48.17%) scored an average in mathematics while 39.18% and 41.64% of those who had high confidence scored below average and average in mathematics respectively. Only 19.18% of students who had high confidence and 10.09% of those with low confidence scored above average while 41.74% of students with low confidence scored below average in mathematics. Overall, 39.76%, 47.79% and 12.45% of students with low academic self-concept scored

below average, average and above average in mathematics. On the other hand, equal numbers (41.12% and 41.12%) of students with high academic self-concept scored below average and average while 17.76% scored above average.

ii. Hypothesis Testing

In line with the first objective of the study which sought to determine whether academic self-concept predicts mathematics achievement of secondary school students, the first null hypothesis was formulated as follows:

H_{01} Academic self-concept does not significantly predict mathematics achievement.

Multiple linear regression analysis was used to test the predictive levels of the domains of academic self-concept. The first task was to test the relationships between the two domains of academic self-concept (confidence and effort) and mathematics achievement. This was done independently as well as collectively to test for linearity using bivariate correlation and the results are shown in Table 4.13

Table 4.13

Relationship between Domains of Academic Self-Concept and Mathematics

Achievement

Domains of Academic self-concept	Mathematics Achievement
Effort	.02
Confidence	.11**
Academic Self Concept	.09

Note. ** $p < .01$.

Table 4.13 reveals that independently, the two domains of academic self-concept had positive linear relationships with mathematics achievement given by $r = .02$; $p = .72$ and $R = .11$; $p = .02$ for effort and confidence respectively. It also reveals that academic self-concept (effort and confidence collectively) was positively correlated to mathematics achievement, $r = .09$, $p = .07$. It is however noted that out of the two domains, only confidence had a statistically significant relationship with mathematics achievement at $p = .02$. The implication of this is that students may hold high perceptions of their mathematics achievement but fail to put efforts in the solving of mathematical problems. Consequently, their overall grade will be affected considering the fact that mathematics is a subject that requires a lot of practical effort. The two domains of academic self-concept were tested for multicollinearity to establish the fitness of multiple regression analysis as the statistical test for the null hypothesis. Results indicated that though effort and confidence were significantly correlated ($R = .18$, $p = .01$) the relationship was weak. This suggests that multiple regression analysis can be used to test the null hypothesis. However, to eliminate any doubts, the variance inflating factor was computed and the results indicated a VIF equal to 1.03 for both effort and confidence meaning that the collinearity between the two was negligible.

A multiple regression model was run to find the extent to which academic self-concept predicts mathematics achievement. From the analysis, the predictive value of academic self-concept was statistically significant, ($F(2, 460) = 2.98$, $p = .05$) although academic self-concept contributed just 1% of variance in mathematics achievement ($R^2 = .01$). The null hypothesis was therefore rejected.

Table 4.14 shows the ANOVA for Academic Self-concept regression model. This is shown in Table 4.14.

Table 4.14

ANOVA for Academic Self-concept

	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.
Regression	538.13	2	269.07	2.98	.05
Residual	41605.46	460	90.46		
Total	42143.60	462			

Note. $N = 463$.

The researcher went further to investigate the predictive values of each of the two domains of academic self-concept on mathematics achievement.

The coefficients for the model are shown in Table 4.15

Table 4.15

Beta Coefficients for Confidence and Effort on Mathematics Achievement

	Unstandardized		Standardized	<i>T</i>	Sig.
	Coefficients		Coefficients		
	β	Std. Error	Beta		
(Constant)	38.54	5.12		7.53	.00
Effort	-.01	.12	-.00	-.07	.94
Confidence	.28	.12	.11	2.41	.02

Note. $N = 463$; B= beta coefficient.

Results presented in Table 4.15 show that effort with $\beta = -.01$, $p = .94$ is a negative and insignificant predictor of mathematics achievement. The implication of this finding is that students may appear to strongly believe in their capability to achieve highly in mathematics but lack the effort to do so. This in turn affects the achievement in mathematics. However, the results indicate that confidence was a significant predictor of mathematics achievement, $\beta = .28$, $p = .02$.

iii. Discussion of Results

The first objective determined whether academic self-concept predicts mathematics achievement. The study revealed a positive and significant relationship between the two variables as indicated in Table 4.14. Of the two domains of the academic self-concept, effort negatively and insignificantly predicted mathematics achievement while confidence positively and significantly predicted mathematics achievement. This means that if confidence amongst students is properly nurtured, they would

achieve highly in mathematics. These results are supported by a study by Martin et al. (2006). It also means that students may be confident that they will achieve in mathematics but fail to put extra efforts in mathematical related tasks. This could result from the negative feedback after mathematics exams. This finding agrees with Deci and Ryan's self-determination theory which asserts that individuals act based on their thoughts, goals beliefs and values. Therefore, effort should be enhanced to raise the academic self-concept of students. This will in turn boost their confidence in mathematics and make them understand the importance of putting efforts in mathematics and thus improve on the grades.

These findings support earlier ones reported by Murugami (2002), Sanchez and Roda (2003), Kwena, Martin and Koller (2004), Ajogbeye (2010), Ishak and Chen (2010) and Macharia (2011). They all report that there exists a positive relationship between academic self-concept and mathematics achievement. For instance, Sanchez and Roda (2003) as well as Kwena (2007) used a sample of primary school students and found a positive correlation between academic self-concept and achievement in mathematics. Similarly, Ajogbeye (2010), using a sample of secondary school students also reported a positive correlation between students' academic self-perceptions and their mathematics performance. These findings show that the level of schooling may not influence the outcome of the relationship between the two variables because some of the samples were drawn from primary school pupils while others were drawn from university students yet there is a similarity in the findings.

Other researchers however report contradictory findings. For instance Zahra et al. (2010), Erdogan and Sengul, (2014) and Osei, (2014), in their findings indicated a negative and insignificant relationship between mathematics achievement and academic self-concept. Though the samples used in the three studies are different in terms of level of schooling, it appears that the contradictory findings may be attributed to cultural differences and study location.

4.3.3 Prediction of Academic Motivation on Mathematics Achievement

The second objective of the study sought to establish whether academic motivation predicts mathematics achievement of secondary school students. Descriptive analysis of respondents' academic motivation scores was done followed by hypothesis testing and discussion of findings.

i. Descriptive Analysis of Respondents' Academic Motivation

Students' academic motivation was measured using four sub-scales of the academic motivation scale which were: perceived probability of success, interest in learning mathematics, satisfaction and relevance. The descriptive analysis of each of the subscales is presented in Table 4.16

Table 4.16

Descriptive Analysis of Academic Motivation Sub-scales

Subscale	Mean	SD
Perceived probability of Success	33.95	5.01
Interest in learning Mathematics	13.14	2.42
Satisfaction	18.69	4.19
Relevance	25.78	4.93
Academic Motivation	88.00	11.34

Note. $N = 463$.

Results presented in Table 4.16 show that the sample had a mean academic motivation equal to 88.00 ($SD = 11.4$). Perceived probability of success, interest in learning Mathematics, satisfaction and relevance, the four domains used to measure academic motivation had means as follows; 33.95 ($SD = 5.01$), 13.14 ($SD = 2.42$), 18.69 ($SD = 4.19$) and 25.78 ($SD = 4.93$) respectively. For each of the sub-scales, groups of low and high scores were formed on the basis of the median score for each sub-scale. This was followed by descriptive comparison which was based on gender and type of school. The results are presented in Table 4.17

Table 4.17

Descriptive Analysis of Academic Motivation by Gender

		Male	Female	Total
Perceived probability of success	Low	61(24.40)	45(21.10)	106(22.89)
	High	189(75.60)	168(78.90)	357(97.11)
Interest in learning Mathematics	Low	93(37.20)	73(34.30)	166(35.85)
	High	157(62.80)	140(65.70)	297(64.15)
Satisfaction	Low	110(44.00)	108(50.70)	218(47.08)
	High	140(56.00)	105(49.30)	245(52.92)
Relevance	Low	100(40.00)	68(36.20)	168(36.29)
	High	150(60.00)	145(63.80)	295(63.71)
Motivation	Low	90(36.00)	77(31.90)	167(36.07)
	High	160(64.00)	136(68.10)	296(63.93)

Note. $N = 463$; () % of the total.

Results presented in Table 4.17 show that majority of the students reported high academic motivation across gender; 64.00% and 68.10% boys and girls respectively had high academic motivation while 36.00% and 31.90% of boys and girls respectively had low academic motivation. Overall, 36.07% and 63.93% of the sample scored low and high motivation levels respectively. The same trend was noted across the domains of academic motivation except in satisfaction where more female students reported low satisfaction than high satisfaction in which 50.70% of girls reported low satisfaction while 49.30% reported high satisfaction. Among the male students, more students reported high satisfaction 56.00% than low

satisfaction 44.00%. Of the male respondents, 24.40%, 37.20% and 40.00% reported low perceived probability of success, interest in learning mathematics and relevance in that order while 75.60%, 62.80% and 60.00% reported high scores in the same domains. On the other hand, 21.10%, 34.30% and 36.20% of the female respondents reported low perceived probability of success, interest in learning mathematics and relevance respectively while 78.90%, 65.70% and 63.80% reported high scores in the same order.

A further descriptive analysis of the domains was done based on participants' school attended. The findings are presented in Table 4.18

Table 4.18

Descriptive Analysis of Academic Motivation by School Type

Domain		National	County	Sub-county	Total
PPS	Low	10(25.64)	42(28.97)	54(19.35)	106(22.89)
	High	29(74.36)	103(71.03)	225(80.65)	357(77.11)
ILM	Low	14(35.90)	59(40.69)	90(32.26)	163(35.21)
	High	25(64.10)	86(59.31)	186(66.67)	297(64.15)
Satisfaction	Low	15(38.46)	56(38.62)	147(52.69)	218(47.08)
	High	24(61.54)	89(61.38)	132(47.31)	245(52.92)
Relevance	Low	15(38.46)	46(31.72)	110(39.43)	171(36.93)
	High	24(61.54)	99(68.28)	169(60.57)	292(63.07)
AM	Low	12(30.77)	57(39.31)	98(35.13)	167(36.07)
	High	27(69.23)	88(60.69)	181(64.87)	296(63.93)

Note: $N = 463$; () = % of the total; PPS = Perceived Probability of Success; ILM = Interest in Learning Mathematics; AM = Academic Motivation.

Majority of the students got high scores in each of the four domains of motivation across the school types. The only exception was in satisfaction where a higher percentage, 52.69% of students from sub county schools reported low satisfaction with the lesser percentage, 47.31% reporting high satisfaction. Generally, majority of the students reported high academic motivation across the school types; 69.23% of students in national schools, 60.69% in county schools and 64.87 in sub county schools reported high academic motivation.

Fewer students reported low academic motivation across the school types; 30.77%, 39.31% and 35.13% of students in national, county and sub –county schools respectively reported low academic motivation. It can therefore be deduced that students in all the school categories have a reasonable level of motivation and those whose mathematics achievement is low could be due to other factors. Of the whole sample, 22.89%, 35.21%, 47.08% and 36.93% scored low levels in perceived probability of success, interest in learning mathematics, satisfaction and relevance respectively. This implies that students in all the categories of schools are not satisfied with their mathematics achievement. This could be due to the general negative attitude that students portray towards mathematics. Further, 77.11%, 64.15%, 52.92% and 63.07% scored high levels in the four domains in the same order. It is seen that on average, satisfaction scored lowest among the four domains and this could be attributed to the high levels of dissatisfaction expressed by students in sub - county schools. The independent shares of each academic motivation domain level in each of the categories of mathematics achievement are presented in cross

tabulations as shown in Table 4.19

Table 4.19

Mathematics Performance by Domains of Academic Motivation

Domain	Level	Below Average	Average	Above Average
PPS	Low	48(45.28)	48(45.28)	10(9.44)
	High	139(38.94)	159(44.54)	59(16.52)
ILM	Low	72(43.37)	77(46.39)	17(10.24)
	High	115(38.72)	130(43.77)	52(17.51)
Satisfaction	Low	105(48.17)	90(41.28)	23(10.55)
	High	82(33.46)	117(47.76)	46(18.78)
Relevance	Low	70(41.67)	82(48.81)	16(9.52)
	High	117(39.66)	125(42.37)	53(17.97)
AM	Low	77(46.11)	77(46.11)	13(7.78)
	High	110(37.16)	130(43.92)	56(18.92)

Note. $N= 463$; () = %, of the total; PPS = Perceived Probability of Success; ILM = Interest in Learning Mathematics; AM = Academic Motivation.

Results in Table 4.19 reveal that 45.28% of students who had low perceived probability of success scored below average in mathematics, another 45.28% of the same group scored an average while the remaining 9.44% scored above average in mathematics. On the other hand, 38.94%, 44.54% and 16.52% of the students who had high perceived probability of success scored below average, average and above average in mathematics respectively. Looking at the second domain of motivation, which is interest in learning mathematics, 43.37% of those with low interest and

38.72% of those with high interest scored below average in mathematics.

Further, 36.39% and 10.24% of those who had reported low interest and 43.77% as well as 17.51% of those who had high interest scored an average and above average in mathematics respectively. Of the students who had low satisfaction in learning, 48.17%, 41.28% and 10.55% scored below average, average and above average in mathematics respectively while 33.46%, 47.76% and 18.78% of those who reported high levels of satisfaction in learning scored below average, average and above average in mathematics respectively. Finally, 41.67% of students who reported low relevance of mathematics, and 39.66% of students who considered mathematics to be highly relevant scored below average, 48.81% and 9.52% reporting low relevance; and 42.37% and 17.97% reporting high relevance scored average and above average respectively. Summing up, 46.11%, 46.11% and 7.78% of the students who had reported low academic motivation scored below average, average and above average in that order while 37.16%, 43.92% and 18.92% of the students reporting high academic motivation scored below average, average and above average respectively. These results indicate that students who reported high academic motivation also scored highly in mathematics. However, there were a few cases where students reported low academic motivation but performed above average (7.78%). Further, a few other students reported high academic motivation but performed below average in mathematics (37.16%)

ii. Hypothesis Testing

Basing on the second objective of the study which sought to establish whether academic motivation predicts mathematics achievement of secondary school students in Nairobi County, the second null hypothesis was formulated:

H₀₂ Academic motivation does not significantly predict mathematics achievement.

To test the hypothesis, the study first sought to establish whether a linear relationship exists between each of the four domains of academic motivation, the overall academic motivation and mathematics achievement. These linear relationships were established using bivariate correlation. The results are shown in Table 4.20

Table 4.20

Relationship between Mathematics Achievement and Academic Motivation

Domain of Academic Motivation	Pearson Correlation
Perceived probability of success	.01
Interest in learning Mathematics	.12**
Satisfaction	.24**
Relevance	.07
Academic Motivation	.14**

Note. $N = 463$.

** Correlation Significant at $p < 01$.

The results in Table 4.20 show that collectively, the domains of academic motivation are positively and significantly related to performance in mathematics;

coefficient of correlation is equal to .14 at $p < .01$. Independently, each of the four domains of academic motivation has a positive relationship with mathematics achievement although it is only interest in learning mathematics and satisfaction that have significant relationships; $r = .12, p = .01$ and $r = .24, p < .01$ respectively. Perceived probability of success and relevance have insignificant relationships with mathematics achievement; $r = .01, p = .77$ and $r = .07, p = .15$ respectively. This implies that students who have a lot of interest in mathematics and are satisfied in the way in which mathematics is taught and they achieve highly in mathematics. However, students' perceived probability of success and the extent to which they find mathematics relevant for them may not necessarily influence mathematics achievement.

A multiple linear regression was done to find the extent to which perceived probability of success, interest in learning mathematics, satisfaction and relevance predict mathematics achievement. Academic motivation explained 7% of variance in mathematics achievement, $R^2 = .07$. The regression equation was significant, ($F(4, 458) = 8.01, p < .01$). The second null hypothesis that academic motivation does not predict mathematics achievement was thus rejected. The ANOVA results are presented in Table 4.21.

Table 4.21

ANOVA for Academic Motivation

	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.
Regression	2755.93	4	689.00	8.01	.00
Residual	39387.67	458	86.00		
Total	42143.60	462			

Note. *N* = 463.

Further, the domains were analysed to establish their respective predictive weights.

Results are presented in Table 4.22.

Table 4.22

Beta Coefficients of Domains of Academic Motivation

	Unstandardized Coefficients <i>β</i>	Std. Error	Standardized Coefficients	<i>t</i>	Sig.
(Constant)	39.65	3.45		11.49	.00
PPS	-.09	.10	-.05	-.98	.33
ILM	.25	.20	.06	1.22	.22
Satisfaction	.58	.12	.25	4.92	.00
Relevance	-.09	.10	-.05	-.86	.39

Note. *N*=463; PPS = Perceived Probability of Success; ILM = Interest in Learning Mathematics.

Data in Table 4.22 shows that both perceived probability of success and relevance negatively and insignificantly predicted mathematics achievement; $\beta = -.09, p = .33$ and $\beta = -.09, p = .39$ respectively. On the other hand, interest in learning mathematics positively and insignificantly predicted mathematics achievement ($\beta = .25, p < .22$) while satisfaction positively and significantly predicted mathematics achievement ($\beta = .58, p < .01$). From these four domains of academic motivation, satisfaction in learning is seen to be the best predictor of performance in mathematics. Although the other three domains of academic motivation (except satisfaction) are insignificant predictors of achievement, the aggregate of them all (academic motivation) predicts achievement in mathematics significantly thus the second null hypothesis was rejected.

iii. Discussion of Results

The second objective sought to investigate whether academic motivation predicts mathematics achievement. The study found that academic motivation positively and significantly predicted mathematics achievement. This concurs with Deci and Ryan (2000) self-determination theory which purports that students who are intrinsically driven to achieve will most likely rate high in academic achievement. Of the four domains of academic motivation, perceived probability of success and relevance negatively and insignificantly predicted mathematics achievement. Interest in learning mathematics positively and insignificantly predicted mathematics achievement while satisfaction positively and significantly predicted mathematics achievement.

The results indicated that out of the four domains of academic motivation, satisfaction in learning mathematics was the best predictor of achievement in mathematics.

Similar results are reported by Mutai 2007, Tella (2007), Ayub (2010), Maria et al. (2012), Imaobong and Umobong (2013), Mutweleli (2014) and Shukla et al. (2015) who all noted a positive and significant relationship between academic motivation and mathematics at different levels of schooling. Tella (2007) in his study of student's academic achievement and learning outcomes among secondary school students found that students differ significantly in their academic achievement based on the extent to which they are motivated. Maria et al. (2012) in a related study reported that motivation related variables are the main predictors of students' attitudes towards mathematics. Similarly, Mutweleli (2014) in his study of academic motivation and self-regulated learning among high school students established that intrinsic motivation had the highest predictive value on academic achievement.

The samples used in these studies are similar in that they use high school students. The findings reveal that despite cultural differences and study backgrounds, academic motivation positively correlates to mathematics achievement. Students who are either extrinsically or intrinsically motivated definitely perform better academically as compared to those who are not.

However, the findings of this study are contrary to those by George (2012) and Areepatamanil (2014) who found no statistically significant relationships between motivation and mathematics achievement among high school students. George (2012) examined the correlation between academic motivation, academic self-perceptions and academic performance in mathematics and English. His findings revealed that there is a significant negative relationship between academic motivation and academic achievement with all indicators of academic motivation that is mastery, performance and social support showing a significant negative relationship. Similarly Areepatamanil (2014) observed that the three types of motivation are not significantly related to mathematics achievement.

This means that when using different domains of academic motivation, one of them must be rated highly than all the others. In the current study, participants expressed high perceived probability of success over all other domains 354 (76.50%). Therefore, schools should focus on domains of academic motivation that boost mathematics achievement that is satisfaction and relevance. Equally, teachers should devise strategies of making the learning of mathematics more meaningful and relevant.

4.3.4 Prediction of Academic Resilience on Mathematics Achievement

The third objective of the study aimed to establish whether academic resilience predicted mathematics achievement of secondary school students in Nairobi County. Descriptive analysis of participant's academic resilience was done followed by

hypothesis testing and finally discussion of findings.

i. Descriptive Analysis of Students' Academic Resilience

Students' resilience was measured using the Academic Resilience Scale. Scores ranged from 9-45. The scores had a mean of 33.08 with a 6.25 standard deviation. Respondents' academic resilience scores were then computed and a median found which was used to split the sample into low and high academic resilience groups. Descriptive analysis was then done on the basis of respondents' gender and type of school attended. The results are presented in Table 4.23.

Table 4.23

Descriptive Analysis of Academic Resilience by Gender

		Male	Female	Total
Academic	Low	41(16.40)	31(14.60)	72(15.55)
Resilience	High	209(83.60)	182(85.40)	391(84.45)

Note. N= 463; () = % of the total.

Table 4.23 shows that an overwhelming number of respondents had high academic resilience 391 (84.45%) with 15.55% reporting low academic resilience. The trend was similar across gender as majority of both boys and girls reported high levels of academic resilience, 83.60% and 85.40% respectively. The results also indicated that the lesser percentages of boys and girls, 16.40% and

14.60% respectively reported low academic resilience.

Table 4.24

Descriptive Analysis of Academic Resilience by Type of School

		Type of School			Total
		National	County	Sub-county	
Resilience	Low	3(7.70)	20(13.80)	49(17.60)	72(15.55)
	High	36(92.30)	125(86.20)	230(82.40)	391(84.45)

Note. N= 463; () = % of the total.

Table 4.24 shows that 7.70%, 13.80% and 17.60% of students from national, county and sub county schools in that order exhibited low academic resilience. On the other hand, the majority, 92.30%, 86.20% and 82.40% of students in national, county and sub-county schools respectively reported high academic resilience. Of the whole sample, 15.55% and 84.45% of the respondents reported low and high academic resilience respectively.

Different proportions of students from the two categories of academic resilience scored below average, average and above average in mathematics. To establish these proportions, scores of academic resilience were cross tabulated with mathematics achievement and the results shown in Table 4.25.

Table 4.25

Mathematics Achievement by Levels of Academic Resilience

	Mathematics Achievement		
	Below average	Average	Above Average
Low AR	42(58.33)	28(38.89)	2(2.78)
High AR	145(37.08)	179(45.78)	67(17.14)

Note. $N= 463$; () = % of the total; AR = Academic Resilience.

The results shown on Table 4.25 indicate that majority of the students who reported low academic resilience scored below average (42%) while majority of those who reported high academic resilience scored an average in mathematics (45.8%). This shows that if properly nurtured, academic resilience may lead to better grades in mathematics.

ii. Hypothesis Testing

To establish whether academic resilience predicted mathematics achievement, the following null hypothesis was formulated:

H_{03} Academic resilience does not significantly predict mathematics achievement

The study first sought to establish whether there existed a linear relationship between academic resilience and mathematics achievement. This was done using bivariate correlation. The results indicated that the coefficient of correlation was positive and significant, $r = .29, p < .01$.

Simple linear regression analysis was then carried out with academic resilience as the predictor and mathematics achievement as the outcome variable. The regression equation was significant, $F(1, 461) = 41.49, p < .01$. From the model, academic resilience accounts for up to 8% of the total variance in mathematics achievement ($R^2 = .08$). This meant that academic resilience positively and significantly predicted mathematics achievement. The third null hypothesis was thus rejected. The results are presented in Table 4.26.

Table 4.26

ANOVA for Academic Resilience

	Sum of squares	<i>df</i>	Mean Square	<i>F</i>	Sig.
Regression	3479.915	1	3479.92	41.49	.00
Residual	38663.680	461	83.87		
Total	42143.595	462			

Note. $N = 463$.

Further, the predictive weight of academic resilience was examined. The results are presented in Table 4.27.

Table 4.27

Beta Coefficient for Academic Resilience

	Unstandardized Coefficients β	Std. Error	Standardized Coefficients Beta	t	Sig.
(Constant)	33.65	2.29		14.67	.00
Academic Resilience	.44	.07	.29	6.44	.00

Note. $N=463$; β = beta coefficient.

Data from Table 4.27 shows that academic resilience positively and significantly predicted mathematics achievement ($\beta = 0.44$, $p < 0.01$). This meant that an increase in students' academic resilience led to a significant increase in mathematics scores. The students in the population may have developed coping mechanisms and poor achievement in mathematics may have been due to other factors.

iii. Discussion of Results

The third objective of the study sought to establish whether academic resilience predicted mathematics achievement. The study found that academic resilience positively and significantly predicted mathematics achievement. This means that students who are able to withstand school stress and study pressure are likely to achieve highly in mathematics as compared to those who are not. These results are similar to those reported by Khadijah and Mahmud (2007), Lee (2009), Chatman (2011), Falcon (2010), Khalaf (2014), Zhaomin (2014), Florez and Fernada

(2015), Ricketts (2015), Mwangi et al. (2015) and Zuil (2016). Falcon (2010) for instance investigated the correlation between students' ability to cope with school challenges and academic achievement among Latino high school students from a low socio-economic background. The results indicated a significant relationship between academic resilience and mathematics achievement. The current study focused on participants from all socio-economic statuses. This means that academic resilience has nothing to do with one's socio-economic status. Ricketts (2015) in her study on academic resilience in mathematics among high school students from a low income set up found that there were significant differences between self-perceptions of academic resilience and mathematics achievement.

In his study, Khalaf (2014) also noted a significant relationship between academic resilience and academic achievement in all subjects. The sample comprised of University students. This means that students who are able to overcome study pressure and other school related challenges are most likely the ones who perform better academically. A study in Kenya by Mwangi et al. (2015) reported similar findings in their study of the interaction between academic resilience and academic performance of secondary school students in Kiambu County. The results of this study revealed a positive correlation between students' ability to cope with school pressure and academic achievement. The study attributed parental support and a conducive school environment as major determinants of academic resilience among high school students.

In another study, Zuil (2016) reported different findings in her study of individual resilience factors and academic success for adolescents. The results of the study indicated a significant positive relationship between resilience and reading achievement but no relationship between resilience and GPA and resilience and mathematics achievement. This means that students may be resilient in one subject and report low levels of resilience in another subject. It is important for schools to create a positive school environment that nurtures academic resilience among students and also focus on the stressors in different subjects so as to know how to deal with them. These results support Flach's (1989) theory of resilience which argues that students who have the psychological strength to effectively re-integrate after disruption are more likely to achieve highly academically and in this case in mathematics.

4.3.5 Predictive Levels of Academic Self-concept, Academic Motivation and Academic Resilience on Mathematics Achievement

The study further sought to determine whether academic self-concept, academic motivation and academic resilience collectively predict mathematics achievement. Various descriptive analyses procedures for these variables in relation to mathematics achievement were carried out. Table 4.28 shows the descriptive statistics for academic self-concept, academic motivation and academic resilience.

Table 4.28

Descriptive Statistics for Academic Motivation, Academic Resilience and Academic Self-concept

Variables	Mean	Std. Deviation
Academic Motivation	88.00	11.34
Academic Resilience	33.08	6.25
Academic Self-concept	66.91	5.81

Note. $N = 463$.

Findings in Table 4.28 reveal that the sample means for academic motivation, academic resilience and academic self-concept were equal to 88.00, 33.08 and 66.91 respectively.

The variables in question were then cross tabulated against mathematics achievement and the results are shown in Table 4.29.

Table 4.29

Mathematics Achievement by Levels of Academic Resilience, Motivation and Self-concept

		Mathematics Achievement		
		Below Average	Average	Above Average
AR	Low	42(58.33)	28(38.89)	2(2.78)
	High	145(40.17)	179(49.58)	67(18.56)
ASC	Low	99(39.76)	119(57.79)	31(12.45)
	High	88(41.12)	88(41.12)	38(17.76)
AM	Low	77(46.11)	77(46.11)	13(7.78)
	High	110(37.16)	130(43.92)	56(18.92)

Note. $N = 463$; () = %, of the total; AR= Academic Resilience; ASC = Academic Self-concept; AM = Academic Motivation.

Table 4.29 reveals that 58.33%, 38.89% and 2.78% of the students who had low academic resilience scored below average, average and above average respectively. On the other hand, 40.17%, 49.58% and 18.56% of those who had high academic resilience scored below average, average and above average respectively in mathematics. Of the students with low academic self-concept, 39.76%, 57.79% and 12.45%; and 41.12%, 41.12% and 17.76% of those who had high academic self-concept scored below average, average and above average respectively. Finally, equal numbers of students with low academic motivation (46.11%) scored below average and average in mathematics while 7.78% of the lowly motivated students

scored above average. Out of the highly motivated students, 37.16% scored below average while 43.92% and 18.92% of students who reported high academic motivation scored average and above average respectively.

i) Hypothesis Testing

Based on the fourth objective, the fourth null hypothesis was formulated:

Ho₄ Academic self-concept, academic motivation and academic resilience do not significantly predict mathematics achievement.

The independent linear relationships of each of these variables and mathematics performance were established as shown in Table 4.30.

Table 4.30

Relationships between Mathematics Achievement, Academic Motivation, Academic Resilience and Academic Self- concept

	Mathematics Achievement
Academic Motivation	.14**
Academic Resilience	.29**
Academic Self- concept	.09

Note. N= 463.

** Correlation significant at $p < .01$.

The Pearson's Product Moment Correlation coefficients for academic motivation, academic resilience and academic self-concept, as shown in Table 4.30 indicates that all the three predictors had positive correlations with mathematics performance; r

$r = .14$, $r = .29$ and $r = .09$ respectively. These correlations were significant, $p < .01$ for academic motivation and academic resilience except for academic self-concept which was insignificant, $p = .07$.

The correlations between the independent variables were established. The results revealed a strong positive and significant relationship ($r = .54$, $p < .01$) between academic resilience and academic motivation. The relationships between academic resilience and academic self-concept, between academic self-concept and academic motivation were also positive and statistically significant, ($r = .33$, $p < .01$) and ($r = .23$, $p < .01$). Further analysis was done to establish the influence of the variables on each other and the results are shown in Table 4.31

Table 4.31

Collinearity among Academic Resilience, Motivation and Self-concept

	Collinearity Tolerance	Statistics VIF
Academic Resilience	.66	1.52
Academic Motivation	.70	1.43
Academic Self-concept	.89	1.13

Note. $N = 463$; *VIF* = Variance Inflation Factor.

The values in Table 4.31 indicate that tolerance for academic resilience, academic motivation and academic self-concept are equal to .66, .70 and .89 respectively. These values suggest that none of these variables is redundant to any other in the model. The VIF values of 1.52, 1.43 and 1.13 for academic resilience, academic motivation and academic self-concept indicated that any multicollinearity that may

have existed among the variables was negligible.

Multiple linear regression analysis was used with academic self-concept, academic motivation and academic resilience as predictors of mathematics achievement. The regression equation was significant, $F(3, 459) = 13.88, p < .01$. This meant that the three variables collectively and significantly predicted mathematics achievement. Working together, the three variables accounted for 8% of the total variance in mathematics achievement ($R^2 = .08$). The null hypothesis; academic self-concept, academic motivation and academic resilience do not significantly predict mathematics achievement was thus rejected. The results are presented in Table 4.32.

Table 4.32

ANOVA for Academic Self-concept, Academic Motivation and Academic Resilience

	Sum of Squares	<i>df</i>	Mean Square	<i>F</i>	Sig.
Regression	3505.06	3	1168.36	13.88	.00
Residual	38638.53	459	84.18		
Total	42143.60	462			

Note. $N = 463$.

Further, the study sought to determine the predictive weight of each of the predictors.

The beta coefficients were examined and findings presented in Table 4.33.

Table 4.33

Beta Coefficients for Academic Self-Concept, Academic Motivation and Academic Resilience

	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	β	Std. Error	Beta		
(Constant)	35.68	5.46		6.54	.00
AM	-.02	.05	-.03	-.51	.61
AR	.47	.08	.31	5.54	.00
ASC	-.01	.08	-.01	-.17	.86

Note. $N = 463$; AM = Academic Motivation; AR = Academic Resilience; ASC = Academic Self-concept.

Results presented in Table 4.33 suggest that while acting simultaneously, academic self-concept ($\beta = -.01$, $p = .86$) and academic motivation ($\beta = -.02$, $p = .61$) are statistically insignificant negative predictors of mathematics achievement while academic resilience was found to positively and significantly predict mathematics achievement ($\beta = .47$, $p < .01$). Of the three, academic resilience was found to be the strongest predictor of mathematics achievement. This implies that students may possess high academic self-perceptions and be highly motivated. However, if they are not resilient, they may not improve in their mathematics scores.

ii. Discussion of Results

The study aimed to determine whether mathematics achievement was predicted by academic self-concept, academic motivation and academic resilience. This objective purposed to determine the predictive weight of each of the predictors when they acted simultaneously. The study found that academic self-concept and academic

motivation negatively and insignificantly predicted mathematics achievement (see Table 4.33). Contrastingly, academic resilience was found to positively and significantly predict mathematics achievement, hence the best predictor of mathematics achievement.

Working independently, the three predictor variables were significantly related to mathematics achievement. However, when working together academic self-concept and academic motivation were insignificant predictors of mathematics achievement while academic resilience was the only significant predictor of mathematics achievement. These results are similar to those of Ochse (2003) and Areepatamanil and Freeman (2008). Ochse's (2003) study established the relationship between academic self-concept and achievement among University students. The results revealed that students with low self-concepts achieved higher marks than those who overestimated themselves and have a higher self-concept. Similarly, Areepatamanil and Freeman (2008) examined the impact of psychological indicators like students' perceptions of their academic capability and the drive to excel on their academic achievement. Their results indicated that some students performed better in mathematics, had higher academic self-perceptions, and better intrinsic and extrinsic motivation than others. Further, mathematics self-perception is a better determinant of mathematics GPA for all students. These results indicated that mathematics self-concept may be determined by the environment and the level of schooling.

Contradictory findings on this predictive relationship are reported by Ahmed and Bruinsma (2006), Zahra et al. (2010), Coetzee and Berge (2014), Marzie and Mahsa (2014), Sikhwari (2014) and Visi (2015). For instance, Ahmed and Bruinsma (2006) in their study on the relationship between academic self-concept and motivation among university students found a positive relationship between academic self-concept and intrinsic motivation. This means that, students who possess positive feelings about their academic capability are definitely intrinsically motivated to perform better. Further, Sikhwari (2014) in a study to examine the relationship between motivation, self-concept and academic achievement among university students revealed significant correlations between students' academic self-perceptions, drive to excel and academic achievement.

Additionally, Coetzee and Berge (2014) examined academic self-concept and academic motivation and academic achievement among university students. Results indicated a positive correlation between academic self-perceptions, motivation and academic achievement which is significant. Moreover, Visi (2015) studied the relationship between students' academic self-concept, motivation and academic achievement. Results revealed a significant correlation between academic self-concept, academic motivation and academic achievement.

These results differ from the ones in the current study which reported that academic self-perceptions and students' drive to excel negatively and insignificantly predict mathematics achievement. The difference may have been the students' level of

education because the reported studies used samples of university students while the current study used secondary school students. This shows that the level of the students strongly determines students' academic self-concept and motivation.

The results that academic resilience positively and significantly predicts mathematics achievement are consistent with previous findings that show that resilience factors such as persistence and confidence are essential for continuous improvement in mathematics. For example, Chatman (2011) examined institutional factors that affect mathematical achievement of female high school students. The results indicated that once the resilience factors are put in place, students show continuous improvement in mathematics. Lee (2009) reported similar findings in his study on the impact of resilience on the academic achievement of at-risk rural and urban high school students. The results revealed that the at-risk students were highly resilient which positively related to their GPAs. Urban participants were found to be slightly more resilient than their rural counterparts. This implies that academic self-concept is important for mathematics achievement; academic motivation is more important while academic resilience is the best predictor of mathematics. These results may help teachers and students to understand the importance of handling study pressure and negative feedback positively. Thus, efforts to boost the academic resilience among students should be enhanced.

4.3.6 Gender Differences in Academic Self-concept, Academic Motivation, Academic Resilience and Mathematics Achievement

The study sought to establish gender differences in academic self-concept, academic motivation, academic resilience and mathematics achievement.

i. Descriptive Findings of Gender Differences in Students' Academic Self-concept, Academic Motivation, Academic Resilience and Mathematics Achievement.

The means of participants' scores on the variables were collated and presented in Table 4.34.

Table 4.34

Means of Academic Self-concept, Academic Motivation and Academic Resilience by Gender

	Males (250)		Females (213)	
	Mean	<i>SD</i>	Mean	<i>SD</i>
ASC	66.76	5.90	67.09	5.70
AM	88.05	11.71	87.94	10.92
AR	32.78	6.63	33.44	5.78

Note. *N*= 463; *SD*= Standard Deviation; ASC= Academic Self-concept; AM = Academic Motivation; AR = Academic Resilience.

From Table 4.34 females had higher means in academic self-concept and academic resilience, 67.09 and 33.44, 66.76 and 32.78, respectively than males. Males were however slightly more motivated than girls as seen from the means 88.05 for males and 87.94 for females. The means for males and females in the different domains of academic self-concept and academic motivation are presented in Table 4.35.

Table 4.35

Descriptive Statistics of Domains Academic Motivation and Academic Self-concept by Gender

	Males (250)		Females (213)	
	Mean	SD	Mean	SD
Effort	31.76	3.80	32.07	3.65
Confidence	35.00	3.82	35.02	3.87
PPS	34.15	5.27	33.72	4.69
ILM	13.06	2.38	13.23	2.46
Satisfaction	18.92	4.32	18.41	4.04
Relevance	25.51	5.01	26.10	4.83

Note. $N = 463$; SD = Standard Deviation; PPS = Perceived Probability of Success;

ILM = Interest in Learning Mathematics.

From Table 4.35, females had higher means of effort and confidence as compared to males, 32.07 and 31.76, 35.02 and 35.00 respectively. In the domains of academic motivation, males had higher means than females in perceived probability of success, 34.15 and 33.72 while in satisfaction, 18.92 and 18.41 respectively. However, these differences were minimal.

ii. Hypothesis Testing

To establish gender differences in students' academic self-concept, academic motivation and academic resilience the following null hypothesis was formulated:

Ho₅: There are no significant gender differences in academic self-concept, academic motivation and academic resilience.

To test this hypothesis, independent samples t-tests were carried out for each of the test variables. The findings show no gender differences in students' academic self-concept, academic motivation and academic resilience on the basis of gender. The null hypothesis was therefore retained. The results are presented in Table 4.36.

Table 4.36

Mean Differences for Mathematics Achievement, Motivation, Self-concept and Resilience by Gender

	Levene's Test for Equality of Variances		t-test for Equality of Means				
	<i>F</i>	<i>Sig.</i>	<i>t</i>	<i>df</i>	<i>Sig.</i>	<i>MD</i>	<i>SED</i>
AM	1.08	.30	.10	461	.92	.11	1.06
AR	1.90	.17	-1.1	461	.25	-.67	.58
ASC	.01	.92	-.60	461	.55	-.33	.54

Note. *N* = 463; *MD* = Mean Difference; *SED* = Standard Error Difference; *df* = degrees of freedom; *ASC* = Academic Self-concept; *AM* = Academic Motivation; *AR* = Academic Resilience.

The results in Table 4.36 indicate that the mean differences in academic motivation, academic resilience and academic self-concept were statistically

insignificant. Assuming equal variances for mathematics scores, $t(461) = .10$, $p = .92$ for academic motivation; $t(461) = -1.1$, $p = .25$ for academic resilience and $t(461) = -.60$, $p = .55$ for academic self-concept, there were hence no significant gender differences in mathematics achievement, academic motivation, academic self-concept and academic resilience. The differences in means were not only marginal but also statistically insignificant. The null hypothesis was therefore retained.

iii. Discussion of Results

The study also sought to establish gender differences in academic self-concept, academic motivation, academic resilience and mathematics achievement. The results indicated that male and female students were not significantly different in academic self-concept, academic motivation, academic resilience and mathematics achievement. This means that given equal opportunities, both male and female students can have comparable levels of academic self-concept, academic motivation, academic resilience and mathematics achievement. While females had higher mean academic self-concept and mean academic resilience than males, males outdid females in mean academic motivation and mathematics achievement. However, the differences were statistically insignificant.

These findings are similar to those reported by Mnyandu (2001) and Agrawal and Kumar (2015). Mnyandu (2001) investigated the effects of gender and mathematics ability on academic performance. The results indicated no significant gender differences in students' achievement in mathematics. Further, Agarawal and Kumar

(2015) in their study on gender differences in academic self-concept of boys and girls found no differences in self-concepts for boys and girls. Hence, environment notwithstanding, gender does not have any significant effect on mathematics achievement.

On the other hand, Cockburn and Cornelius (2000), Honora (2002), Muchera, Dixon and Hartley (2010) and Makwolo, Wasanga and Olely (2014) report contrary findings. Muchera et al. (2010) for instance reported that boys have higher mathematic self-concept as compared to girls. They examined the perceptions of self-concept and actual academic achievement in mathematics and English among high school students in Kenya. The results revealed gender and grade differences in performance and academic self-concept. Girls performed better in mathematics while boys rated themselves higher in the self-concept measures. This difference may have been due to the fact that the study sample was drawn from only two schools hence not generalizable across other schools. The implication is that differences in academic self-concept may not be determined by the study location because studies carried out in developing and developed countries reveal contradictory results.

Still on contrary results, is Rusillo and Pedro's (2004) study of gender and motivation among high school students. They found that male students have greater extrinsic motivation and are more likely to seek positive judgments and avoid negative ones as compared to female students. Similarly, Koseoghu (2013) revealed a significant effect of gender on motivation. These findings contradict the present study findings that were no gender differences in academic motivation. The

differences may be due to the differences in the studies locations, cultural differences and the level of schooling.

Results on gender differences in academic resilience are also contradicting. Mousavi and Askari (2010) examined the influence of gender differences on academic resilience among University students. The results indicated a significant relationship between academic resilience and academic achievement in favour of girls in English but not in mathematics. Similarly, Khalaf (2014) carried out a study to establish the validity of the academic resilience scale among university students. The results indicated a significant difference among males and females in favour of males. These differences may have been due to the differences in the level of schooling. Both samples were drawn from university students while in the current study the sample was drawn from high school students. In fact, in the current study, regardless of the type of school, boys and girls rated the same in terms of academic self-concept, academic motivation, academic resilience and mathematics achievement. This implied that gender was not a significant predictor of achievement since there were no significant differences in mathematics achievement and also there were no significant differences in the predictor variables.

4.3.7 Differences in Academic Self-concept, Academic Motivation, Academic Resilience and Mathematics Achievement by Type of School

The last objective of the study tried to establish differences in academic self-concept, academic motivation, academic resilience and mathematics achievement

by the type of school attended.

i. Descriptive Analysis of Differences in Academic Self-concept, Academic Motivation, Academic Resilience and Mathematics Achievement by Type of School

Data on respondents' academic self-concept, academic motivation, academic resilience and mathematics achievement was collated and presented in Table 4.37.

Table 4.37

Mean Scores for Academic Self-concept, Academic Motivation, Academic Resilience and Mathematic Achievement

	National		County		Sub county	
	Mean	<i>SD</i>	Mean	<i>SD</i>	Mean	<i>SD</i>
MA	62.14	5.27	49.68	8.36	45.43	8.69
ASC	66.56	4.85	66.76	5.32	67.04	6.17
AM	88.46	10.41	87.58	11.19	88.16	11.57
AR	35.87	6.25	33.73	5.80	32.35	6.36

Note. *N*= 463.

Results presented in Table 4.37 show that students from sub-county schools had the highest academic self-concept in general, with a mean of 67.04 (*SD* =6.17), while students from national schools had the lowest mean academic self-concept 66.56 (*SD* = 4.85). County schools had a mean academic self-concept equal to 66.76 (*SD* = 5.32). Students from national schools reported the highest academic motivation with

a mean of 88.46 ($SD = 10.41$), with their counterparts from the sub-county stratum following closely with a mean of 88.16 ($SD = 11.57$). Students from county schools had a mean motivation equal to 87.58 ($SD = 11.19$). National schools reported the highest academic resilience with a mean of 35.59 ($SD = 5.81$) and overall mathematics achievement mean 62.99 ($SD = 5.05$) while sub-county schools reported lowest in both categories mean 32.35 ($SD = 6.36$); and mean 45.43 ($SD = 8.69$) respectively. County schools had a mean of 33.73 ($SD = 5.80$); and mean of 49.68 ($SD = 8.36$) in academic resilience and mathematics achievement respectively.

Students from national schools reported the highest means in academic motivation, academic resilience and mathematics achievement. This can be attributed to various factors including better facilities, teacher-student ratio, entry behaviour among others. Interestingly, students from sub-county schools reported the highest academic self-concept. This could be explained by the fact that academic self-concept does not only depend on a student's academic ability but also the abilities of the schoolmates. In this case, students in sub-county schools compete amongst themselves hence the report of high academic self-concept.

ii. Hypothesis Testing

To establish whether there were any differences in respondents' academic self-concept, academic motivation, academic resilience and mathematics achievement based on the type of school, the following null hypothesis was formulated:

H_{06} There are no significant differences in academic self-concept, academic motivation, academic resilience and mathematics by type of school

One-way ANOVA was used to test the hypothesis. Results suggested significant differences in means of academic resilience and mathematics achievement between students in national, county and sub-county schools.

The results are presented in Table 4.38

Table 4.38

ANOVA of Academic Self-concept, Academic Motivation, Academic Resilience and Mathematics Achievement.

		Sum of Squares	df	Mean Squares	F	Sig.
MA	BG	10038.14	2	5019.07	71.91	.00
	WG	32105.45	460	69.79		
	Total	42143.60	462			
AM	BG	40.91	2	20.45	.16	.85
	WG	59390.09	460	129.11		
	Total	59431.00	462			
AR	BG	512.14	2	256.07	6.71	.00
	WG	17552.74	460	38.16		
	Total	18064.88	462			
ASC	BG	12.92	2	6.46	.19	.83
	WG	15565.63	460	33.84		
	Total	15578.54	462			

Note. N= 463; df = degrees of freedom; MA = Mathematics Achievement; ASC= Academic Self-concept; AM = Academic Motivation; AR = Academic Resilience; BG = Between Groups; WG = Within Groups.

Results presented in Table 4.38 indicate there were significant differences in the

means of mathematics achievement and academic resilience among the school types. $F(2,460) = 71.91, p < .01$ for mathematics achievement, $F(2,460) = 6.71, p < .01$ for academic resilience. The mean differences for academic motivation $F(2,460) = .16, p < .85$ and academic self-concept $F(2,460) = .19, p < .83$ between the school types were however statistically insignificant. The null hypothesis was thus rejected. Turkey's HSD post hoc analysis was then done to determine the groups which introduced the differences in means.

The results are presented in Table 4.39.

Table 4.39

Post hoc analysis

DV	ToS (I)	ToS (J)	MD (I-J)	SE	Sig.
Mathematics Achievement	National	County	12.46*	1.51	0.00
		Sub-county	16.71*	1.43	0.00
	County	National	-12.46*	1.51	0.00
		Sub-county	4.25*	0.86	0.00
Academic Resilience	Sub-county	National	-16.71*	1.43	0.00
		County	-4.25*	0.86	0.00
	National	County	2.14	1.11	0.13
		Sub-county	3.52*	1.06	0.00
	County	National	-2.14	1.11	0.13
		Sub-county	1.38	0.63	0.08
	Sub-county	National	-3.52*	1.06	0.00
		County	-1.38	0.63	0.08

Note. $N = 463$; DV = Dependent Variable; ToS = Type of School; MD = Mean Difference; SE = Standard Error.

Post hoc analysis using Tukey's HSD in Table 4.38 indicate that there were significant differences in mathematics achievement between national and county schools with a difference of 12.46, $p < .01$; between national and sub-county schools, with a mean difference of 16.71, $p < .01$; and also between county and sub-county schools, mean difference = 4.25, $p < .01$. There was also a significant difference in the levels of academic resilience for national and sub-county schools. Students from national schools reported higher academic resilience than their counterparts from sub-county schools with a difference of 3.52, $p < .01$. The levels of resilience in national and county schools were statistically not different. This suggests that students in national and county schools are considerably equally resilient. The differences between school categories in academic self-concept and academic motivation were statistically insignificant. This shows that the level of academic self-concept and academic motivation are not determined by the type of school attended.

iii. Discussion of Results

Finally, the study sought to establish differences in academic self-concept, academic motivation, academic resilience and mathematics achievement by the type of school. Results revealed that the type of school had no significant influence on academic self-concept and academic motivation while it significantly influenced academic resilience and mathematics achievement. The differences in mathematics achievement and academic resilience in the different types of schools may be attributed to the students' entry behaviour, availability of resources and teacher-

student ratio among others. The levels of academic motivation and academic self-concept may not be determined by the type of school but may be attributed to other factors.

These findings are similar to those reported by Srivastara and Joshi (2011), Momanyi et al. (2011), Fin and Zahari (2013), Mburu (2013), Karaguren (2015), and Mwangi, et al. (2015). For instance, Srivastara and Joshi (2011) examined the effect of school and area on academic self-concept and academic achievement. Results revealed that academic self-concept and academic achievement of adolescents were higher in high facility schools than in the low facility schools. In the present study, academic self-concept was not significantly influenced by the type of school but mathematics achievement was. Results also concurred partly with those of Momanyi et al. (2011). The three investigated academic motivation and academic performance of secondary school students and the findings indicated that the type of school strongly contributed to academic motivation and academic achievement. In the present study however, while achievement in mathematics was influenced by type of school, academic motivation was not.

Further, Mwangi et al. (2015) examined the correlation between students' ability to cope with school pressure and academic achievement among secondary school students. The results showed that in schools where there is emphasis on good grades, students learn how to survive and thrive even in the face of academic setbacks so as to get better grades.

Contradictory findings are reported by Baran and Maskan (2011) who examined the relationship between students' academic self-concept and certain variables like type of school, gender and family background. Results revealed that students attending vocational high schools had a lower self-concept compared to students attending other schools. The differences in results could have been caused by the single subject approach used in the present study as compared to the other studies which used a general subject approach. This means that the type of school majorly brings out differences in academic resilience and mathematics achievement depending on what the school environment presents. Both teachers and parents should collaborate towards improving learning conditions in all types of schools so that students in some schools are not disadvantaged. The government in policy making should create similar school environments in order to boost learners' overall academic achievement.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter is divided into four sections. The first section presents a summary of the major findings. The second part of this chapter deals with the implications of the study while in the third section conclusions of the study are presented. In the final section, recommendations for policy and research are presented.

5.2 Summary

The study was designed to investigate academic self-concept, academic motivation and academic resilience as predictors of mathematics achievement. The study also aimed to find out whether there were significant gender differences in students' academic self-concept, academic motivation, academic resilience and mathematics achievement. The influence of the type of school on students' academic self-perceptions, academic motivation and academic resilience were also studied.

The first objective determined the significant prediction of academic self-concept on mathematics achievement of students. Empirical evidence indicated a positive though insignificant correlation between students' academic self-perceptions and mathematics achievement. Further analysis revealed that most students reported high academic self-concept than low academic self-concept. On the two domains of academic self-concept, more students reported higher confidence across gender and type of school than low confidence. However, more students reported lower effort

than high effort across gender and type of school. Confidence nonetheless was a positive and significant predictor of mathematics achievement while effort was a negative and insignificant predictor of mathematics achievement.

The second objective sought to investigate the significant prediction of academic motivation on mathematics achievement. The study found a significant and positive relationship between academic motivation and mathematics achievement. Results of multiple linear regression on the domains of academic motivation revealed that of all the domains of academic motivation, satisfaction was a strong and positive predictor of mathematics achievement. The predictive value of interest in learning though positive was insignificant while the other two domains were negative and insignificant predictors of mathematics achievement.

The third objective sought to establish whether academic resilience significantly predicted mathematics achievement. The study found that academic resilience positively and significantly predicted mathematics achievement in the population of study. Majority of the respondents reported high academic resilience across gender and type of school. Interestingly, a higher percentage of girls reported high academic resilience than boys.

The fourth objective aimed to determine the relative prediction of academic self-concept, academic motivation and academic resilience on mathematics achievement. The study found that academic self-concept positively predicted mathematics achievement. There was a positive relationship between academic motivation and

mathematics achievement although some domains portrayed a negative relationship. In contrast, academic resilience was found to positively and significantly predict mathematics achievement. Of the three predictor variables, academic resilience was found to be the strongest predictor of mathematics achievement. This implies that besides raising students' academic self-concept and enhancing academic motivation, a lot of efforts need to be directed towards a positive school environment with teachers giving positive feedback as a way of nurturing academic resilience.

The fifth objective sought to establish if there were significant gender differences in academic self-concept, academic motivation and academic resilience of secondary school students. The findings revealed that female students scored above average in general and had higher academic motivation. Male students reported higher scores on two domains of academic motivation that is perceived probability of success and satisfaction. Further analysis revealed that female students reported higher means on academic resilience as compared to their male counterparts. Surprisingly, male students reported higher means on mathematics achievement. However, there were no significant gender differences in the three variables.

The last objective sought to investigate if the type of school influenced academic self-perceptions, academic motivation and academic resilience of secondary school students. One-way ANOVA revealed that there were significant differences in mathematics achievement and academic resilience among the different school types. This means that teachers, parents and all other stakeholders should improve learning conditions in all categories of schools. Better strategies of learning should be adopted and geared towards uplifting grades in some schools. This is in

consideration of the differences in entry behaviour.

5.3 Conclusion

The results of this study presented evidence of the existence of a relationship between academic self-concept, motivation, academic resilience and mathematics achievement. It was found that academic self-concept positively and insignificantly predicted mathematics achievement. Further, effort negatively and insignificantly predicted mathematics achievement while confidence positively and significantly predicted mathematics achievement. Overall, academic self-concept however had a weak positive predictive value meaning that to some extent, academic self-concept predicted mathematics achievement.

The study found that academic motivation positively and significantly predicted mathematics achievement. In addition, both perceived probability of success and relevance negatively and insignificantly predicted mathematics achievement. This meant that students may not have been exposed to opportunities for enhancing probability of success and relevance in mathematics. Interest in learning mathematics positively and insignificantly predicted mathematics achievement while satisfaction positively and significantly predicted mathematics achievement. It is therefore important to enhance aspects of schooling and learning that improve satisfaction as high levels of satisfaction with the learning process determines to a greater extent the level of academic achievement.

Academic resilience positively and significantly predicted mathematics achievement. This is evidence that students who are able to handle study pressure and negative feedback about their mathematics performance are likely to get good grades. Students should therefore be encouraged to cope with difficult situations in school and use every feedback as an insight into improvement.

Of the three predictor variables, academic resilience was found to be the strongest predictor of mathematics achievement. This means that high academic self-concept and high levels of academic motivation may not translate to high achievement if the student lacks the capacity to cope with pressure and negative academic feedback.

Moreover, there were no significant gender differences in mathematics achievement. This suggested that both male and female students had the same capacity to achieve if all other factors were held constant. Similarly, there were no gender differences among the three predictor variables. This implied that if both male and female students were exposed to similar study conditions, they would exhibit similar levels of achievement all other factors notwithstanding.

The type of school was found to significantly influence students' academic self-perceptions, drive to excel, academic resilience and mathematics achievement. Students in national and county schools seemed to perform much better as compared to students in sub-county schools. The students' entry behaviour could have been a determinant.

5.4 Recommendations

The researcher, guided by the findings, conclusion and the theories of self-determination and resilience made recommendations related to policy and further research.

5.4.1 Policy Recommendations

- i. The study found that academic self-concept positively and insignificantly predicted mathematics achievement. Students should be trained on skills that can be utilized in improving their academic self-concept. This will help in bringing those students who have no confidence to view themselves as capable of better performance in mathematics.
- ii. Academic motivation was found to positively and significantly predict mathematics achievement. Students should be equipped with knowledge and skills, and be given opportunities that will improve their academic motivation.
- iii. Of the three predictor variables, academic resilience was found to be the strongest predictor of mathematics achievement. Academic resilience should be nurtured among students by teachers, parents and all other educational stakeholders. Since academic resilience alone may not work to promote mathematics achievement, efforts should also be made to enhance academic self-concept and academic motivation since to some extent they influenced mathematics achievement.
- iv. There were no gender differences among the three predictor variables and mathematics achievement. Interventions should target exposing both boys and girls to similar conditions that enhance academic self-concept, academic motivation and academic resilience.

- v. The type of school was found to significantly influence students' academic self-perceptions, drive to excel, academic resilience and mathematics achievement. There should be efforts to remove disparities in the different types of schools.

5.4.2 Recommendations for Further Research

- i. There is need to carry out a similar study in other parts of the country aimed at determining whether there might be rural-urban disparities in the students' academic self-perceptions, drive/desire to excel, academic resilience and mathematics achievement.
- ii. Findings of this study have shown that of the three predictor variables, academic resilience was the strongest predictor of mathematics achievement. However, the study did not investigate the determinants of this construct. Consequently, further research is required to establish factors that may relate to mathematics achievement and influence the development of the constructs.
- iii. A similar study may be carried out in other counties for the purpose of generalization of findings. This will help resolve cultural and geographical differences.
- iv. The type of school was found to have a significant influence on students' academic self-concept, academic motivation, academic resilience and mathematics achievement. There is need for another study in other parts of the country for the purpose of comparison.
- v. The current findings were based on secondary school students. To contribute to a better understanding of the constructs, a similar study should be replicated using a sample of university or primary school students.

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APPENDICES
APPENDIX A
Letter of Consent

Gachigi Priscilla Njoki

Department of Educational Psychology

Kenyatta University,

P.O BOX 43844.

Nairobi.

Dear student,

I am a PhD Student in the department of Educational Psychology of Kenyatta University. I am conducting a research involving form three students in Nairobi County. The research will use questionnaires to collect information about your academic self- concept, motivation and resilience specifically in mathematics. Through the information collected, students, teachers and parents may be helped in improving mathematics achievement. Your answers will be kept confidential.

I wish to let you know that you have been chosen to participate in the research because you are in form three. You are free to choose whether to participate or not. If you agree to participate and you happen not to be comfortable in due course, you are free to discontinue. I promise that I will share the findings of the study upon its completion with all the participants. If you agree to participate please sign as indicated below.

Thank you.

Signature..... (I agree to participate in the study)

Appendix B: Students' Questionnaire

Demographic Information

Below are statements about yourself. Please answer them as honestly as possible.

Your Admission Number

1. Are you Male or Female?

2. How old are you? (Tick one)

Below 16

16

17

18

Over 18

3. Type of school (Tick one)

National

County

Sub-County

4. How would you generally describe your overall score in mathematics?(Tick one)

Mostly 70% and above

Mostly 60%

Mostly 50%

Mostly 40%

Mostly 30% and below

APPENDIX C**ACADEMIC SELF-CONCEPT QUESTIONNAIRE – ASCQ**

Below are statements about how you feel about mathematics. Read them carefully and tick (v) the best that describes how you feel about your performance. The answers range from strongly disagree to strongly agree. There are no correct or false responses and your teacher will not look at your work.

KEY: SD = Strongly Disagree, D = Disagree, NS = Not Sure, A = Agree, SA = Strongly Agree

	Statement	SD	D	NS	A	SA
		1	2	3	4	5
1	I am able to pay attention during mathematics lessons easily.					
2	I get carried away a lot in a mathematics class.					
3	I am capable of assisting my classmates in their mathematics schoolwork.					
4	I easily do my mathematics homework					
5	If I put a lot of effort, I am sure I will go to the university.					
6	I concentrate a lot during mathematics lessons					

7	Most of my classmates perform better than me in mathematics.					
8	I revise a lot for my mathematics tests					
9	My teachers complain a lot about my performance in mathematics work.					
10	I am very keen on my mathematics schoolwork					
11	I forget whatever I learn in mathematics very fast					
12	I am willing to go an extra mile so as to pass in mathematics.					
13	I get scared when the mathematics teacher asks me a question					
14	I often feel like dropping out of school because of my poor mathematics performance.					
15	I do well in mathematics.					
16	I always long for the mathematics lessons to end.					
17	I do not think I will ever improve on mathematics tests.					
18	I do not lose hope when am faced with a difficult question in my mathematics schoolwork					

19	I can do better than my friends in mathematics.					
20	I am not ready to put any more effort in my mathematics schoolwork.					

APPENDIX D**ACADEMIC MOTIVATION SCALE**

Using the information below, select to what extent each of the following items corresponds to your motivation to learn mathematics. Tick/circle your choice. Choices are as follows;

KEY: SD = Strongly Disagree, D = Disagree, NS = Not Sure, A = Agree, SA = Strongly Agree

NOTE. There are no correct or wrong answers and your teacher will not be shown your work.

	Statement	SD	D	NS	A	SA
		1	2	3	4	5
1	I enjoy mathematics lessons					
2	Mathematics lessons are discouraging					
3	The time I spend solving mathematics problems is the time I love most					
4	I am highly motivated to learn mathematics.					
5	I find it difficult to solve work mathematical problems alone.					
6	I do not think I will ever apply mathematics in life situations.					

7	I rarely expect to do well in mathematical tasks given by teachers in mathematical classes					
8	Learning mathematics gives me chances of becoming a better person.					
9	I do a lot of mathematical exercises on my own during school holidays.					
10	I have no hope of performing better in mathematics-related subjects.					
11	I expect to be able to solve mathematical problems anywhere I come across them if they are of my level of education					
12	I am able to work on my own in mathematics exercises in and outside mathematics classrooms.					
13	I expect to get very good grades in mathematics tests					
14	I expect to be able to make use of mathematical knowledge easily in other situations in life					
15	Learning mathematics is in itself rewarding					
16	I am contented with the way I learn mathematics					

17	I do not feel uncomfortable during mathematics lessons					
18	I am not contented with my participation in classroom mathematics activities					
19	I am contented with the way mathematics is taught					
20	I am contented with my performance in mathematics assignments, tests and examinations					
21	I aim to study mathematics after KCSE					
22	I am not certain whether it is important for me to continue studying mathematics					
23	I find activities in mathematics lessons very important					
24	Everything about mathematics is related to my daily experiences					
25	Mathematics is very important for my needs and goals both in school and at home					
26	Mathematics gives me opportunities for choice, responsibility and inter-personal influence					
27	Mathematics lessons give me opportunities for exchanging ideas with other people.					
28	I would prefer a career that has nothing to do with mathematics					

APPENDIX E**ACADEMIC RESILIENCE SCALE**

Using the information below, select to what extent each of the following items corresponds to your feelings about your life in school. Tick/circle your choice. Choices are as follows;

KEY: SD = Strongly Disagree, D = Disagree, NS = Not Sure, A = Agree, SA = Strongly Agree

NOTE. There are no correct or wrong answers and your teacher will not be shown your work.

	Statement	SD	D	NS	A	SA
		1	2	3	4	5
1	I believe that I am mentally tough when it comes to mathematics exams					
2	I do not let study pressure get on top of me in mathematics.					
3	I am good at bouncing back from a poor mark in my mathematics tests					
4	I think I am good at dealing with mathematics work pressure					
5	I do not let a bad mathematics mark affect my confidence					
6	I am good at dealing with setbacks at school like a bad mark and negative feedback on my work in mathematics					

7	I believe that mathematics will be useful to me in the future					
8	I know where to get help if I am having trouble with mathematics					
9	I plan to get a good grade in mathematics at KCSE					

APPENDIX F**SCORING THE ACADEMIC MOTIVATION SCALE (AMS)**

Item	Type/ domain/orientation of motivation measured
5, 6, 7, 8, 9, 10, 11, 12, 13, 14	Perceived probability of success
1, 2, 3, 4	Interest in learning mathematics
15, 16, 17, 18, 19, 20	Satisfaction
21, 22, 23, 24, 25, 26, 27, 28	Relevance

Calculations;

To calculate a participant's score on the AMS, the mean response for each of the sub-scales will be found. These means will vary between 1 and 5 and they will be used to calculate a student's academic motivation.

APPENDIX G**SUMMARY OF STUDENTS MATHEMATICS ACHIEVEMENT**

School: Gender: Male () Female ()

Code no:

Examination	Total Marks	Mean Score
Form two: Term II 2015		
Term III 2015		
Form three: Term I 2016		

APPENDIX H

RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MS. PRISCILLA NJOKI GACHIGI
 of **KENYATTA UNIVERSITY**, 0-200
NAIROBI, has been permitted to conduct
 research in **Nairobi County**

Permit No : NACOSTI/P/16/95813/11996
Date Of Issue : 6th July,2016
Fee Received :Ksh 2000

**on the topic: ACADEMIC SELF-CONCEPT,
 MOTIVATION AND ACADEMIC
 RESILIENCE AS PREDICTORS OF
 MATHEMATICS ACHIEVEMENT OF
 SECONDARY SCHOOL STUDENTS IN
 NAIROBI COUNTY, KENYA.**

**for the period ending:
 5th July,2017**

**Applicant's
 Signature**




**Director General
 National Commission for Science,
 Technology & Innovation**

CONDITIONS

- 1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit**
- 2. Government Officers will not be interviewed without prior appointment.**
- 3. No questionnaire will be used unless it has been approved.**
- 4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.**
- 5. You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.**
- 6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice**

REPUBLIC OF KENYA




**National Commission for Science,
 Technology and Innovation**

**RESEARCH CLEARANCE
 PERMIT**

Serial No. A 9985

CONDITIONS: see back page

APPENDIX I: RESEARCH AUTHORISATION



**NATIONAL COMMISSION FOR SCIENCE,
TECHNOLOGY AND INNOVATION**

Telephone: +254-20-2213471,
2241346, 3310571, 2219420
Fax: +254-20-318245, 318249
Email: nc@nacosti.go.ke
Website: www.nacosti.go.ke
when replying please quote

9th Floor, Utalii House
Utalii Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref. No. _____ Date _____

NACOSTI/P/16/95813/11996

6th July, 2016


Priscilla Njoki Gachigi
Kenyatta University
P.O. Box 43844-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on "*Academic self-concept, motivation and academic resilience as predictors of mathematics achievement of secondary school students in Nairobi County, Kenya.*" I am pleased to inform you that you have been authorized to undertake research in **Nairobi County** for the period ending **5th July, 2017.**

You are advised to report to **the County Commissioner and the County Director of Education, Nairobi County** before embarking on the research project.



On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.


BONIFACE WANYAMA
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner **COUNTY COMMISSIONER**
Nairobi County. **NAIROBI COUNTY**
P. O. Box 30124-00100, NBI
TEL: 341066

The County Director of Education
Nairobi County.

National Commission for Science, Technology and Innovation is ISO 9001:2008 Certified

APPENDIX J

KENYATTA UNIVERSITY RESEARCH AUTHORIZATION



KENYATTA UNIVERSITY
GRADUATE SCHOOL

E-mail: dean-graduate@ku.ac.ke

Website: www.ku.ac.ke

OUR REF: E83/20529/10

The Director General
National Commission for Science, Technology & Innovation
P.O. Box 30623-00100
NAIROBI

P.O. Box 43844, 00100
NAIROBI, KENYA
Tel. 8710901 Ext. 57530

Date: 17th May, 2016

Dear Sir/Madam,

RE: RESEARCH AUTHORIZATION FOR MS. GACHIGI P. NJOKI REG. NO. E83/20529/10

I write to introduce Ms. Njoki who is a Postgraduate Student of this University. She is registered for Ph.D. Degree programme in the Department of Educational Psychology in the School of Education.

Ms. Njoki intends to conduct research for a Ph.D. thesis entitled, "Academic Self-Concept, Motivation and Academic Resilience as Predictors of Mathematics Achievement of Secondary School Students in Nairobi County, Kenya".

Any assistance given will be highly appreciated.

Yours faithfully,



MRS. P. K. 43844-00100
FOR: DEAN, GRADUATE SCHOOL

KM/cao

APPENDIX K

MAP OF NAIROBI COUNTY

