The Relationship between Selected Factors and Students' Mathematics Self-Concept and Achievement in the Military Science Programme of Egerton University, Kenya

By

Nelson K. Kemboi

A Thesis Submitted to Graduate School in Partial Fulfillment for the Requirements of the Award of a Masters of Education (Science Education) Degree of Egerton University.

EGERTON UNIVERSITY

DECEMBER 2009

DECLARATION AND RECOMMENDATION

DECLARATION

This is my original work and has not been presented for an award of a Degree or Diploma in this or any other University.

Signature...Date. 8th Dec 2009

Nelson K. Kemboi
EM14/1558/05

RECOMMENDATION

This work has been submitted for examination with our approval as University Supervisors.

Signature...Date. 8/12/09

Prof. Bernard N. Githua

Signature...Date. 8th Dec. 2009

Prof. Johnson M.Changeiywo

COPYRIGHT

DEDICATION

This work is dedicated to my parents, my wife Anne and my children.

ACKNOWLEDGEMENT

I would like to acknowledge the following: The Ministry of State for Defence, who sponsored and gave me time off to study; my two supervisors, Prof. Bernard N. Githua and Prof. Johnson M. Changeiywo for their invaluable advice, guidance, help, inspiration and the patience they gave me in the preparation of this thesis; The staff members of the Faculty of Education and Community studies and Graduate School, Egerton University, who assisted me in many ways during the research process. I acknowledge the Kenya Military Academy (formerly Armed Forces Training College – AFTC) and Cadets who participated during the data collection. Glory to the Almighty God for His continued provision throughout the time I was doing this work and future endeavours.

ABSTRACT

Knowledge of mathematics as a tool for use in everyday life is important for the existence of any individual and society. It equips students with unique and powerful set of tools to understand and change the world. It is for this reason that tertiary institutions, take mathematics as part of professional development. Despite the importance of mathematics as a basic preparation for full participation as a functional member of the society, the performance in the subject has been poor as shown in national examinations in Kenya. The general trend in students' performance in mathematics in the military science programme of Egerton University indicates higher percentage of graduates who underachieve in the subject. There is limited research that has been carried out in students' mathematics self concept and achievement at tertiary institutions in Kenya. Furthermore there is no documentary research study in the military science programme. This study sought to investigate the relationship between selected factors and students' mathematics self-concept and achievement in the military science programme offered at Egerton University in Kenya. The guiding theory was based on the Systems Approach theory. Correlation research design was used in the study. The study population was 145 student officers (Cadets) enrolled in the military science programme of Egerton University in Kenya. Sample size for the study was the entire population. Four instruments were used namely: Self Descriptive Questionnaire III (SDQ III), Students' Mathematics Attitude Scale (SMATS), Students' Motivation to Learn Mathematics (SMLM), and Students' Learning Environment Questionnaire (SLEQ). These instruments were validated and pilot tested for suitability and reliability before being used in the study. All the instruments had a reliability index (Cronbach Alpha) above the required threshold of 0.7. Questionnaires solicited information on the students' academic background and their mathematics scores in KCSE. Students' Mathematics Achievement Scores (SMAS) were mathematics scores in University examinations and were obtained from School of Continuing Education, Egerton University. Data was analyzed using descriptive and inferential statistics to test the stated hypotheses at alpha (α) level of 0.05. Pearson moment correlation was used to test hypotheses. Statistical Package for Social Sciences (SPSS) version 15 was used for data analysis. Findings of the study show that the military science students have a positive attitude towards mathematics which is related to their self concept in the subject. The results also show that military science students' mathematics self concept and their achievement in the subject have no significant relationship with the learning environment. The findings of the study are expected to enable policy makers in education, the military, career counselors and other stakeholders in the field of education to understand factors that affect students' mathematics self concept and achievement; and to device ways of intervention in order to embrace mathematics as a utilitarian subject in school and life.

TABLE OF CONTENTS

LIST OF TABLES

Page

LIST OF FIGURES

Page

LIST OF ABBREVIATIONS AND ACRONYMS

ACO	African Curriculum Organization
AFTC	Armed Forces Training College
DOD	Department of Defence
KCSE	Kenya Certificate of Secondary Education
KIE	Kenya Institute of Education
KMA	Kenya Military Academy
KNEC	Kenya National Examinations Council
MS	Military Science
SCANS	Secretary's Commission on Achieving Necessary Skills
SDQ III	Self Descriptive Questionnaires III
SLEQ	Students' Learning Environment Questionnaire
SMAS	Students' Mathematics Achievement Scores
SMSC	Students' Mathematics Self – Concept
SPSS	Statistical Packages for Social Sciences.
TIMSS	Trends in International Mathematics and Science Study
USMA	United States Military Academy

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Mathematics is an indispensable tool in the development of science and technology in the sense that formulation, computing, calculation, evaluation among others are the important methodologies applied in them (Cockcroft, 1982; Saitoti, 2000.) It is also a fact that without advances in science and technology no country can make any meaningful progress in improving the quality of life of its people. Mathematics equips students with uniquely powerful set of tools to understand and change the world. These tools include logical reasoning, problem-solving skills, and the ability to think.

Problems in which mathematical expertise may be helpful do not come with course labels attached. For example, a U.S. government report on what work requires of schools embeds mathematical ideas in entirely different categories (SCANS, 1991). Some performance expectations that require mathematical competence, as espoused by SCANS, are identified as basic and thinking skills. Basic skills include arithmetic, estimation, graphs and charts, logical thinking and understanding chance. Thinking skills include evaluating alternatives, making decisions, solving problems, reasoning, organizing and planning.

Many of the basic and thinking skills fall under one or more advanced mathematical competencies involving resources, information, systems and technology. Under resources which require competence in mathematics are allocation of time, money, material, and human resources. Information in mathematics involves acquiring, evaluating, organizing, maintaining, interpreting, communicating, and processing. Under mathematical systems there is understanding, monitoring, improving and designing while mathematical technology involves selecting, applying, maintaining and troubleshooting.

Mathematics is an essential subject in military science. Roman warfare and Modern warfare have been characterized by the rationality of goals and means; quantization of troops, inventory, distances, order of battle; and discipline and shared goals of fighting troops, commanders and the hinterland (Bernhelm & Booss, 2001).

Today, most military historians agree that the rise of modern war in the period 1500-1945 was accompanied by a rise in mathematics based technologies and other innovations, but not driven by it (Machiavelli, 1990). The new ways of warfare came from the mathematical idea. Discarding differences and emotions between adversaries, the basic assumption of modern warfare is that both sides are guided by the same kind of logic, rationality, and reason which is embedded in mathematics learning.

As documented in Booss, Bernhelm, and Hoyrup (1984), Babylonian clay tablets from about 1800 B.C dealt with siege computation. These included the number of bricks needed for siege ramps, the volume of earth to be dug and how much workforce was required. The same calculations were used when building a temple or digging an irrigation canal. Many real-world mathematical problems on the thousands of preserved tablets show, for instance in the choice of unknowns for the quadratic equations, that they were meant to puzzle and train the student in preparation for the solution of problems in real situations.

The Renaissance had a high appreciation of the possibilities of mathematics in every practice. Specific military needs (cartography, artillery and ballistics) partly preceded, partly met specific civilian needs like the theory of the central perspective, bookkeeping, merchants' calculation and algebra (Booss et al, 1984). Keeping it a strict military secret, the fifteenth-century Portuguese court took up a systematic development of navigational mathematics which led them to distinguish between great circle arcs (geodetic curves) and loxodromes (curves of constant angles like the parallels). As cited in Booss et al, when Niccolo Tartaglia tried to give rules for the art of the bombardier Nova Scientia, he abandoned Aristotle's concept of a piecewise linear trajectory and created the modern concept of a function f(x) that produces a smooth curve. The Flemish mathematician Simon Stevin later quartermaster general of the army under Maurice of Nassau, engineered a system of sluices to flood certain areas in defence of besieged cities and thus founded the modern statics and hydrostatics (Booss et al, 1984).

The education cadets acquire from core mathematics, sciences, and technology courses at United States Military Academy (USMA) in West Point include both the acquisition of a body of knowledge and the development of thought process (USMA, 2007). It is judged essential to a cadet's understanding of the fundamental ideas and principles in mathematics, science, technology and engineering. This foundation affords opportunities for graduates to progress in their development as life long learners who are to formulate intelligent questions, research for answers and reach logical conclusions that make informed decisions.

Blyden as cited in Bennaars, Otiende and Boisvert (1994) suggested the study of all branches of mathematics but argued that this should be accompanied by classical studies. This was because he believed the study of mathematics and classics complemented each other in training of an influential character and attributed it to the development of such qualities as care, industry, judgment and fact. The national goals of education in Kenya include the promotion of the social, economic, technological and industrial needs for national development (KIE, 1992). In as far as technological and industrial needs are concerned it is geared towards providing the learners with the necessary skills and attitudes for industrial development of which mathematics play a vital role.

Despite the importance that mathematics play in progress towards attaining the stated educational goals, many studies have shown poor performances in the subject (Ogunniyi, 1996). This is also attested by Kenya Certificate of Secondary Examinations (KCSE) results (KNEC, 2006). The year 2005 KCSE Examination Candidates Performance Report of the Kenya National Examinations Council indicated a mean score of 31.91 out of a maximum score of 200 marks (15.96%). The trend has been generally the same over the years as shown in Table 1 (KNEC, 2006).

Table 1: Candidates Overall Performance in KCSE Mathematics for years 2000 to 2005.

YEAR	PAPER	CANDIDATURE	MAX SCORE	MEAN SCORE	STD. DEV.
2000	1		100	17.46	16.44
	2		100	15.05	16.06
	OVERALL	181,947	**200**	**33.22**	**31.00**
2001	1		100	18.83	18.45
	2		100	18.62	17.15
	OVERALL	193,702	**200**	**37.43**	**34.00**
2002	1		100	19.95	19.38
	2		100	19.51	19.25
	OVERALL	197,118	**200**	**39.39**	**37.95**
2003	1		100	17.17	16.31
	2		100	21.45	19.86
	OVERALL	205,232	**200**	**38.20**	**36.17**
2004	1		100	14.57	15.42
	2		100	22.63	20.43
	OVERALL	221,295	**200**	**37.20**	**35.85**
2005	1		100	17.87	16.44
	2		100	17.04	16.06
	OVERALL	259,280	**200**	**31.91**	**31.00**

Source: 2006 KNEC Report

Most courses offered at tertiary and university institutions require students to have passed at certain minimum grade level in mathematics at KCSE in addition to other subjects. Even non mathematical courses require the usage of mathematics at certain stages. Thus mathematics is regarded as essential due to the type of skills and knowledge that learners acquire. Performance in mathematics is a critical tool of selection of students into science courses at universities and into science related careers (Burton, 1996; Eshiwani, 1984; Fennema, 1990).

Tertiary institutions and mainly the middle level colleges are consumers of the bulk of secondary school leavers who enroll for various courses in preparation for the world of work. According to Cockcroft (1982) and Githua (2002) the knowledge of mathematics as a tool for use in everyday life is important for the existence of any individual and society. Researchers have interest in the conceptualization, assessment and investigation of students' mathematics self concept and their perceptions of the subject at all levels of education.

The Kenya Armed Forces has continuously developed and expanded its services in the various sectors of the Kenyan economy since independence. In order to improve the performance and service to the public, education and training were noted to be essential components of the development of the serving officers. The need for training officers at different levels was identified in order to improve their overall efficiency and effectiveness of the military services. The Department of Defence (DOD) jointly with Egerton University developed a Military Science (MS) programme in 1999 to address the set objectives (Egerton, 1999).

The objectives of the programme are to develop military officers to perform professional duties, plan, design and implement innovative military projects and services using available resources effectively and efficiently. It also aims to develop officers who will evaluate and analyse different situations and make rational decisions, and adjust to different working environments and mobilize resources for maximum best use for the Kenyan Society.

Mathematics is one of the subjects taught to realize the objectives in the MS programme. The performance of military students in mathematics in the MS programme has been relatively poor with a high number underachieving with grade D as shown in Table 2.

Table 2: Candidates Overall Performance in Mathematics for Three Intakes by Grade in the MS of Egerton University.

Year/ Grades	A	B	C	D	Totals
2004	22	26	34	57	139
	(15.83%)	(18.71%)	(24.46%)	(41.00%)	
2005	25	29	29	61	144
	(17.36%)	(20.14%)	(20.14%)	(42.36%)	
2006	33	32	31	49	145
	(22.76%)	(22.07)	(21.38)	(33.79)	

Source: School of Continuing Education, Egerton University (2006).

The inclusion of mathematics in the MS is not a new phenomenon. Mathematics has played a substantive role in the development of warfare since the ancient times. The mathematics courses are aimed at giving students the opportunity to acquire a sound mathematical foundation and to develop powers of applying mathematics concepts and procedures and an analytical problem-solving approach.

In the South African Military Academy the mathematics program emphasises conceptual thinking, accuracy and competence in problem solving and is an excellent tool for preparing junior military officers for future command posts (Military Academy – South Africa, 2007). Formal understanding of mathematical methods and techniques forms the foundation for the acquisition of technological knowledge and competence in the military.

Academic achievement is a measure of what is learnt and is a major goal in education (Gall, Gall & Borg, 2003). Tables 1 and 2 indicate that a high percentage of students underachieve in the subject. The low student achievement in mathematics may be due to negative attitude, lack of motivation to learn mathematics and the students' mathematics self concept among others. Attitudes are learned predispositions to respond positively or negatively to certain objects, situations, institutions, concepts, or other persons (Aiken, 1982). Negative attitudes play a prominent role in the determination of thoughts, memory, learning process and behaviour (Mondoh, 1994). There is a general belief that positive attitudes and in particular the liking for mathematics leads to greater effort that leads to higher achievement (Costello, 1991).

Self-concept is the organization of the perception that the individuals have of themselves and is important in affecting behaviour (Dembo, 1994). Students' mathematics self concept refers to ones' perceived personal mathematical skill, ability, mathematical reasoning ability, enjoyment interest in mathematics (Marsh, 1990c). The students need to have a positive self-concept. Studies that have been conducted in the western world have found a link between self-concept, motivation and achievement in mathematics (Schunk & Pajares, 2000; Watt, 2001). Marsh (1990c) found that mathematics achievement is highly correlated to mathematics self concept.

Motivation is an internal state or condition that activates behaviour and gives it direction; it is also defined as the desire or want that energises and directs goal-oriented behaviour (Huitt, 2001). Most motivation theorists assume that motivation is involved in the performance of all learned responses; that is, a learned behaviour will not occur unless it is energized. In this study students' motivation to learn mathematics referred to affective psychological process that influence the learning of mathematics and addressed four areas namely:

i. Perceived probability of success,
ii. Interest in learning mathematics,
iii. Satisfaction and
iv. Relevance.

The poor performance in mathematics has been attributed to many factors within and outside learning institutions. They include learning environment and resources, teaching methodology, attitudes, motivation and society's value system among others (Mondoh, 1994; Githua, 2002; Ngeno, 2004). A considerable amount of research work has been conducted in Kenya over the last few years on students' self concept, attitudes, perceptions, motivation, classroom environment and learning outcome in primary and secondary school mathematics (Githua, 2002; Ngeno,2004). However, limited similar research studies have been carried out to examine the situation in tertiary learning environments and in particular in the military establishment where mathematics is perceived to be of great value in the military strategy and its operations. An important step towards this end was to find out whether attitudes and learning environments are related to students' self concept and achievement in mathematics that is offered in the military science programme of Egerton University, Kenya.

1.2 Statement of the Problem.

Despite the importance of mathematics as a basic preparation of learners for full participation and be functional members of the society the students' performance in the subject has been poor. This is attested by past KNEC Reports and the Military Science programme offered at Egerton University. The special capacity of mathematics in modern armament and warfare indicate its role in enhancing the efficiency of delivery in the military profession. There is limited research that has been carried out on factors that relate to students' mathematics self-concept and achievement at tertiary institutions in Kenya. Furthermore there is no documentary research study in Military science programme. There was need therefore to understand the factors that are related to students' mathematics self-concept and achievement in mathematics. This study addressed three selected factors that were hypothesized to be related to students' mathematics self-concept and achievement. The selected factors in this study included learner attitudes, learning environment, students' characteristics that were hypothesized to be related to self-concept and achievement in mathematics.

1.3 Purpose of the Study

The purpose of the study was to establish the relationship between some selected factors (attitude, learning environment, and students' characteristics) and students' mathematics self-concept and achievement in the military science programme offered at Egerton University in Kenya.

1.4 Objectives of the Study.

The following objectives guided the study:

i. To establish the relationship between students' attitude towards mathematics and their mathematics self-concept in the MS programme offered by Egerton University.

ii. To establish the relationship between students' attitude towards mathematics and achievement in the subject in the MS programme.

iii. To establish the relationship between students' learning environment and their mathematics self-concept in the MS programme.

iv. To establish the relationship between students' learning environment and their achievement towards mathematics in the MS programme.

v. To find out whether there is a relationship between students' personal characteristics and their mathematics self-concept in the MS programme.

vi. To find out whether there is a relationship between students' personal characteristics and their achievement in mathematics in the MS programme.

1.5 Hypotheses of the Study

The following null hypotheses were addressed and tested at 0.05 alpha (α) level:

$H_0$1: There is no statistically significant relationship between students' attitude towards mathematics and their mathematics self-concept in the MS programme of Egerton University.

$H_0$2: There is no statistically significant relationship between students' attitude towards mathematics and achievement in the MS programme.

$H_0$3: There is no statistically significant relationship between students' learning environment and their mathematics self-concept in the MS programme.

H_04: There is no statistically significant relationship between students' learning environment and their achievement in mathematics in the MS programme.

H_05: There is no statistically significant relationship between students' personal characteristics and their mathematics self-concept in the MS programme.

H_06: There is no statistically significant relationship between students' personal characteristics and their achievement in mathematics in the MS programme.

1.6 Significance of the Study

Mathematics, being an integral part of scientific thought, is a necessary component of contemporary advances in all scientific fields (Howson & Kahane, 1988). It has served science and commerce for thousands of years. The special capacity of mathematics in modern armament and warfare is its role in enhancing the efficiency of delivery which was traditionally the domain of engineering, for instance the construction of canons, tanks, and warhead enforcement. There are no natural limitations because we progress mainly through new ways of symbolic manipulation. In such a way mathematics promises an infinite curve of innovations in precision; timing and coordination; miniaturization; and new physical ways of delivery. Mondoh (2001) recommends that mathematics teaching in Kenya should employ a method that would enable mathematics to serve as a functional tool and to be a service to other disciplines and as a mode for logical thinking. As noted, the rise of modern warfare was accompanied by a rise in mathematical technology and other technical innovation. Hence mathematics therefore cannot be divorced from the military circles. The study would provide more insight to students' self-concept, perceptions and attitude towards mathematics. This knowledge will enable the policy makers in the military and curriculum developers in Egerton University, career counselors and stakeholders in the field of education design an environment that embraces mathematics as relevant and a utilitarian subject in school and beyond.

1.7 Scope of the Study

The study focused on relationships between selected factors and students' mathematics self-concept and achievement among students in the military science programme of Egerton University in collaboration with the Department of Defence in Kenya. The study looked into students' attitude towards mathematics; learning environment; students' characteristics and the students' mathematics self-concept and achievement in the subject. The study involved students undergoing military training as cadet officers at the Kenya Military Academy (KMA) who were pursuing a diploma course of Egerton University.

1.8 Assumption of the Study.

i) The study assumed that the participants whose educational level range from secondary school certificates to University degrees were frank and revealed their true perceptions and experiences.

ii) That, cadet officers had intrinsic drive to study mathematics in the military science programme.

1.9 Limitation of the Study

The study was limited to military officers whose entry into the profession considers only the mean grade of KCSE performance. The diversity in terms of their strength in science related subjects or aptitude was not factored in.

1.10 Definition of Terms.

The following constitutive and operational definitions were used for the purpose of this study.

Attitude towards mathematics. Attitude is the mental view, opinions and behaviour towards a certain aspect or occurrence. In this study it is taken to mean students' acquired internal state or feeling influencing their choice towards learning mathematics. It was measured using a twenty four item Students mathematics Attitude Scale (SMAS) on a 1 – 5 level Likert scale.

Learning environment. The entire setting of learning. It encompasses the relationships between and among institution, students and teachers including norms for learning and behaviour (Hastings & Schwieso, 1985). A military learning environment is a place where military training is carried out and characterized by order and strict discipline. In this study it refers to the entire Armed Forces Training College including the classroom environment where military studies are conducted. It was measured using Students Learning Environment Questionnaire (SLEQ) of ten items on a 5 – point scale (See Appendix D).

Military Science. This is the academic programme tailored for the military officers that encompass selected disciplines in order to improve their performance and the overall efficiency and effectiveness of the military services. In this study it was the programme that was offered by Egerton University to the Kenyan military officers.

Motivation. This is the cognitive and affective psychological process that influences the learning of all subjects in college (Slavin, 1997). Operationally, in this study students' motivation to learn mathematics was a moderator variable. This was measured using Students' Motivation to Learn Mathematics (SMLM) questionnaire of twenty eight items on a 5 – point Likert scale type survey instrument. It addressed four areas namely: Perceived probability of success, interest in learning mathematics, satisfaction and relevance. (See Appendix C).

Students' Mathematics Achievement Score (SMAS). This is a measure of the degree of success in performing tasks in mathematics after teaching or instructions. In this study it was students' scores in mathematics in University examinations (in the MS programme)

Students' Mathematics Self Concept (SMSC). The set of cognitive feelings one has on oneself (Gall, Gall & Borg, 2003). In this study, students' mathematics self-concept was taken to mean ones perceived personal mathematical skills, ability, mathematical reasoning enjoyment and interest in mathematics as defined by Marsh, (1990c). Operationally, the variable referred to students' scores on ten items adapted from Marsh's SDQ III instrument that measured students' mathematics self-concept on a 5 – point Likert type scale (See Appendix A).

Students' Personal Characteristics. This refers to students' academic background, age and motivation to learn mathematics. Operationally, in this study **academic** background was the students' grades scored in KCSE mathematics, while **motivation** was a defined above.

Underachievement. This refers to unsatisfactory finishing or gaining something through skill and hard work. Operationally, the variable refers to scoring a grade of D and below in a mathematics examination.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

The chapter covers a review of the literature relevant to the study. It deals with the importance of mathematics education for life, mathematics as it relate to warfare, students' mathematics self-concept, motivation and attitude towards mathematics, academic background, achievement, learning environment, and the theoretical framework.

2.2 Mathematics Education for Life

In today's fast paced world where individuals deal with information generated from computers and calculators to that of mental estimations of daily purchases, it is imperative that students become proficient in mathematics. Not only must learners deal with a wide range of operational skills, such as computing decimals, percents and fractions to accomplish tasks, they must also understand underlying numerical concepts in order to succeed in a variety of day-to-day commercial and work place situations.

Mathematics is an integral part of scientific though which is a necessary component of contemporary advances in all scientific fields (Howson & Kahane, 1988). Mathematics is important and needed for everyday life, in many forms of employment, science and technology, medicine, the economy, the military, the environment and development, in public decision making and as a part of total human culture. Mathematics is one of the basis for most growing careers like computer science or engineering.

Mathematics is one of the rare subjects that transcend time and culture. The Pythagorean Theorem, named after a Greek sage despite being discovered independently in ancient China and probably elsewhere as well, is true in any culture and every century, and is studied wherever mathematics is taught (softServer.com, 2004). In a world of rapid change, mathematics is one thing that endures. Its heritage is a treasure that is passed from generation to generation, a common store of wisdom whose usefulness takes on different manifestations in different cultures and settings.

Mathematics provides a set of tools for describing, analyzing and predicting the behaviour systems of many kinds covering different aspects of the world and space. According to Husen and Postlethwaite (1995), the range of fields in which mathematics is useful has widened rapidly since the 1940s from a historical base in accounting, surveying, engineering and business, and many facets of everyday life. For thousands of years mathematics has been an invaluable tool for design and construction. The practical utility of mathematics provides a justification for the substantial amount of time in the school curriculum. Mathematics is allocated seven lessons (periods) of forty minutes each per week compared to three lessons of the same for other subjects. The tools of mathematics are powerful, but as with all tools, only if one know how to use them across a range of suitable situations. Mondoh (2001), recommends that mathematics teaching in Kenya should employ a method that would improve performance in the subject, enable mathematics to serve as a functional tool, to be a service to other academic disciplines as well as to pupils and to serve as a model for logical thinking. The importance given to mathematics in school curriculum reflects the vital role that it plays in contemporary society (KIE, 1992). A solid mathematical preparation offers to the student a wide range of career choices. From a societal perspective, mathematical competence is both an essential component of the preparation of an informed citizentry and a requisite for the education of personnel required by industry, technology, engineering and science.

Mathematics provides a highly effective means of conveying information in as concise and precise a form as possible (Cockcroft, 1982; Mbugua, 2004; Mutunga & Breakell, 1992). It helps to develop powers of logical thinking which is an appropriate attribute to encourage. Mathematics, whether understood or not, is an important subject to the continued growth of any nation in society. It is used in almost all subjects and is sometimes referred to as "The Queen of all sciences" (Mutunga & Breakell, 1992). Mutunga and Breakell define mathematics as a way of thinking in which one determines and interprets the truth of an idea or information. It is also a language, which like other languages, uses carefully defined terms, and symbols, to express ideas and communicate thought. It is an organized and well structured body of knowledge, where ideas, concepts, principals, theorems are built logically, from previously built ideas, thoughts among others.

The capacity or the ability to interpret figures is therefore critical and important in all fields. Muindi (2008) argued that even the Professor of Literature has to give a mathematical expression to Shakespeare's use of certain words, metre, and timbre and that we cannot just run away from numbers.

The policies of many countries in Africa are to move towards mathematics for the majority or terminal mathematics for use in everyday life (ACO, 1979). Tertiary institutions, which are mainly the middle level colleges, are the main recipient of secondary school leavers who register for various courses in preparation for the world of work.

Japanese children attend school six days a week for over forty weeks a year and spend more time at school than in any other country in the world (Cantor, 1989). During their years at schooling, Japanese children achieve high levels of accomplishment in their native language and in mathematics, and acquire habits of diligence and perseverance which equip them well as future workers. Findings from an Australian study of first year tertiary mathematics students across five universities found that the most powerful factor motivating students to enroll in first year mathematics was that it was a pre-requisite to a mathematics or non-mathematics course or subject the following year. A far less influential factor was actual liking for the subject (Forgasz & Leder, 2001).

2.3 Mathematics and War

The practical military or civilian preoccupations have proved fruitful for the development of mathematics and mathematics based physics and engineering when they are related to the network of current scientific knowledge and theory.

Mathematics has for centuries been stimulated, financed and credited by military purposes. Through history there are instances as attested by Booss, Bemhelm, and

Hoyrup (1984) where mathematical calculations, concepts or mathematics based construction of immediate military relevance can be pointed. This should help in shaping the students' mathematics self-concept and the attitude towards it in preparation for the career in the military profession. The cases according to Booss et al., 1984 [Online], include:

i. Polybios judged it necessary to imprint Roman commanders that the hypotenuse is substantially longer than even the longest other side in a rectangular triangle and hence ladders for storming a wall should be substantially longer than the shear height of the wall.

ii. Archimedes' mechanical calculations could not prevent the fall of Syracuse but supported the excellence of siege machinery in Roman warfare.

iii. The application of ordnance (canons, howitzers) became efficient only with quantitative relations between the slope of the pipe and the range.

iv. We are used to attaching Galileo's work in geometrical optics for better telescopes to the confirmation of the new planetary view by the discovery of the Jupiter moons, but that was not what Galileo demonstrated to the Venice Seniors from the top of the tower of St. Marc. What he demonstrated was the military relevant capacity of seeing ships and their details long before encountering them.

v. A legendary case of mathematical ingenuity was Turing's contribution to the design of the "Colossi" computers and the breaking of the German code Enigma. By the Germans believed un-breakable until the end of the World War II.

The list of war-relevant mathematical ingenuity on the eve of and during World War II could be largely expanded. The MS programme introduces mathematics which includes calculus, probability and statistics, operations research and computer science that is expected to enhance reasoning, computations and optimization techniques (Egerton, 1999). Since quantitative predictions based on most modern theories require extensive computations, new methods and tools are needed to assure that mathematical models can be translated into realistic simulations. Such simulations are needed to understand, design and optimize the solution to the more complex challenges faced by the Army.

2.4 Mathematics in Tertiary Institutions.

When Plato argued for practical application of mathematics in primary schools, he saw them as a means of exercising the faculty of reasoning in preparation for higher studies (Husen & Postlethwaite, 1995a). The power of mathematics to improve the mind has for centuries provided the central rationale for teaching it at all levels of education and training. As noted, the learning of mathematics provides basic preparation for full participation as a functional member of the society. A solid preparation offers to the student an entry into a wide array of career choices.

In the United States Military Academy (USMA) in West Point the goal is to produce graduates who understand and apply the mathematical, physical, and computer sciences to reason scientifically, solve quantitative problems, and use technology (The USMA, 2007) [Online]. This goal is linked in several ways to the general educational goal of enabling graduates to anticipate and respond effectively to the technological, social, political, and economic uncertainties of a changing world. Graduates who reason, formulate and solve problems and use technology productively are able to anticipate and response effectively. This goal insures graduates understand the quantitative and technological aspects of the uncertainties of a changing world.

As further argued by the USMA (2007) a strong foundation in mathematics, physical sciences, and computer science, along with the abilities to solve problems, reason scientifically, and understand technology directly, supports the goal of learning and using of the engineering thought process to serve human purposes. This foundation in quantitative reasoning also provides additional tools to better understand current issues in the social sciences and humanities and provides sufficient proficiency and versatility in the technical disciplines, enabling graduates to serve in any of the Army's technology-based functional areas.

In Africa there has been an urgent desire for attaining economic self-sufficiency with well trained manpower (ACO, 1979). This has made it necessary to change mathematics curriculum to make it adoptable for developing other disciplines and training the educational products for out-of-school activities. A belief in the usefulness of mathematics is included in many studies of mathematics learning because students' decision to take optional mathematics classes depends in part on their believing that mathematics will help them in gaining admission to college and careers (Reyes, 1984). Burton (1996) taught mathematics to adults returning to school in United Kingdom and worked to change the learners' image of mathematics and of their relationship to it and found out that it was possible to change the adults' perception of mathematics from rigid and rule oriented to something that was both cooperative and creative.

2.5 Students' Mathematics Self Concept.

Self-Concept is derived from the kind of statements that the individual makes about himself/herself. Self-concept is ideas or perceptions that people have about them (Dembo, 1994; Zengeya, 2002). Self concept can also be understood as the relatively stable picture people have of themselves and their own attributes (Husen & Postlewaithe, 1995a). According to Travers (1982), a person would be described as having a positive self-concept if he makes positive statements about himself, about what he can accomplish, about the extent to which he regards himself as a successful person, and about his expectations of being able to handle the future. A negative self concept is indicated when a person makes statements about himself that are derogatory, that describe his performance as inadequate, and that reflect a withdrawal from challenges. The belief has been widely held that a positive self concept has an energising effect on behaviour and results in a vigorous pursuit of goals that the individual believe are worthwhile and should be used to enhance students' mathematics self concept. The implication has been that a positive self concept has energising properties and that successful achievement is partly a result of a positive self concept. Bandura (1986) argued that constructs such as Self concept, perceived usefulness, and anxiety are "common mechanisms" of personal agency in the sense that they influence an outcome.

According to Epstein (1973), as cited in Husen and Postlewaithe (1995b), self concept serves to maximize pleasure and to assimilate the data of experience. The first function is equivalent to the enhancement of self esteem and the second focuses on the need to maintain the conceptual system and consistency. Figure 1 show the hierarchical model of self-concept and its development.

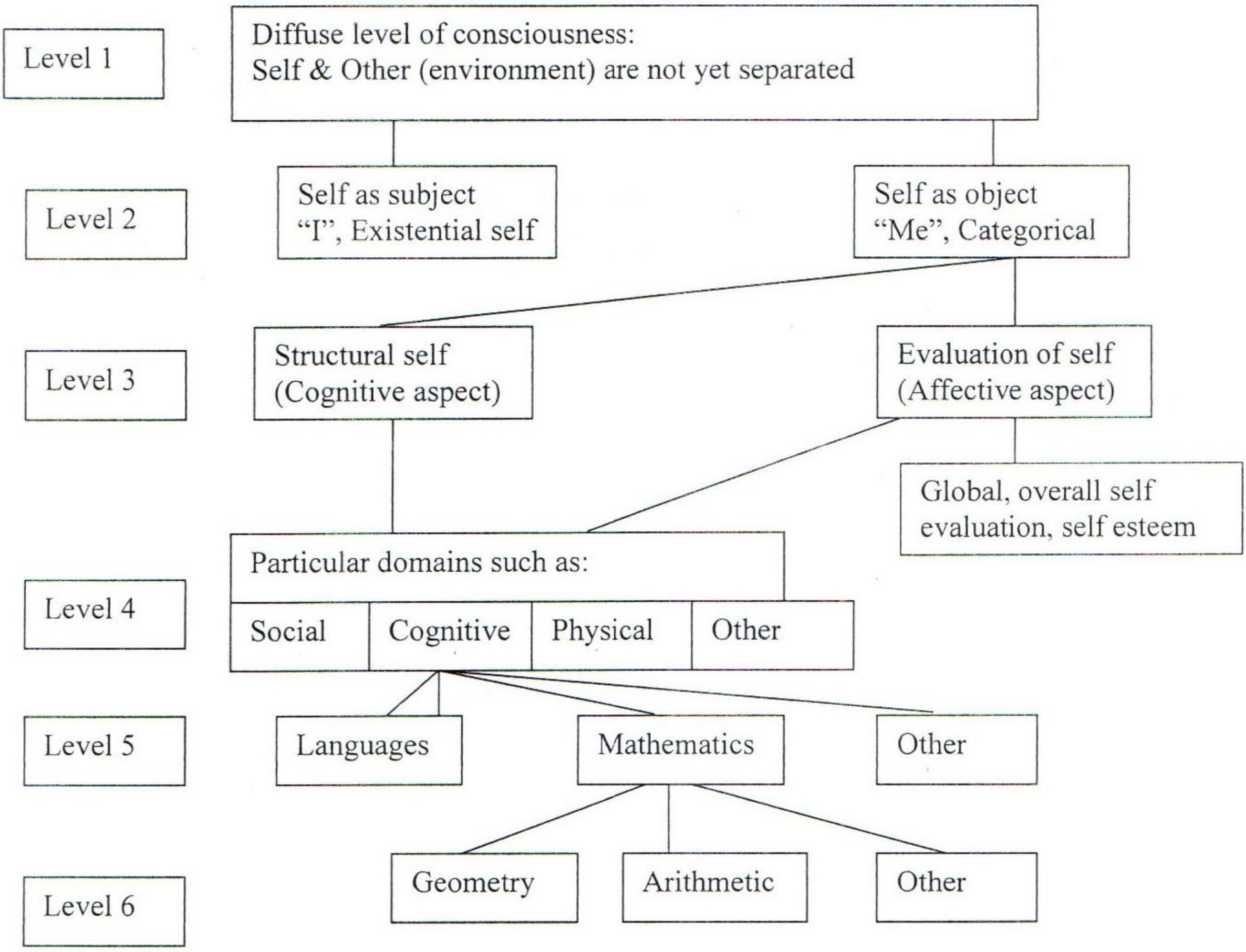


Figure 1: Hierarchical model of self concept.
Source: The International Encyclopedia of Education 2nd Ed. Volume 9.

A necessary precondition for the development of a self-concept as shown in Figure I above is the ability to differentiate the self from the surrounding environment. This is the development of a sense of the self as subject, existential self. As espoused by Epstein, the second developmental task of the infant is to learn the particular attributes that define the self as object, the categorical self. The theoretical perspective of symbolic interactionism suggests that academic self-concept more or less accurately reflects past achievement, related successes and failures. Self-concept is primarily the result of subsequent achievement. Academic self-concept is a cause rather than an effect of academic achievement. A high self-concept is regarded a precondition for effort and persistence and as a protective buffer against self-doubts that impair achievement in situations (Epstein, 1973).

Marsh (1990c) gives a multidimensional and hierarchy of the various self-concept and constructs. He classifies self concept beginning with the general self concept at the top while the domain specific self concept is at the bottom. The domain specific self concept is in two domains of academic and non academic self concept. Students' mathematics self concept, which is the subject of this study falls under the academic domain in addition to others as shown in Figure 2 below:

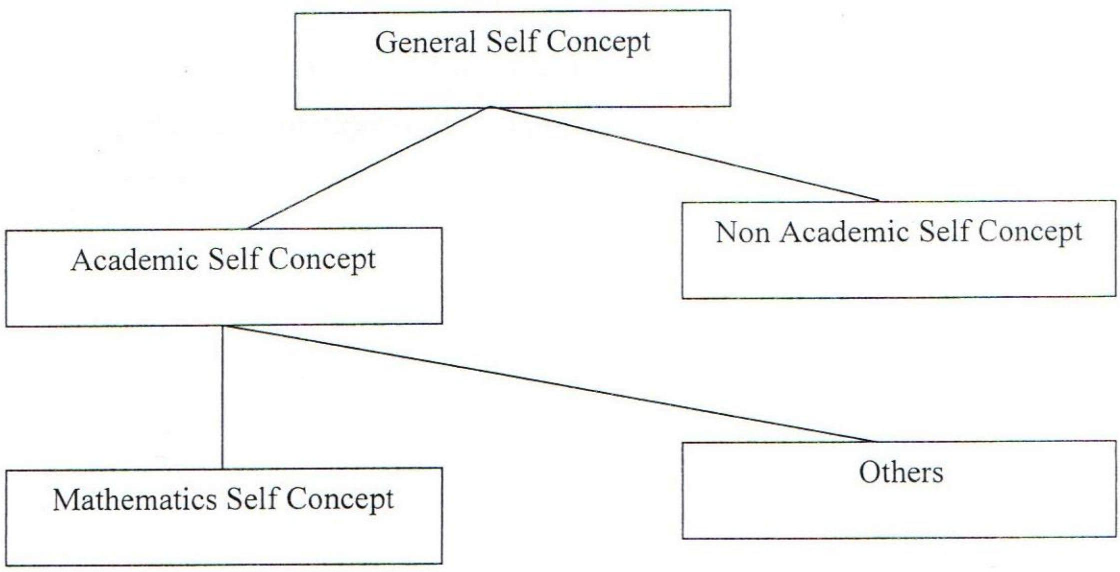


Figure 2: Simplified Marsh's Hierarchical Model of Self concept.

Students' mathematics self concept refers to ones' perceived personal mathematical skill, ability, mathematical reasoning ability, enjoyment and interest in mathematics (Marsh.

1990). Marsh (1991 & 1993) argues that maximizing self concept of ability in an academic subject like mathematics is recognized as a critical goal in itself and a means to facilitate the attainment of other desirable outcomes in education. This includes achievement in mathematics and other educational pursuits. The formation of self concept is influenced significantly by others and their academic achievement (Marsh, Smith & Barnes, 1984). Bandura (1986) argued that constructs such as self concept, perceived usefulness, and anxiety are "Common Mechanisms" of persona agency in the sense that they influence an outcome. Franken (1994) states that there is a great deal of research which shows that self concept is perhaps, the basis for all motivated behaviour. It is the self - concept that gives rise to possible selves, and it is possible selves that create motivation for behaviour. Most findings in this area showed that those who have higher self-concept, that, perceives themselves more confident in mathematics have higher scores in the subject (Wilhite, 1990). Githua (2002) argues that students' self concept is evaluative in that individuals evaluate themselves in given situations and that within a mathematics classroom a student may have low self-esteem but could surprisingly have very high self esteem in other lessons.

The preliminary investigation of the Trends in International Mathematics and Science study (TIMSS) data of 1999 in Iran showed that the relationship between the index of mathematics self concept and mathematics achievement for Iranian students was positive and significant (Kiamanesh & Kheirieh, 2001). The mathematics achievement score of Iranian students who benefited from high self concept was much higher than of those who had medium or low self-concept.

Research has been done at upper primary and secondary schools in Germany and Kenya and have shown that students' mathematics self concept shapes their perception towards the subject (Hemke, 1990; Githua 2002; Ngeno, 2004). Tertiary institution courses are entry points to formal and informal employment and this study attempted to investigate the situation at this level and more so in the military science course where employment was guaranteed on successful completion.

2.6 Students' Motivation towards Mathematics.

Many cognitive psychologist hold that, as we move about in the world, we create a model of how the world works (Wikipedia 2006). That is, we sense the objective world, but our sensations map to percepts, and these percepts are provisional, in the same sense that scientific hypotheses are provisional. As we acquire new information, perception shifts. Motivation is the cognitive and effective psychological process that influences the learning of all subjects in school (Slavin, 1997). Students' motivation and attitudes towards mathematics contributes to their perception towards the subject. Students' motivation to learn mathematics refers to the pupils' interest, students' perceived probability of success, satisfaction and relevance of the subject to the student's life (Githua & Mwangi, 2003). One or all the four dimensions of motivation can be the psychological driving force to the learner needs. Motivation is an internal process that activates guides and maintains learners' behaviour over time (Slavin, 1997). Motivation may be negative or positive (Chambers, Wakley, Iqbal & Field, 2002). With positive motivation, the individual may be stimulated to learn more or act differently because of an inspiring teacher, an interesting subject or that they see the great relevance to their future career progress. With negative motivation, the individual may learn or act because of a fear of failure or punishment or threat of other adverse events. The fear of punishment can be a powerful motivating force for change.

There are two types of motivation to learn. These are intrinsic and extrinsic motivation. Intrinsic motivation is a respond to individual's internal needs while extrinsic motivation is directed at earning rewards that are external to the learner. Intrinsic motivators include fascination with the subject, a sense of its relevance to life and the world and sense of mastering it. Extrinsic motivators include parental expectations, expectation of other trusted role models, earning potential of a course of study and grades which enhance promotions or scholarships.

There are three elements in motivation of this type as suggested by Ausubel. The Cognitive drive, where the learner attempts to satisfy perceived need to know, Self enhancement where the learner satisfies the need of self-esteem and affiliation where the learner is seeking approval of others (Curzon, 1996). The implication is that motivation to learn positively relates to the academic achievement and plays a role in determining achievement of students.

Keller's model of motivational design views motivation as a sequence of events which may include attention, relevance, confidence and satisfaction (ARCS). For example, you first gain the attention of the learner, and then provide relevance of what you are teaching to their personal goals and needs. The learner gains confidence as the learning process unfolds. The satisfaction of the new knowledge provides motivation to continue learning (Driscoll, 1994). Positive motivation towards mathematics is hypothesized to be the driving force in the military profession where promotions are pegged on competent, passing examinations and personal discipline.

According to a study titled "*Student achievement in mathematics – the roles of attitudes, perceptions and family background among 15 year old students in Canada*" it showed that motivation to learn mathematics, as measured by interest and enjoyment in math and belief in its usefulness, was positively related to achievement (McLeod, 1989). The students believed more strongly in its usefulness to their future employment and education. Research has found that students who perceive the utility of studying mathematics will tend to perform better in the subject.

Weiner's (1979 & 1985) attribution theory of motivation cited in Githua, 2002, emphasizes the importance of students' confidence, high self-concept and perceived probability of success to students' motivation to learn. Weiner showed that attributions influence students' achievement. Students often attribute their outcomes to variables like hard work, good luck and natural talent. Even though students may attribute their success or failure to the afore-mentioned variables, the effort that they make in order to learn mathematics at school or college probably have an effect on the achievement. In this study students' interest in mathematics, their perceived probability of success in mathematics, relevance of mathematics to their goals and the needs as well as satisfaction in the learning of mathematics was studied as the four dimensions of motivation to learn mathematics.

2.7 Students' Attitude towards Mathematics

Attitudes are learned predispositions to respond positively or negatively to certain objects, situations, institutions, concepts, or other persons (Aiken, 1982). Attitude towards mathematics is positive or negative reaction towards mathematics. Parental and teacher attitudes towards the student as a learner of mathematics are influential (Fennema, 1981; Taylor, 1996). Research evidence show that if an important person encourages somebody to behave in a certain way, he or she will accept it. The influence of an important person is so strong that even the individual may change his or her attitude in agreement with that of the important person (Berkowitz, 1986). In a study of the attitude of bridging mathematics students, Milne (1992) defined attitude in terms of confidence, motivation, perceived usefulness of mathematics, mathematics anxiety, attitude towards success in mathematics, and casual attributes (ability level, effort, quality of teaching, application) in mathematics. Milne's research, conducted with a group of mature-age students returning to study in Victoria, Australia, showed that motivation, attitude to success, and perceived usefulness of mathematics were high for students throughout their course of study. It was found that female students had lower confidence levels, higher anxiety, and stronger attitudes towards success than males. Students who dropped out of the course had less confidence, less motivation, and did not see mathematics as useful. The kind of attitude the student has will affect learning. Attitude about oneself is important as it yields to self confidence and determines a student's readiness to learn. Attitudes are wrapped up with a person's feelings, needs and self concept. Individuals with poor attitudes towards mathematics are often reported to have a low self concept and feelings of incompetence (Ames & Ames, 1989). Investigations of the Trends in International Mathematics and Science Study (TIMSS) 1999 data in Iran indicated that students who have positive perceptions or attitudes towards mathematics showed better achievement in both mathematics and science (Kiamanesh, 1997).

Attitudes are not innate but developed over a period of time and attitudes do affect achievement (Husen & Postlewaither, 1995b). Attitude play a major role in achievement in a subject and change of attitude by students towards mathematics is needed for good performance. Psychologist define "attitude" as any strong belief or feeling or any approval or disapproval toward people and situations. We have favourable or unfavourable attitudes towards people, politics, academic subjects, etc. We favour the things we think are good and helpful, and oppose the things we think are bad and harmful (Kagan, 1984). The students' attitude towards an academic subject is a crucial factor in learning and achievement in that subject. Whether a student views herself or himself as a strong or weak person in a specific subject may be an important factor in academic achievement. The attitude of students towards mathematics is likely to shape the perception towards the subject.

Attitudes are important, because they relate to actual achievement behaviour in mathematics, as well as enrollment in higher level maths courses and possible to career interests in science and mathematics (Keys & Ormerod, 1977). It is known that admission to tertiary institutions as well as selection to most jobs is based on a good pass in mathematics, yet at secondary school level in Kenya they seem to be drifting away from the subject as reflected in the general underachievement in national examinations and needs attention. This study attempted to find out the relationships between students' attitudes towards mathematics and their self-concept and achievement in the subject at the tertiary level when they are preparing for professional careers and in particular an assured career in the military upon successful completion of cadet training course.

2.8 Effect of Military Environment on Achievement in Mathematics

Learning environment is the entire setting for learning. It encompasses the relationships between and among institutions, students and teachers, including norms for learning and behaviour (Hastings & Schwiescso, 1987). The importance of the school and classroom environment in enhancing learning has been investigated in Britain and strong links between students' outcome and their educational environments have been found (Fraser, 1986, 1991). Hattie (1987) demonstrated that classes and schools differ in terms of their learning environment. This in turn influence students' achievement and showed that twenty per cent (20%) of students in desirable climates are better off than students in average classrooms. Videotape study of TIMSS 1995 from three different countries (Japan, German and USA) showed that outside interruptions affect the flow of the lesson and detract from instructional time. A study by Githua (2002) among secondary schools in Nairobi and Rift Valley provinces in Kenya found out that the relationship between the mathematics classroom physical conditions and students' motivation to learn mathematics was positive and significant at 0.05 alpha level.

The MS programme is administered to students at KMA which is a military establishment. The military environment is characterized by order and discipline which are strictly adhered to. The military training is rigorous and demanding. The daily routines are packed with training activities. The academic programme starts at 0800 Hours and ends at 1830 Hours with health breaks in between (See Appendix F). The time outside the academic programme is occupied by other military activities such as parades, drills and physical training exercises; attending to academic assignments and personal cleanliness. The students are expected to manage time and to complete class assignments and other tasks that are required of them as scheduled.

The lecturers during the academic term are drawn from the staff of Egerton University and the military. This brings in a mixture of civilian and military staff of diverse and vast experiences teaching military students. This study established the relationship between students' learning environment and their mathematics self concept and achievement in the subject in the MS programme.

2.9 Effect of Academic Background on Mathematics Achievement

Academic achievement is a measure of what is learnt in a subject area and is a major goal in education (Gall, Gall & Borg, 2003). The backgrounds, including academic, of students contribute to their performance in school or college than any variables associated with teaching (Crocker, 1991). In the United States Military Academy, West Point, cadets with weak backgrounds in algebra and trigonometry are required to complete a course in pre-calculus prior to undertaking the standard programme (USMA, 2007). The minimum academic qualification of students undergoing cadet military training in Kenya is KCSE mean grade of B. Other requirements include that there ages should be in the bracket of 18 to 26 years. Within this age bracket, the potential candidates would have academic qualifications ranging from KCSE mean grade of B to University degrees. The situation is reflected in the composition of cadets at KMA. All the students are subjected to the same level of military training programmes which include the MS programme. Despite the relatively high admission KCSE mean grade of B, a considerable number of students underachieve in mathematics in the military science course. The study sought to establish the relationship between the academic background and students' mathematics self concept and achievement in the subject.

2.10 Theoretical Framework

The theoretical framework to guide the study was based on the Systems Approach theory (Ayot & Patel, 1987, Joyce & Weil, 1980), which holds that the teaching and learning process has inputs and outputs. The premise of the general System theory is that to fully understand the operations of an entity, it must be viewed as a system. A system is defined as a number of interdependent parts functioning as a whole for some purpose (Certo, 1980). General systems theory integrates the knowledge of various specialized fields so that the system as a whole can be better understood. The components, or elements, that make up a system are closely interdependent and actions or conditions that affect any one element will affect all others within the system (Powers, Cheney & Crow, 1990). It involves the analysis of interrelationships existing between interacting subsystems and the interpretation of these interactions in terms of predicting what may happen in other parts of the system if certain changes are made in a particular part. An effective system will be synergetic. The inputs, which are the selected factors in this study, undergo a process that includes the lecturers, time, learning environment and the curriculum among others. The inputs must have suitable materials in order to achieve desired results (outputs).

Using this theory the following were the variables. The Independent variables were students' attitudes towards mathematics and the learning environment. The moderator variables were the students' individual motivation to learn mathematics and their academic backgrounds. The Dependent variables were students' mathematics self concept and achievement in the subject.

The students' mathematics self concept and achievement in the subject in this study were hypothesized to be related to students' attitude towards mathematics, their learning environment, motivation to learn mathematics and entry qualifications. The independent, moderator and dependent variables of the study are represented diagrammatically in Figure 3.

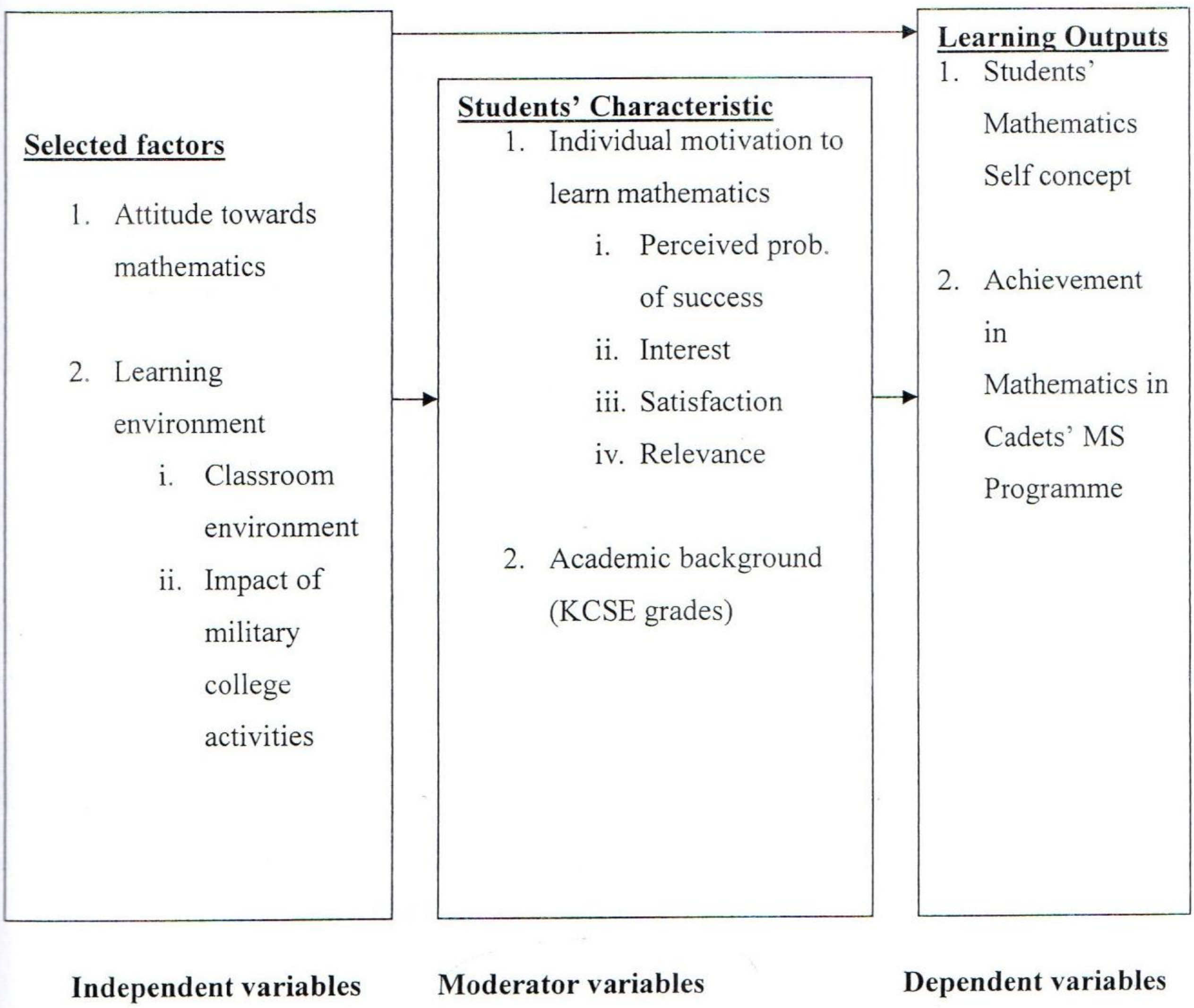


Figure 3: Conceptual Framework of the Study Showing Relationship of the Variables.

The students' mathematics self concept and achievement in mathematics taken as dependent variables are probably shaped by the motivation to pass examinations which is a determining factor in the world of work and in particular the employment opportunities in the military profession. The moderator variables include motivation to learn mathematics and academic background, and are controlled by perceived drive to pass examinations and to serve in the military profession and were tested in this study (Mugenda & Mugenda, 1999).

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

The chapter describes the activities and procedures that were followed in conducting the research. It describes the research process that includes the research design, population and its characteristics, sampling procedures and sample size, data collection instruments, data collection procedures and data analysis. A summary of statistical test that were used in the testing of the hypotheses is given.

3.2 Research Design

The study used correlation research design to explore relationships between variables. Correlation research design refers to studies whose purpose is to discover relationships between variables through the use of correlation statistics. The design allows analysis of the relationships among a large number of variables in a single study. It also provides information concerning the degree of the relationship between the variables being studied and expressed as a correlation coefficient (r) (Gall, Gall & Borg, 2003; Cohen & Manion, 1994; Kathuri & Pals, 1993). The interrelationship of the variables (Independent, Moderator and Dependent) therefore warranted a correlation research design which allowed the researcher to analyse several variables and explain how they affected the pattern of behaviour in the study (Gall, Gall & Borg, 2003). The research design focused on the military officers whose entry into the profession considers only the mean grade of KCSE performance and does not consider the diversity in terms of their strength in sciences.

3.3 Target Population

The target population was the 2007 academic year student military officers enrolled in the military science programme of Egerton University in Kenya. Their academic backgrounds vary from KCSE level to University graduates. The accessible population was military student officers who underwent military training at KMA and registered in the MS programme. The number of military student officers who registered for the programme from KMA was 145 according to University admission records for the 2006/2007 academic year and was the only cohort at the college.

3.4 Sampling Procedure and Sample Size

The students pursuing military science programme were used as the sample. The general rule is to use the largest sample possible because the main interest is learning about a population from which a sample is drawn (Kathuri & Pals, 1993). Frankel and Wallen (2000) recommend a minimum sample of 100 subjects while Kathuri and Pals (1993) recommend a sample of 103 from a population of 145 for survey research for statistical analysis. For the purpose of this study, the whole population of 145 registered student officers was taken for the study.

3.5 Data Collection Instrument

Questionnaires were used to collect data from the student officers. The questionnaires were used because it is more efficient, economical and practical and also allows for the use of a larger sample (Frankel & Wallen, 2000). Standard instructions were given to all the respondents but the researcher was also present to explain questions that were not clear to the respondent (Ary, Jacobs & Razavieh, 1979). Administration and scoring of a structured questionnaire is straightforward and the results lend themselves readily to analysis (Mugenda & Mugenda).

All the questions/statements in the instruments described below were scored on a non negative 5-point Likert type scale based on the extent to which the respondents agree with the statements. The 5-point scale ranged from strongly Disagree (SD), Disagree (D). Undecided (U), Agree (A), and Strongly Agree (SA) and was scored on 1, 2, 3, 4, and 5 points respectively. The instruments were:

3.5.1 Self Descriptive Questionnaire III (SDQ III)

The questionnaire was adapted from Marsh's SDQ III of 1992. The SDQ III is designed to measure multiple dimensions of self-concept for college students and adults. It comprises a multidimensional structure rooted in Shavelson et al. (1976) theoretical model of self-concept. The SDQ III is designed to measure self-concepts related to eight non academic areas (physical ability, physical appearance, peer relations – same sex, peer relationship – opposite sex, parent relations, emotional stability, honesty/trustworthiness, and spiritual values/religion), four academic areas (Verbal, mathematics, problem solving, and General academic) and a single global perception of self (General – self). This study used the part that measures students' mathematics self concept. This part has 10 statements. The tool uses an eight-point response scale ranging from: Definitely False; False; More False than True; More True than False; Mostly True; True; Definitely True. The language might be confusing to the respondents in the Kenyan situation. In this study the responses were modified to a 5-point Likert type scale based on the extent to which they agree with the statement (See Appendix A)

3.5.2 Students' Mathematics Attitude scale (SMATS)

The scale, adapted from Aiken (1982), which is constructed by Likert's method of summated ratings, was used to determine the direction and the intensity of their attitude in mathematics. The questionnaire consists of 24 statements. Each of the statement expresses a feeling or attitude toward mathematics (See Appendix B)

3.5.3 Students' Motivation to Learn Mathematics (SMLM)

The instrument which consists of 28 items that measured students' motivation to learn mathematics was adapted from Githua and Mwangi (2003). It addresses four dimensions of motivation namely: perceived probability of success, interest in learning of mathematics, satisfaction and relevance of learning mathematics. The 28 statements were scored on a 5–point Likert type scale based on the degree the respondents agree with the statements (See Appendix C).

3.5.4 Students' Learning Environment Questionnaire (SLEQ)

The instrument which consists of 10 items that were modified from Githua's 2002 instrument was used to measure students' learning environment. A 5–point Likert type scale instrument was used on the items (See Appendix D).

3.5.5. KCSE Grades and Students' mathematics Achievement Scores (SMAS)

The questionnaire solicited information on the students' academic background and KCSE mathematics grades. KCSE grades range from grades A to E and were scored on a 5–point scale as shown in Table 3.

Table 3: KCSE Grades and Scores.

KCSE Grades	A, A-	B+, B, B-	C+, C, C-	D+, D, D-	E
Score point	5	4	3	2	1

The Students' Mathematics Achievement Score (SMAS) in mathematics were scores in the university examinations with grades ranging from A, B, C, D and F and were assigned 5,4,3,2 and 1 marks respectively.

3.5.5 Validity

Validity is the degree to which results obtained from analysis of the data actually represent the phenomenon under study (Mugenda & Mugenda, 1999). The adapted instruments were modified to answer the set objectives of the study. The instruments used in this study were validated by four experts in educational research from the Faculty of Education and Community Services, Egerton University, to assess the content, construct and face validity of the questionnaires. Their comments were incorporated into the instruments before being taken to the field.

3.5.6 Reliability

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. In this study, pilot testing of the instrument was done on a sample of 30 student officers selected randomly from a course intake of 145 cadets in AFTC in Lanet, Nakuru District and registered in the military science course. They were the only cohort who graduated and posted out before the admission of a new course intake that was used for the study. The sample had similar characteristics to those studied. Reliability of the instrument was calculated using Cronbach's coefficient alpha, which is suitable when items are not dichotomous (Gall, Gall & Borg, 2003, Frankel & Wallen, 2000). Cronbach's Coefficient Alpha assesses the homogeneity of the items; uses one administration of the instrument and assesses multiple response items which were employed in this study. The results of the reliability of the instruments were obtained as indicated in Table 4.

Table 4: Reliability of Instruments.

Instrument		**Reliability (α)**
SMSC:	Students' Mathematics Self Concept	0.86
SMATS:	Students' Mathematics Attitude Scale	0.82
SMLM:	Students' Motivation to Learn Mathematics	0.74
SLEQ:	Students' Learning Environment Questionnaire	0.70

(Critical Value $\alpha \geq 0.70$)

The reliability estimate for the scales of SMSC, SMATS, SMLM and SLEQ using Cronbach's Alpha method were 0.86, 0.82, 0.74 and 0.70 respectively. All the instruments met the threshold reliability coefficient of 0.70 and higher which is recommended (Gall, Gall & Borg. 2003; Fraenkel & Wallen 2000; Mugenda & Mugenda 1999).

3.6 Data Collection Procedure

Authority was sought from the Ministry of State for Defence through Graduate School, Egerton University to conduct the research. When authority was granted, the researcher visited the Kenya Military Academy, where the subjects resided, to seek permission to facilitate the administration of the questionnaires. The researcher administered the instruments with the assistance of the Academy Education Instructors who had been briefed accordingly. The tests were scored and data obtained for analysis.

3.7 Data Analysis

The data was coded and analysed using the Statistical Packages for Social Sciences (SPSS) version 15. Descriptive and inferential statistics were used to analyse the relevant objectives. The study has three variables, the independent, moderator, and dependent variables. Descriptive statistical tools (sums, means, median and standard deviations) were used to describe and compare a group of items. Inferential statistics (Pearson product correlation coefficient) were used to test hypotheses and draw inferences concerning relationships that were found in the research results of the study. Data on relationship was analysed using Pearson correlation (r) to obtain degree of relationship. Pearson Moment correlation (r) is used when variables of the study are measured at ratio or interval scales and are continuous (Mugenda & Mugenda 1999). Correlation matrix was used to see how each measured variables in a set of variables correlates with all other variables in the set. The hypotheses were tested at 0.05 alpha (α) level. Table 5 gives a summary of the statistical tests that was used to analyse data.

Table 5: Summary of Data Analysis

HYPOTHESES	INDEPENDENT/ MODERATOR VARIABLE	DEPENDENT VARIABLE	STATISTICAL TESTS
H_o1: There is no statistically significant relationship between students' attitude towards mathematics and their mathematics self concept in the MS programme.	Students' attitude towards mathematics	Students' mathematics self-concept scores	Pearson Product Moment correlation (r)
H_o2: There is no statistically significant relationship between students' attitude towards mathematics and achievement in the MS programme	Students' attitude towards mathematics	Students' achievement in mathematics scores	Pearson Product Moment correlation (r)
H_o3:There is no statistically significant relationship between students' learning environment and their mathematics self concept in the MS programme	Students' learning environment. i.Classroom environment ii.Impact of college military activities.	Students' mathematics self-concept scores	Pearson Product Moment correlation (r)

$H_0$4: There is no statistically significant relationship between students' learning environment and their achievement in mathematics in the MS programme.	Students learning environment. i.Classroom environment. ii.Impact of college military activities	Students' achievement in mathematics scores	Pearson Product Moment correlation coefficient (r)
$H_0$5: There are no statistically significant relationships between students' personal characteristics and their mathematics self concept in the MS programme.	Students' Personal Characteristics. i.Individual motivation to learn maths. (Perceived prob. of success, Interest, Satisfaction, and Relevance) ii.Academic background (KCSE grades)	Students' mathematics self-concept scores	Pearson Product Moment correlation coefficient (r)
$H_0$6: There are no statistically significant relationships between students' personal characteristics and their achievement in mathematics in the MS programme	Students' Personal Characteristics. i.Individual motivation to learn maths. (Perceived prob. of success, Interest, Satisfaction and Relevance ii.Academic background (KCSE grades)	Students' achievement in mathematics scores	Pearson Product Moment correlation coefficient (r)

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

In this study research findings have been described by use of descriptive statistics, tables and short explanations. Pearson product moment correlation was used to analyse the relationships of the independent and the dependent variables of the six hypotheses studied. A total of one hundred and forty (140) military science students participated in the study. Each of the six hypotheses is restated, results presented in tabular form and finally a conclusion made indicating whether the hypothesis is rejected or not rejected at the stated level of significance. The results and discussion are presented in the order which the hypotheses are stated.

4.2 Results and Discussion

4.2.1 Relationship between Students' Attitude towards Mathematics and their Mathematics Self Concept.

4.2.1.1 Results

Hypothesis one (H_o1) of the study sought to find out whether there is a statistically significant relationship between students' attitude towards mathematics and their mathematics self concept in the military science programme of Egerton University. The relationship between the two constructs was obtained by running a bivariate correlation. In this study, students' attitude towards mathematics was constitutively defined as the mental view, opinions and behaviour towards a certain aspects or occurrence. The students responded to 24 statements (items) that expressed a feeling or attitude towards mathematics. Out of 140 students who filled in the questionnaire, 139 responded to all the 24 items on the scale measuring their attitude towards mathematics. The overall mean and standard deviation for the 24 items used to measure attitude is summarized in Table 6.

In this study the students' mathematics self concept was taken to mean one's perceived personal mathematics skills, ability, mathematical reasoning, enjoyment and interest in mathematics as defined by Marsh (1990b). The students responded to ten statements (items) that measured the construct on a 1–5 point Likert type scale based on the extent to which they agree with the statement. That is Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A), and Strongly Agree (SA). Negative statements were scored in a reverse order. The overall mean and standard deviation for the ten items used to measure students mathematics self concept is summarized in Table 6.

Table 6: Summary of Means and Standard Deviations for the items measuring Mathematics Self Concept and Attitude in Students.

Variable	N	Mean	SD
SMSC	138	3.98	.69
SMATS	139	4.01	.56

The results in Table 6 show the overall mean and standard deviation of 3.98 and 0.69 respectively for students' mathematics self concept (SMSC) and 4.01 and 0.56 respectively for students' attitude towards mathematics (SMATS) against a maximum possible score of 5.

A bivariate correlation was run to establish whether the relationship was statistically significant between students' attitude towards mathematics (SMATS) and their mathematics self concept (SMSC) in the MS programme of Egerton University. This gave a correlation coefficient (r) which represents the degree of association between the two variables. The results are summarized in Table 7.

Table 7: Pearson Correlation between Students' Attitude towards Mathematics and their Mathematics Self Concept (N = 138)

Variable	SMSC	SMATS	N
SMSC	1	0.702*	138
SMATS	0.702*	1	139

* Correlation is significant at Alpha (α) = 0.05 level.

The relationship is statistically significant at 0.05 Alpha (α) level in a two tailed test. The results show that there is a strong positive relationship between students' self-concept and students' attitudes towards mathematics. The Pearson product moment correlation coefficient is 0.702 and is statistically significant at 0.05 α level. The null hypothesis (H_o1) that states that there is no statistically significant relationship between students attitude towards mathematics and their mathematics self concept was therefore rejected.

4.2.1.2. Discussion.

The findings of the study revealed that the relationship between students' attitude towards mathematics and their mathematics self-concept was strong and statistically significant at 0.05 Alpha (α) level with a correlation coefficient (r) of 0.702. The findings of the study also show high mean scores of 4.01 (80.27%) and 3.93 (79.57%) for the students' attitude towards mathematics (SMATS) and their mathematics self concept (SMSC) respectively. This indicates that the students pursuing the military science course have positive attitude towards mathematics and a positive mathematics self concept.

The strong positive relationship between the two constructs agrees with Travers (1982) and Milne (1992). Travers held that students with a positive self concept has energizing effect on behaviour while Milne's findings showed that motivation, attitude to success and perceived usefulness of mathematics were high for mature age students throughout the course of study in Victoria, Australia. Travers (1982) argued that a positive self concept has an energizing effect on behaviour and results in vigorous pursuits of goals that individuals believe are worthwhile and should be used to enhance students mathematics self concept. These results are also consistent with the findings of a study in Iran which showed that the relationship between the index of mathematics self concept and mathematics achievement for Iranian students was positive and significant (Kiamanesh & Kheirieh, 2001). The positive relationship between the constructs could be attributed to the prospect of securing employment and the privilege of serving in the military as a commissioned officer on successful completion of the course.

4.2.2 Relationship between students' attitude towards mathematics and achievement in the MS programme.

4.2.2.1 Results

Hypothesis two (H_02) of the study sought to find out whether there is a statistically significant relationship between students' attitude towards mathematics and their achievement in the MS programme. In this study the achievement were students' final scores in their mathematics course in the University examinations. The means and standard deviations of students' attitude towards mathematics (SMATS) and their achievement in mathematics (SMAS) are summarized in Table 8.

Table 8: Summary of Means and Standard Deviations for the items measuring Students' Attitude towards Mathematics and their Achievement.

Variable	N	Mean	SD
SMATS	139	4.01	.56
SMAS	140	3.84	1.20

To establish whether the relationship was statistically significant between students' attitude towards mathematics and their achievement in mathematics in the MS programme a bivariate correlation was run. The results are summarised in Table 9.

Table 9: Pearson Correlation between Students' Attitude towards Mathematics and their Achievement (N = 139)

Variable	SMATS	SMAS	N
SMATS	1	0.467*	139
SMAS	0.467*	1	140

* Correlation is significant at Alpha (α) # 0.05 level.

The results show a positive relationship between the two constructs with a correlation coefficient (r) of 0.467. The correlation is significant at 0.05 Alpha (α) level in a 2-tailed test. The null hypothesis (H_o2) that states that there is no statistically significant relationship between students' attitude towards mathematics and their achievement in the MS programme was therefore rejected.

4.2.2.2. Discussion

The results of the study show mean scores of 4.01 and 3.84 out of a possible score of 5 in students' attitude towards mathematics (SMATS) and their achievement (SMAS) respectively. The results also indicate a positive relationship with a correlation coefficient (r) of 0.354. The relationship is statistically significant at 0.05 Alpha (**α**) level.

The results agree with Milne's (1992) research results in Australia which showed that attitude to success and perceived usefulness of mathematics were high for students throughout the course of study. A study in Iran indicated that students who have positive perceptions or attitudes towards mathematics showed better achievement in both mathematics and science (Kiamanesh, 1997). Other findings show that there is a positive correlation between attitude and achievement though neither attitude nor achievement is dependent on the other but rather interact which each other in a complex and unpredictable ways (Dossey, Mullis, Lindquist & Chamber, 1988). The positive attitude in mathematics in this study, probably driven by the desire to secure employment and serve as an officer in the military, could lead to greater effort and in turn higher achievement as is manifested by the results.

4.2.3 Relationship between Students' Learning Environment and their Mathematics Self Concept.

4.2.3.1 Results

The third hypothesis (H_o3) sought to establish whether there is a statistically significant relationship between students' learning environment and their mathematics self concept in the MS programme The tools to measure the constructs were for Students' learning environment questionnaire (SLEQ) and Self Descriptive Questionnaire III for SMSC. The students responded to the statements on 1-5 point Likert-type survey instruments. The overall mean and standard deviation of the items are summarised in Table 10.

Table 10: Summary of Mean and Standard Deviations for the items measuring Students' Mathematics Self Concept and their Learning Environment

Variable	N	Mean	SD
SMSC	138	3.98	.70
SLEQ	139	3.60	.45

A bivariate correlation was generated to establish whether the relationship was statistically significant between students' learning environment and their mathematics self concept. The results are shown in Table 11.

Table 11: Pearson Correlation between Students' Learning Environment and their Mathematics Self Concept (N = 137)

Variable	SMSC	SLEQ	N
SMSC	1	0.115	138
SLEQ	0.115	1	139

Correlation not significant at Alpha (α) = 0.05 level.

The results show that the relationship is not significant at 0.05 Alpha (α) level. The null hypothesis (H_o3) of no statistically significant relationship between students' learning environment and their mathematics self concept was therefore accepted.

4.2.3.2 Discussion

The results show that students' learning environment and their mathematics self concept have a positive relationship, though statistically insignificant, with a correlation coefficient (r) of 0.115.

The findings of the study are in contrast with the results of a similar study by Githua (2002) among secondary schools in Nairobi and Rift Valley Provinces in Kenya. Githua found out that the relationship between the mathematics classroom physical conditions and students' motivation to learn mathematics was positive and significant at 0.05 alpha level. This suggests that the students at this level have a self concept of being responsible for their own decisions and their own lives irrespective of the learning environment. Once they have achieved their self concept, they develop a deep psychological need to be seen and be treated by others as capable of self direction. The students are ready to learn those things that they need to know and be able to do in order to cope effectively with real life situation.

4.2.4 Relationship between Students' Learning Environment and their Achievement in Mathematics

4.2.4.1 Results

Hypothesis four (H_04) sought to establish whether there is a statistically significant relationship between students' learning environment and their achievement in mathematics in the MS programme. The means and standard deviations were calculated and a summary given as shown in Table 12.

Table 12: Summary of Means and Standard Deviations for the items measuring Students' Learning Environment and Achievement in Mathematics.

Variable	N	Mean	SD
SMAS	140	3.84	1.20
SLEQ	139	3.60	.45

The relationship between the two variables was obtained by running a bivariate correlation and the results are indicated in Table 13.

Table 13: Pearson Correlation between Students' Learning Environment and their Mathematics Achievement Scores (N = 139).

Variable	SMAS	SLEQ	N
SMAS	1	-0.001	140
SLEQ	-0.001	1	139

Correlation not significant at Alpha (α) = 0.05 level.

The results show a very weak relationship with a correlation coefficient (r) of -0.001 between the two variables. The relationship is not statistically significant at 0.05 Alpha (α) level in a two tailed test. The null hypothesis that states that there is no statistically significant relationship between students' learning environment and their achievement in mathematics in the MS programme was therefore accepted.

4.2.4.2 Discussion

The results of this study indicate an insignificant relationship with a correlation coefficient (r) of -0.001 between the two variables. The mean scores for SLEQ and SMAS was 3.60 and 3.84 respectively out of a possible 5. Though the mean scores are relatively high, the Pearson Moment correlation coefficient (r) reveals an almost no relationship situation in this study.

The findings of the study agree with those of TIMSS 1999 data which revealed that school climate was not a predictor for Iranian students' mathematics achievement but external motivation had a significant effect on the performance (Kiamanesh, 2001). However, the findings of the study is in contrast with a study in Britain on the importance of the school and classroom environment in enhancing learning which has been investigated in Britain and strong links between students' outcome and their educational environments have been found (Fraser, 1986, 1991). The findings also are in contrast with Hattie (1987). Hattie demonstrated that classes and schools differ in terms of their learning environment which in turn influences students' achievement. It showed that 20% of students in desirable climates are better off than students in average classrooms.

4.2.5 Relationship between Students' Personal Characteristics and their Mathematics Self Concept.

4.2.5.1 Results

Hypothesis five (H_05) sought to establish whether there is a statistically significant relationship between students' personal characteristics and their mathematics self concept. In this study, students' personal characteristics referred to students' academic background and their motivation to learn mathematics. Operationally, students' academic background was students' grades in their KCSE mathematics. Motivation to learn mathematics referred to affective psychological process that influences the learning of mathematics. This was measured using 28 items on a 5 – point Likert type survey instrument. It addressed four dimensions of motivation namely: Perceived probability of success, Interest in learning mathematics, Satisfaction and Relevance.

The relationship between the students' Personal characteristics (academic background and motivation to learn mathematics) and their mathematics self concept was obtained by generating a correlation matrix. The results are shown in Table 14.

Table 14: Pearson Correlation Matrix among Students' Mathematics Self Concept, Students' Motivation to Learn Mathematics and their Academic Background

Variable	SMSC	SMLM	KCSE	N
SMSC	1			138
SMLM	.713*	1		140
KCSE	.583*	.410*	1	134

* Correlation is significant at Alpha (α) = 0.05 level (2-tailed)

The results show a positive relationship between students' academic background (KCSE grades) and their mathematics self concept with a correlation coefficient (r) of 0.583. The results also show a relatively strong positive relationship between Students' Motivation to Learn Mathematics (SMLM) and their Mathematics Self Concept (SMSC) with a correlation coefficient of 0.713. The results further show a positive relationship between KCSE and SMLM with a correlation coefficient of 0.410. The relationships are all statistically significant at 0.05 Alpha (α) level in a two tailed test. Hypothesis five (H_o5) that states that there are no statistically significant relationships between students' Personal characteristics and their mathematics self concept was therefore rejected.

4.2.5.2 Discussion

Students' personal characteristics, treated as a moderator variable, in this study comprised Students' Motivation to Learn Mathematics (SMLM) and their Academic Background represented by students' KCSE grades in mathematics.

The results revealed a strong positive and significant relationship between Students' Motivation to Learn Mathematics and their Mathematics Self Concept. The results also showed positive relationship between students' academic background (KCSE

Mathematics grades) and their mathematics self concept. The overall mean scores for SMLM, KCSE, and SMSC were high.

The findings agree with those of a study among upper primary school pupils in Germany which revealed that pupils' self-concept of ability in mathematics was related to the motivation to learn mathematics (Hemke, 1990). A study among secondary school students in Kenya revealed a strong and significant relationship between mathematics self concept and students' motivation to learn mathematics (Githua & Mwangi, 2003). The results also agree with a study among upper primary school pupils in Kericho Municipality, Kenya which showed a positive relationship between pupils' mathematics self concept and pupils' motivation to learn mathematics (Ngeno, 2004)

4.2.6 Relationship between Students' Personal Characteristics and their Achievement in Mathematics

4.2.6.1 Results

Hypothesis six ($H_0 6$) of the study sought to establish whether there are any statistically significant relationships between students' Personal characteristics (motivation and academic background) and their achievement in mathematics in the MS programme. A correlation matrix was generated to find out the relationships between the variables as defined. The results are shown in Table 15.

Table 15: Correlation Matrix among Students' Mathematics Achievement, Students' Motivation to Learn Mathematics and their Academic Background.

Variable	SMAS	SMLM	KCSE	N
SMAS	1			140
SMLM	.475*	1		140
KCSE	.518*	.410*	1	136

* Correlation is significant at Alpha (α) = 0.05 level (2-tailed)

The results show a positive relationship between the two Personal characteristics (Mathematics grades at KCSE, r = 0.518; Motivation to learn mathematics r = 0.475) and their achievement in mathematics. The two relationships are statistically significant at 0.05 Alpha (**α**) level in a two tailed test. The sixth hypothesis (H_o6) which stated that there are no significant relationships between students' personal characteristics and their achievement in mathematics in the MS programme was therefore rejected.

4.2.6.2. Discussion

The findings of this study show a positive and significant relationship between students' motivation to learn mathematics and their achievement in the subject. It also indicates a positive relationship between students' academic background (KCSE mathematics grades) and achievement in mathematics.

According to Bandura (1997), the real performance of students could be measured only when they are motivated to do well in a test. This can happen when the test result is important for the students' academic performance. The most potent motivators are likely to be internal pressures such as to secure employment, a desire for increased job satisfaction, self esteem and quality of life. In this study achievement in mathematics contributed towards the final scores in military science course where a pass in the course almost guarantee one to serve in the armed forces and a fail is a sure way of discontinuation from the course in cadets training.

4.2.7 Relationship Among all the Variables

Correlation matrix was generated among the Independent, Moderator and Dependent variables of the study to examine how each measured variables in a set of variables correlates with all other variables in the set. The results are shown in Table 16.

Table 16: Correlation Matrix among the Variables.

Variable	SMSC	SMATS	SMAS	SLEQ	SMLM	KCSE
SMSC	1					
SMATS	.702*	1				
SMAS	.601*	.467*	1			
SLEQ	.115	.263*	-.001	1		
SMLM	.713*	.837*	.475*	.028*	1	
KCSE	.583*	.354*	.518*	-.008	.410*	1

*Correlation is significant at Alpha (α) = 0.05 level (2-tailed)

The results in Table 16 show significant relationship between SMSC and four of the five variables. The weakest relationship is between SMSC and SLEQ, which though positive, is weak and not significant. The Pearson Moment Correlation Coefficient for this relationship is 0.115. The strongest relationship is found in the Students' Motivation to Learn Mathematics (r=0.713); followed by Students Mathematics Attitude Scale (r=0.702); third is Students Mathematics Achievement Score (r=0.601) and fourth is in students' KCSE mathematics grade (r=0.583). All these relationships are significant at α=0.01 significance level. The order in relationship strength between SMSC and the five variables are summarized as follows:

Table 17: Summary of Relationship Strength between SMSC and 5 variables

Variables	Correlation coefficient (r)
Students' Motivation to Learn Mathematics (SMLM)	0.713
Students' Mathematics Attitude Scale (SMATS)	0.702
Students' Mathematics Achievement Scores (SMAS)	0.601
Academic Background (KCSE) Mathematics grade)	0.583
Students' Learning Environment Questionnaire (SLEQ)	0.115

The results also show that there is a significant positive relationship between Students, Mathematics Achievement Score and other variables considered in this study with the exception of SLEQ with a very weak, non significant relationship with SMAS (r = -0.001). The following is a summary in order of strength.

Table 18: Summary of Relationship Strength between SMAS and 5 variables

Variables	Correlation coefficient (r)
Students Mathematics Self Concept (SMSC)	0.601
Academic Background (KCSE Mathematics grade)	0.518
Students' Motivation to Learn Mathematics (SMLM)	0.475
Students' Mathematics Attitude Scale (SMATS)	0.467
Students' Learning Environment Questionnaire (SLEQ)	-0.001

The SLEQ has a positive and significant relationship between two of the five variables, that is Students' Mathematics Attitude Scale and Students' Motivation to Learn Mathematics with the Pearson Correlation Coefficient of r = 0.263 and r = 0.028 respectively. The results in Table 16 show that there are no significant relationships between SLEQ and three variables namely SMSC, SMAS, and KCSE. The following (Table 19) is a summary in order of strength in relationship with SLEQ.

Table 19: Summary of Relationship Strength between SLEQ and 5 variables.

Variables	Correlation coefficient (r)
Students' Mathematics Attitude Scale (SMATS)	0.263
Students' Mathematics Self Concept (SMSC)	0.115
Students' Motivation to Learn Mathematics (SMLM)	0.028
Students' Mathematics Achievement Scores (SMAS)	-0.001
Academic Background (KCSE Mathematics grade)	-0.008

Table 16 show that the relationship between Students' Mathematics Attitudes Scores and other variables. They are all significant at $\alpha = 0.05$ significant level. Table 20 show the order of strength in relationship between Students' Mathematics Attitudes scores and the five variables.

Table 20: Summary of Relationship Strength between SMATS and 5 variables

Variables	Correlation coefficient (r)
Students' Motivation to Learn Mathematics (SMLM)	0.837
Students' Mathematics Self Concept (SMSC)	0.702
Students' Mathematics Achievement Scores (SMAS)	0.467
Academic Background (KCSE)	0.354
Students' Learning Environment (SLEQ)	0.263

The varied strength of relationship with SMATS with other variables as given in the above table indicates a strong relationship with SMLM. The Pearson Moment Correlation coefficient (r) for this relationship is 0.837. Students' Learning Environment (SLEQ) had a weak relationship with SMATS in comparison with the other five variables. The Pearson Moment Correlation coefficient (r) is 0.263.

CHAPTER FIVE

SUMMARY, CONCLUSIONS, IMPLICATIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter a summary of the findings of the study are listed, conclusions are presented, implications discussed and recommendations for mathematics educators, stake holders and researchers are outlined.

5.2 Summary

On the basis of the data analysis presented in chapter four, the following are the main findings of the study. The findings are generalized to students of military science of Egerton University:

i. There is statistically significant relationship between students' attitude towards mathematics and their mathematics self-concept.
ii. There is statistically significant relationship between students' attitude towards mathematics and achievement in the subject.
iii. There is no statistically significant relationship between students' learning environment and their mathematics self-concept.
iv. There is no statistically significant relationship between students' learning environment and their achievement in mathematics.
v. There is statistically significant relationship between students' personal characteristics (motivation, academic background) and their mathematics self concept.
vi. There is statistically significant relationship between students' personal characteristics (motivation, academic background) and their achievement in mathematics.

5.3 Conclusions

On the basis of the findings of the study, the following conclusions related to the hypotheses of the study were generalized to the learners of mathematics in the military and post secondary school institutions.

i. Students' attitude towards mathematics affects their self-concept towards the subject.
ii. Students' attitudes towards mathematics affects their achievement in the subject
iii. Students' learning environment does not affect their self-concept towards mathematics.
iv. Students' learning environment does not affect their achievement in mathematics
v. Students' personal characteristics affect their self-concept in mathematics
vi. Students' personal characteristics affect their achievement in mathematics
vii. The mathematics Self-Concept and the Attitude towards Mathematics of the military science students of Egerton University was above average (79.6% and 80.2% respectively)

5.4 Implications of the Study

The findings of this study reveal some practical implications to mathematics education and further research in tertiary institutions. The findings suggest a guideline for educational practitioners, curriculum developers and other stake holders so that they can ensure that utilized educational policies, methodologies and activities would help enhance and improve students' academic self-concept as well as positive attitudes towards school and college subjects particularly mathematics.

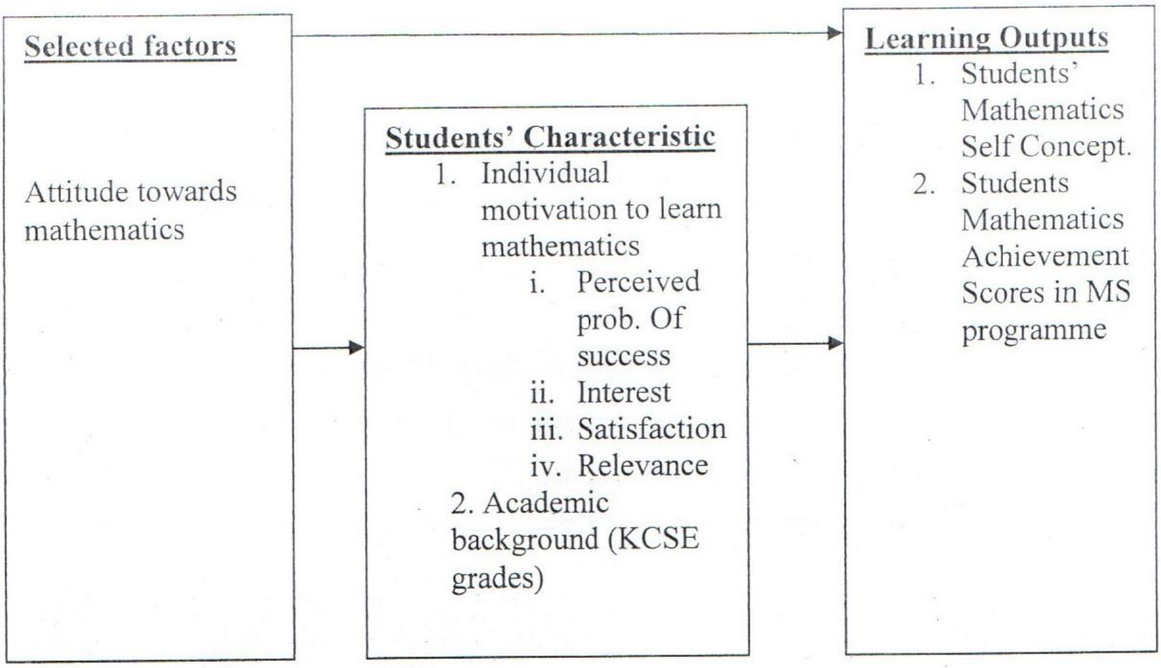
The results of the study indicate that military science students have positive attitude towards mathematics. Their attitude towards mathematics is positive with a corresponding positive mathematics self-concept. The positive attitude towards mathematics and the positive self-concept in mathematics suggest that students in tertiary institutions have an intrinsic drive to succeed in the mathematics courses they take despite the diverse interest and liking mathematics. As indicated, mathematics is one of the subjects studied in the military science course. The findings suggest that students in tertiary institutions, irrespective of their background performance, interest and liking of mathematics have the potential to develop favourable attitudes and self esteem towards the subject. Tertiary institutions should therefore exploit the positive change in order to improve the general performance in mathematics. Travers (1982) held that students with a positive self concept have energizing effect on behaviour and results in vigorous pursuits of goals that individuals believe are worthwhile and should be used to enhance students mathematics self concept.

The results of the study have also shown that students' attitude towards mathematics and achievement in the subject are positively related. This implies that a favourable attitude towards mathematics among students in post secondary school institutions is possible to be enhanced in order to improve on their achievement in mathematics.

The study showed a weak and insignificant relationship in students' learning environment and their mathematics self concept; and students' learning environment and their achievement in mathematics. It has been cited before that with TIMSS 1995 data which revealed that school climate was not a predictor for students' mathematics achievement but external motivation had a significant effect on the performance (Kiamanesh, 1977). The findings that military students' self concept and their achievement in the subject have no significant relationship with learning environment suggest that probably external factors influence SMSC and SMAS. Post secondary school students and in particular University students have chosen career courses in preparation to entering the challenging environment of the world of employment. Most employers, including the military, are looking for graduates who have a grasp of mathematics because they discern trends and even predict the future. The grasp of the subject goes a long way in helping strategic and analytical decision – making.

The imminent challenges, fears, and prospects of job opportunities could probably suggest the drive to succeed irrespective of the learning environment that the students are subjected to. The military science students are subjected to learning under diverse conditions, conventional and non conventional classes, in both professional and academic courses and this has not adversely affected performance. The underpinning factor could be attributed to the benefits and prestige that accrue on successful completion of the course. This probably applies to students pursuing other courses in the university where qualification and further education enhances one's chance of securing meaningful employment and promotions. The implication is that the mathematics educators and curriculum developers should therefore exploit the intrinsic drive that the students have at that level to maximize on the teaching resources while keeping and enhancing positive trends in the self esteem and achievement in mathematics. The mathematics educators and curriculum developers should further use the findings of the study to popularize the subject at lower levels, particularly secondary and to impress upon the students that there is no escape from mathematics even to those whose careers are not mathematic oriented.

Figure 4 is the revised model of the conceptual framework of the study that was used to show the hypothesized relationship of the selected factors and the students' mathematics self-concept (SMSC) as well as their achievement scores (SMAS) in the subject.



Independent Variables **Moderator Variables** **Dependent Variables**

Figure 4: Revised model of the Conceptual Framework of the Study.

In the revised model the Students' Attitude towards Mathematics was found to relate positively with Students' Mathematics Self Concept and their Achievement in the subject. Students Learning Environment was not significantly related to SMSC and SMAS and was omitted in the revised model. The Students' Personal Characteristics (moderator variables) which comprised the Individual Student Motivation to Learn Mathematics (SMLM) and the scores in KCSE mathematics were related to the dependent variables and were retained in the revised model. The researcher therefore predicted that Students' Attitude towards Mathematics is related to their Self Concept and Achievement in the subject in tertiary institutions.

5.5 Recommendations

The following are recommendations that were made from the results of the study:

i. The positive relationship between students' mathematics and their achievement should be exploited and used to improve the general performance in the subject as well as to enhance the students' self concept in the subject. Tertiary institutions and in particular universities should use the opportunity to popularize mathematics education in linking its usefulness to life. Some of the university students may have developed positive attitude towards mathematics because it was part of the course one pursued. These are the people who could be used to promote the performance of the subject in schools which has been reported to be underachieved in past examinations (KNEC, 2006).

ii. The findings of the study also indicated a positive relation between students' personal characteristics and their mathematics self-concept and achievement in the subject. The personal characteristics included the motivation to learn mathematics and their achievement in mathematics at KCSE level. The educators at tertiary institutions should be able to take advantage of the intrinsic drive to demystify the myth that mathematics is a difficult subject and use it to improve its performance at all levels of education.

iii. University students and by extension those in tertiary institutions including military schools and colleges are focused on succeeding in their chosen courses irrespective of the learning environment. The educators and trainers should therefore focus on the provision of qualified staff and learning materials, and maximize on the available space and time for the benefit of students who qualify for university education and other tertiary colleges.

5.6 Suggestions for Further Research

The following are areas suggested for further research:

i. A similar study on the relationship between the selected Factors and Students Mathematics Self-Concept and Achievement in other programmes of Egerton University where Mathematics is offered as part of the course to verify the findings of this study.
ii. A study on Learning Environment, Mathematics Achievement and Student Attitude among University Mathematics Students in Kenya.
iii. A cross sectional study on the relationship between the selected Factors and Students Mathematics Self-Concept and Achievement in Primary Secondary and Tertiary institution in Kenya.
iv. A study on students' interest on areas of specialization in mathematics such as pure mathematics and statistics among university mathematics students in Kenya.

REFERENCES

African Curriculum Organization (ACO), (1979). Basic Training Course in Systematic Curriculum Development: Course Six: Curriculum Development in SubjectAreas: Mathematics: KIE, UON, GTZ.

Aiken L. R. (1982). Psychological Testing and Assessment (4th Ed.). London: Allyn and Becon, Inc.

Ames, R. E. & Ames, C. (Eds.) (1989). Research on Motivation in Education Vol.3 London: Academic press Inc.

Ary, D. Jacobs, L. C & Razavieh, A. (1979). Introduction to research in education 2nd Ed. USA: Hort, Rinehart and Winston.

Ausubel, D. P. (1968). Educational Psychology: A Cognitive View. New York: Holt, Rinehart and Winston.

Ayot, H. O & Patel, M. M (1987. Instructional Methods, (pp34 – 53). Nairobi, Kenya: Kenyatta University.

Bandura, A. (1986). Social foundations of thought and actions: A social cognitive theory. Englewood Cliffs, NJ: Prentice Hall.

Bandura, A (1997). Self-efficacy: The exercise of control. New York: W. H. Freeman.

Bernhelm & Booss (2001). Mathematics and war: Draft Essay for Hutchinson Companion Encyclopedia of Mathematics. [Online] Available: http://www.mmf.ruc.dk/~booss/mathwar/bb~mathwar.htm. Last visited on 22/8/2006.

Bennaars, G. A. Otiende, J. E. & Boisvert, R (1994). Theory and Practice of Education. Nairobi: East African Educational Publishers Ltd.

Booss, Bernhelm, & Høyrup, J. (1984). On mathematics and war: an essay on the implications, past and present, of the military involvement of the mathematical sciences for their development and potentials. [Online] Available. http://www.mmf.ruc.dk/~booss/mathwar/bb~mathwar.htm. Last visited on 22/8/2006.

Burton L. (1996). Gender and Mathematics. An International Perspective. London: Short Run Press.

Cantor, L (1989). Vocational Education and Training in the developed world. A Comparative study. London: Routledge.

Chamber, R. Wakley, G. Iqbal, Z. & Field, S. (2002). Prescription for Learning Techniques, games and activities. United Kingdom: Radcliffe Medical press Ltd.

Changeiywo, J. M. (2000). Students' images of science in Kenya: A comparison by gender difference, levels of schooling and regional disparities. Unpublished PhD. Thesis, Egerton University, Njoro.

Cockcroft, W. J. (Chairs). 1982). Mathematics Counts. Report of the committee of inquiry into the teaching of mathematics in schools in England and Wales. London: HMSO.

Cohen, L. & Manion, L., (1994). Research methods in education (London: Routledge.

Certo, S. C. (1980). Principles of Modern management. IOWA, USA: WMC Brown Company Publishers.

Costello, J (1991). Teaching and learning mathematics 11-16. London: Routledge.

Crocker, R. K. (1991) understanding the dynamics of classroom behaviour. In Short, R. H.Stewin, L. L. & McCann, S. J. H. (1991). Educational Psychology: Canadian Perspective. Toronto: Copp Clark Pitman.

Dembo, M. H. (1994). Applying Education Psychology (5th Ed). White Plains, New York: Longman.

Driscoll, M. (1994). Psychology of learning for instruction. Boston: Allyn & Bacon. [Online]. Available: http://library.clark.cc.oh.us.search/dMotivation. Visited 15/8/2006.

Dossey, J.A., Mullis, L.V., Lindquist, M.M. & Chambers, D.L. (1988). The Mathematics report card: Are we measuring up? Trends and achievement based on the 1986 national assessment. Princeton, NJ: Educational Testing Service.

Edith Cowan University, Perth Western Australia (2000). Australian Indigenous Education Conference. Indigenous Australian adults? Perception and attitudes to mathematics and on-line learning of mathematics [Online]. Available: http://www.ecu.edu.au/csess/kk/aeic/ Last visited on 28/7/2006.

Education Matters, December 2004, number 5. "First Results from 2003 programme for International Student Assessment". Catalogue number 81-004-XlE. [Online]. Available:http://www/statcan.english/freepub/81-004-XlE/81-004 XlE20050001.htm. Visited on 30/10/07.

Egerton University, (1999). Curricula for the award of: Certificate in Military science; Diploma in Military Science; Bachelor in Military Science. School of Continuing Education, Njoro.

Epstein, S. (1973). The Self Concept revisited: Or a theory of a theory. Am. Psycho. 28(9): 405-416.

Eshiwani, G. S. (1984). Education for women in Kenya. A Document prepared for the Decade of Women Conference. Nairobi, Kenya.

Fennema, E. & Leder, G. C. (1990). Mathematics and Gender. New York: Teachers College Press.

Fennema, E. & Peterson, P. C. (1985). Autonomous learning behaviour: A possible explanation of gender related differences in mathematics. In: Wilkinson, L. C & Marret (Eds,), Gender related differences in classroom interactions. New York: Academic Press.

Fennema, E. (2000). Gender and mathematics: What is known and what I wish was known. Wisconsin Center for Education Research. [Online]. Available: Http://www.wcer.wise.educ/nise/news-Activities/foruma/Fennemapaper.html Last visited on 26 July 2006.

Forgasz, H.J. & Leder, G.C. (2001). The Victorian Certificate of Education – a gendered affair? Australian Educational Researcher, 28(2), 53-66.

Forgasz, H. J., Leder, G.C., & Kloosterman, P. (2004). New Perspective on gender stereotyping of mathematics. Mathematical Thinking and Learning, 6(4) 389-420.

Frankel & Wallen (2000). How to design and evaluate research in education. USA: The McGraw Hill Companies, Inc.

Franken (1994). Human Motivation (3rd. ed). CA: Brooks Cole publishing co.

Fraser, B. J. (1986). Classroom environment. Kent, England: Croom Helm.

Fraser, B. J. (1991). Two decades of classroom environment research. In B. J. Fraser & H. J. Walberg (Eds.), Educational environments: Evaluation, antecedents and consequences. Oxford: Pergamon Press.

Gall, M. D., Gall. J. P. & Borg, W. R. (2003). Education Research: An introduction (7th Ed.) New York: Person Education Inc.

Githua, B. N. (2002). Factors related to the Motivation to Learn Mathematics among Secondary School Students in Kenya's Nairobi Province and Three Districts of Rift Valley Province. Unpublished PhD. Thesis, Egerton University, Njoro.

Githua, B. N. & Mwangi, J. G. (2002). Students' mathematics self concept and motivation to learn mathematics. Relationship and gender differences among Kenya's secondary-school students in Nairobi and Rift Valley provinces: International Journal of Educational Development Vol.23 (487-499).

Hastings, N. Schwieso, J. G. (Eds) (1985). New direction in Education psychology: Behaviour and Motivation in the classroom. London. Falmer press

Hattie, J. A. (1987). Identifying the salient facets of a model of student learning: A synthesis of meta-analyses. International Journal of Education Research, 11, 187-212.

Hemke, A. (1990). Mediating processes between children's self concept of ability and mathematical achievement: A longitudinal study. In H.Mandhl, E. Decorte, S. N. Bennet & H. F. Friedrich (Ed). Learning and instruction: European in an international context. Vol 2.2. Analysis of complex skills and complex knowledge domains. (pp. 537 – 549). Oxford: Pergamon Press.

Howson, A. G. & Kahane, J. P. (1988). Mathematics as a service subject. ICMI study series. New York: Cambridge University press.

Huitt, W. (2001). Motivation to learn: An overview. Educational Psychology Interactive. Valdosta, GA: Valdosta State University. [Online]. Available: http//Chiron.valdosta.edu/whuitt/col/motivation/motivate.html. Visited on 13/4/2007.

Husen, T. & Postletthwaite, T. N. (1995a). The International Encylopaedia of education. 2nd Edition. Volume 6. New York, pargamon press.

Husen, T. & Postletthwaite, T. N. (1995b). The International Encylopaedia of education. 2nd Edition. Volume 9. New York, pargamon press.

Joyce, B & Weil, M. (1980). Models of Teaching. New Jersey: Prentice-Hall.

Kagan, J. (1984). The nature of the child. New York: Basic Books.

Kathuri, N. J. & Pals, D. A. (1993). Introduction to Educational Research. Njoro: Educational Media Centre.

Kenya Institute of Education (KIE) (1992). Secondary Education Syllabus. Nairobi: Kenya Literature Bureau.

Keys, W. & Ormerod, M.B. (1977). Some Sex-related Differences in the Correlation of preference in the middle years of Secondary Education. Educational Studies 3 (2): 111 -116.

Kiamanesh, A.R. (1997). The findings of the third international mathematics and science study: mathematics and achievement in middle school years. Tehran: Institute for Educational Research Publication.

Kiamanesh, A.R. & Kheirieh, M. (2001).Trends in mathematics educational inputs and outputs in Iran: Findings from the third international mathematics and science and its repeat. Tehran: Institute for Educational Research Publication.

KNEC, (2003). The Certificate of Secondary Education (KCSE): Examination Performance report. Nairobi, Kenya: The Kenya National Examination Council.

KNEC, (2006). The Year 2005 KCSE Examination Candidates Performance Report. Nairobi. The Kenya National Examination Council.

Kothari C. R. (2005). Research Methodology: Methods and Techniques. 2nd Edition. New Delhi: New Age International (P) Ltd., Publishers.

Machiavelli, N. (1990). (Eds). The Art of War. A Revised Edition of the Ellis Farneworth Translation With an Introduction by Neal Wood. (Bobbs-Merril, Indianapolis, 1965). "The Art of War" was originally published in 1521. New York: Da Capo Press.

Maraffi, M. (2006) Girls' Attitudes, Self-Expectations, and performance in math. An Annotated Bibliography. [Online]. Available: http://www.mathforum.org/ Last visited 22/8/2006.

Marsh, H. W., Relich, J. D., Smith, I. D., & Barnes, J. (1984). Multidimensionality of self concept: Relationship with inferred self-concept and academic achievement. [Online]. Available: http://www.edweb.uws.edu.au/self Last visited on 22/8/2006.

Marsh, H. W. (1990a). Self descriptive questionnaire- 11 manual. Macarthur: University of Western Sydney.

Marsh, H. W. (1990b). Self descriptive questionnaire- 111 manual. Macarthur: University of Western Sydney.

Marsh, H. W. (1990c). Casual ordering of academic self concept and academic achievement: A multi-wave, longitudinal panel analysis. Journal of Educational Psychology. 82(4): 646-656.

Marsh, H. W. (1993). Academic self-concept: Theory, measurement and research In J.Suls (Ed.), Psychological Perspective on the Self (Vol. 4, pp59-98). Hillsdale, NJ: Erlbaum.

Mbugua, Z. K. (2004). Influence of Mathematical Language on Students' understanding and achievement in Mathematics at selected secondary schools in Kenya. Unpublished PhD. Thesis, Egerton University, Njoro, Kenya.

McLeod, D.B. (1989). Perceived Usefulness is Important for Gender – related Differences in Mathematical Achievement. In: Affect and Mathematical problem – solving: A new perspective edited by D. B. McLeod & V. M. Adams. pp 20 – 36. New York: Springer press.

Meyer, M. R. & Koehler, M. S. (1990). Internal influences on gender differences in mathematics. In: Fennema, E & Leder, G. C. (1990). Mathematics and Gender. New York: Teachers College Press.

Milne, L. (1992). Bridging mathematics students: Attitudes, autonomous Learning behaviours, and problem solving paper presented at the Proceedings of the fifteen annual conference Mathematics Education Research Group of Australasia (MERGA). UNWS conference centre, Richmond.

Military Academy South Africa (2006). General Description of Subject Group Mathematics. [Online] Available: http//academic.sun.ac.za/mil/faculty/sj.asp. Visited on 22/8/2006.

Mondoh, H. O. (2001). Girls' Performance in Mathematics: A Critical Review. In Humanities, Social Sciences and Education series: The Field of Consciences permeates the members of an organization and their Relationships: Egerton University Journal, 4(1), 154-174.

Mugenda, O.M. & Mugenda, G.D. (1999). Research Methods: Quantitative and Qualitative Approaches. Nairobi: Acts Press.

Muindi, B. (2008, December 12). Graduate: Run away from Math at your own peril. Kenya's Daily Nation, Friday Magazine pp 4). Nairobi, Kenya.

Mutunga, P. K. & Breakell, J. (1992). Mathematical Education (1st Ed.). Nairobi: Nairobi Educational Research & Publication.

Ng'eno, J. K. (2004). Pupils' self-concept and motivation to learn mathematics: Relationship and Gender Differences among upper primary school pupils in Kericho Municipality, Kenya. Unpublished MEd. Thesis, Egerton University, Njoro.

Ogunniyi, M. B. (1996). Science, Technology and Mathematics. The Problem of Developing Critical Human Capital in Africa. International Journal of Science Education, 18 (3), 284.

Oywaya-Nkurumwa, A & Changeiywo, J. M. (2004). Higher Education and Gender: Analysis of Enrollment Trends at Egerton University from 1991 to 2001: Journal of Education and Human Resources, Egerton University, 2 (2), 1-18.

Powers, J. M., Cheney, P. H. & Crow, G. (1990). Structured Systems Development Analysis, Design, and Implementation. Boston MA USA: Boyde and Fraser publishing.

Purkey, W.W. (1970). Self-Concept and School achievement. Englewood Cliffs, NJ: Prentice – Hall.

Reyes, L. H. (1984). Affective variables and mathematics education. The Elementary School Journal, 84, 558-581.

Saitoti G (2000) Key note address. Strengthening mathematics and computer science and Research in Kenyan Universities. Proceedings and recommendations of career improvement workshop in mathematics and computer science at Nairobi University, Chiromo Campus on 27/2 – 4/3/2000.

Schunk & Pajares, (2000). Self-belief. Self-concept. [Online] Available: http:/www.emory.edu/education/mfp/eff.html. Visited on 17 September 2006.

Schwartz, W. & Hanson, K. (1992). "Equal Mathematics education for Female Students," Center for Equity and Cultural Diversity, USA. Newton, MA Educational Developmental Center, Inc.

Secretary's commission on Achieving Necessary Skills (SCANS). (1991). What Work Requires of Schools: A SCANS Report for America 2000. Washington, DC: U. S. Department of Labor. [Online]. Available: http://www.stolaf.edu/people/steen/twolits.html Visited on 17 August 2006.

Shavelson, R. J., Hubner, J. J. & Stanton, G. C. (1976). Self-concept: Validation of construct interpretation of scores. Review of Educational Research, 46, 407-441.

Slavin, R. (1997). Cooperative learning. New York: Longman.

Short, R.H., Stewin, L. L. & McCann, S.J.H. (1991). Educational Psychology: Canadian Perspectives. Toronto: Copp Clark Pitman.

SoftServer.com (2004). A short History of the Geometry. [Online]. Available: http://geometryalgorithms.com/history.htm Visited on 28/11/2005.

Taylor, L (1996). American Female and Male University Professors' Mathematical Attitudes and Life Histories. In: Burton L. (1996). Gender and Mathematics. An International Perspective. London, Short Run Press.

The United States Military Academy – West Point (2007). Educating Army Leaders. [Online]Available: http://www.dean.usma.edu/curriculum/EducationArmyLeaders/text.htm#anchor13 9967.

Travers, R. M. W. (Ed) (1982). Essentials of Learning: The new cognitive learning for students of Education. New York: Macmillan publishing co., Inc.

Watt, H. (2001). Self-Task- and value perception in mathematics. [Online]. Available: http//www.edfac.usyd.edu.au/staff/watth/ Visited on 14/8/2007.

Weiner, B. (1979). "A theory of motivation for some classroom experiences." Journal of Educational Psychology 71, 3-25.

Weiner, B. (1985). An attributional theory of achievement, motivation, and emotion. Psychological Review, 92, 543-573.

Wikipedia. (2006) Perception – Wikipedia, the free encyclopedia. [Online]. Available: http://en.wikipedia.org/wiki/perception. Last visited 26/7/06.

Wilhite, S.C. (1990). Self-efficacy, locus control, self-assessment of memory ability, and study activities as predictors of college course activities. Journal of Educational Psychology, 82, 696-700.

Zengeya, A, (2002). Early Adolescents' Self Esteem and Achievement. Zimbabwe Journal of Educational Research, 14 (3), 197 – 212.

APPENDICES

The appendices consist of data collection instruments and the training programme (time table). They are as follows:

1. Appendix A: Students Mathematics Self-Concept Questionnaire (SMSC).
2. Appendix B: Students' Mathematics Attitude Scale (SMAS).
3. Appendix C: Questionnaire to measure Students' Motivation to Learn Mathematics (SMLM).
4. Appendix D: Students' Learning Environment Questionnaire (SLEQ).
5. Appendix E: KCSE and University Mathematics Scores by Student officers in the Study.
6. Appendix F: MS Time Table.

APPENDIX A

STUDENTS' MATHEMATICS SELF CONCEPT QUESTIONNAIRE (SMSC)

PART A

Please complete this part by filling in the spaces provided. Do not write your name.

Service: Army…………Airforce…………Navy…………(Tick √ appropriately)

University Admission no………………

Gender: Male………………Female……………

Age bracket: 18 – 20.........................

21 – 23………………

24 -26………………...

27 – 29………………

Other…………………..Specify

Academic Background

KCSE ………………….KCSE Mathematics Grade………………

Diploma ………………….{Indicate whether Science or Arts based}

Degree …………………..{BSc, BEd(Science/Arts), BA, etc}

Other …………………..Specify

PART B

Instructions:

This questionnaire has 10 questions. Please read each question carefully and provide the appropriate answer. All information supplied will be confidential.

This is a chance for you to consider how to think and feel about yourself. This is not a test. There are no right and wrong answers, and everyone will have different responses. The purpose of this study is to determine how you perceive yourself in relation to the mathematics course. Please indicate what you think about each item.

Please read the given questions carefully before you supply the answer. Indicate the extent to which you agree by **ticking (√)** the correct answer in each question. **Tick (√)** the letter(s) that best describe your level of agreement. Try to avoid any items blank.

Key:

SD – Strongly Disagree; D – Disagree; U – Undecided; A – Agree; SA – Strongly Agree.

Example: Mathematics is a simple subject. SD D U A√ SA

In this example the respondent agreed with the statement and **ticked (√)** letter A. Use the key provided to indicate your level of agreement with each of the statement given.

1. I find many mathematics problems interesting and challenging.	SD	D	U	A	SA
2. I have hesitated to take courses that involve mathematics.	SD	D	U	A	SA
3. I have generally done better in mathematics courses than other courses.	SD	D	U	A	SA
4. Mathematics makes me feel inadequate	SD	D	U	A	SA
5. I am quite good at mathematics.	SD	D	U	A	SA

6. I have trouble understanding anything that is based upon mathematics.	SD	D	U	A	SA
7. I have always done well in mathematics classes.	SD	D	U	A	SA
8. I never do well on test that require mathematics reasoning.	SD	D	U	A	SA
9. At school my friends always came to me for help in mathematics.	SD	D	U	A	SA
10. I have never been very excited about mathematics.	SD	D	U	A	SA

APPENDIX B

STUDENTS' MATHEMATICS ATTITUDE SCALE (SMATS)

Instructions:
Each of the statement on this questionnaire expresses a feeling or attitude toward mathematics. You are to indicate on a five-point scale the extent of agreement between the attitude expressed in each statement and your own personal feeling. The five points are: Strongly Disagree (SD), Disagree (D), Undecided (U), Agree (A), Strongly Agree (SA). Please **tick (√)** the letter(s) which best indicate(s) how closely you agree or disagree with the attitude expressed in each statement AS IT CONCERNS YOU.

Example: I am interested in mathematics. SD D U A SA√

In this example the respondent strongly agreed with the statement and **ticked (√)** letters SA. Use the key provided to indicate your level of agreement with each of the statements given:

1. Mathematics is not a very interesting subject.	SD	D	U	A	SA
2. I want to develop my mathematical skills and study this subject more.	SD	D	U	A	SA
3. Mathematics is a very worthwhile and necessary subject.	SD	D	U	A	SA
4. Mathematics makes me feel nervous and uncomfortable.	SD	D	U	A	SA
5. I have usually enjoyed studying mathematics in school.	SD	D	U	A	SA
6. I don't want to take any more mathematics than I absolutely have to.	SD	D	U	A	SA
7. Other subjects are more important to people than mathematics.	SD	D	U	A	SA
8. I am very calm and unafraid when studying mathematics.	SD	D	U	A	SA

9. I have seldom liked mathematics.	SD	D	U	A	SA
10. I am interested in acquiring further knowledge of mathematics.	SD	D	U	A	SA
11. Mathematics helps to develop the mind and teaches a person to think.	SD	D	U	A	SA
12. Mathematics makes me feel uneasy and confused.	SD	D	U	A	SA
13. Mathematics is enjoyable and stimulating to me.	SD	D	U	A	SA
14. I am not willing to take more than the required amount of mathematics.	SD	D	U	A	SA
15. Mathematics is not especially important in everyday life.	SD	D	U	A	SA
16. Trying to understand mathematics doesn't make me anxious.	SD	D	U	A	SA
17. Mathematics is dull and boring.	SD	D	U	A	SA
18. I plan to take mathematics as I possibly can during my education.	SD	D	U	A	SA
19. Mathematics has contributed greatly to the progress of civilization.	SD	D	U	A	SA
20. Mathematics is one of my most dreaded subjects.	SD	D	U	A	SA
21. I like trying to solve new problems in mathematics.	SD	D	U	A	SA
22. I am not motivated to work very hard on mathematics problems.	SD	D	U	A	SA
23. Mathematics is not one of the most important subjects for people to study.	SD	D	U	A	SA
24. I don't get upset when trying to work mathematics problems.	SD	D	U	A	SA

APPENDIX C

QUESTIONNAIRE TO MEASURE STUDENTS' MOTIVATION TO LEARN MATHEMATICS (SMLM)

Instructions:

Please indicate the extent to which you agree with the statements in the following questions. **Tick (√)** the letter(s) that best describe your level of agreements.

Key:

SD= Strongly Disagree; D= Disagree; U= Undecided; A= Agree; SA= Strongly Agree.

1. I look forward to study mathematics.	SD	D	U	A	SA
2. I always need help in mathematics.	SD	D	U	A	SA
3. I love learning mathematics.	SD	D	U	A	SA
4. I find it easy to work alone on mathematical problem.	SD	D	U	A	SA
5. I always expect to be able to apply mathematics in life situations.	SD	D	U	A	SA
6. Learning mathematics is easy.	SD	D	U	A	SA
7. I always expect to be successful in mathematics assignment given by mathematics lecturers in the classroom.	SD	D	U	A	SA
8. Learning mathematics gives me chances for personal improvement.	SD	D	U	A	SA
9. I practice solving mathematical problems on my own during my free time.	SD	D	U	A	SA
10. The hours I spend doing mathematics are the ones I enjoy most.	SD	D	U	A	SA
11. I always expect to perform well in mathematics related subjects.	SD	D	U	A	SA
12. I expect to be able to solve mathematical problems anywhere I come across them					

if they are of my level of education.	SD	D	U	A	SA
13. Mathematics assignments are useful.	SD	D	U	A	SA
14. I will continue learning mathematics.	SD	D	U	A	SA
15. I am able to work alone in mathematics exercises in and outside mathematical classrooms.	SD	D	U	A	SA
16. I expect to get high scores in mathematics tests.	SD	D	U	A	SA
17. I am happy with the way I learn mathematics.	SD	D	U	A	SA
18. I do not feel uneasy during mathematics lessons.	SD	D	U	A	SA
19. I am satisfied with my participation in classroom mathematical activities.	SD	D	U	A	SA
20. I find activities in mathematics useful.	SD	D	U	A	SA
21. Mathematics subject matter is related to my daily activities.	SD	D	U	A	SA
22. Mathematics is related to my needs and goals both in college and at home.	SD	D	U	A	SA
23. Mathematics lesson give me chances for cooperative social interaction.	SD	D	U	A	SA
24. I am happy with the mathematics taught in my class.	SD	D	U	A	SA
25. I am happy with my mathematics assignments, tests and examinations.	SD	D	U	A	SA
26. I am highly motivated to learn mathematics.	SD	D	U	A	SA
27. I expect to be able to apply mathematics easily to other life situation.	SD	D	U	A	SA
28. I would like a career that require mathematics.	SD	D	U	A	SA

APPENDIX D

STUDENTS' LEARNING ENVIRONMENT QUESTIONNAIRE (SLEQ)

Instructions:

Please indicate the extent to which you agree with the statements in the following questions. **Tick (√)** the letter(s) that best describe your level of agreements.

Key:

SD= Strongly Disagree; D= Disagree; U= Undecided; A= Agree; SA= Strongly Agree.

1. The mathematics classroom where I learn mathematics has sufficient lighting.	SD	D	U	A	SA
2. The classroom where I learn mathematics is spacious.	SD	D	U	A	SA
3. The hours I spend doing mathematics are the ones I enjoy most.	SD	D	U	A	SA
4. I complete mathematics assignments in time.	SD	D	U	A	SA
5. The chairs in mathematics classroom where I study are uncomfortable.	SD	D	U	A	SA
6. The mathematics classroom where I learn mathematics has adequate chairs for all students.	SD	D	U	A	SA
7. The mathematics classroom where I study mathematics has adequate ventilation to let in fresh air.	SD	D	U	A	SA
9. The mathematics classroom where I learn mathematics has adequate desks for all students.	SD	D	U	A	SA
10. I have adequate time in college to do revision in mathematics.	SD	D	U	A	SA
11. My mathematics lecturers are cooperative.	SD	D	U	A	SA

12. Other military activities interfere with my learning of mathematics.	SD	D	U	A	SA
13. I learn mathematics under pressure in AFTC.	SD	D	U	A	SA

APPENDIX E

KCSE AND UNIVERSITY STUDENTS MATHEMATICS SCORES

S/NO	UNIVERSITY ADMISSION NO.	KCSE MATHS GRADE	UNIVERSITY MATHS SCORE	REMARKS

APPENDIX F

MS TIME TABLE

EGERTON UNIVERSITY

COLLEGE OF OPEN AND DISTANCE LEARNING

DIPLOMA IN MILITARY SCIENCE CADET INTAKE 34

YEAR I SEMESTER I (25th August – 14th October 2006)

Day	8.00-10.00	10.30-12.30	2.00-4.00	4.30-6.30
Monday	Financial Accounting	Communication Skills	National &Intern. Affairs I	Military History I
Tuesday	National &Intern. Affairs I	National & Intern.	Military History I	Introduction to Philosophy
Wednesday	P R O F E S S I O N A L T R A I N I N G – AFTC (CADET SCHOOL)			
Thursday	Financial Accounting	Mathematics/Introduction to Philosophy	Introduction to Philosophy	Mathematics
Friday	Mathematics	Financial Accounting/Communication Skills	Communication Skills	S E L F S T U D Y
Saturday	**INTRODUCTION TO COMPUTER APPLICATIONS**			

Examination Dates: 14th October – 21st October 2006

Note: The blocks with two courses, implies that each course takes one hour in the order given e.g. 10.30 – 12.30. National & International Affairs/ Military History I means National & International Affairs 10.30 – 11.30, Military History I 11.30 – 12.30.

APPENDIX G

RESEARCH PERMIT

MINISTRY OF STATE FOR DEFENCE

Telegrams: "DEFENCE", Nairobi
Telephone: Nairobi 2721100
When replying please quote

Defence Headquarters
ULINZI HOUSE
P O Box 40668 - 00100
NAIROBI, KENYA

DHQ/EDN/300/701

18 September, 2007

RESEARCH AUTHORITY
MAJ N K KEMBOI (18738) - REG NO. EM14/1558/05

Ref: Egerton University Graduate School letter EM14/1558/05 dated 30 Aug 07

The above named officer is granted authority to collect research data for his Master of Education degree on **"The Relationship Between Some Selected Factors and Students' Mathematics Self Concept and Achievement in the Military Science Programme of Egerton University, Kenya"**.

The officer is kindly requested to forward a copy of the research findings to this HQs on completion of the course.

B K KIMANI
Colonel
for Permanent Secretary

Copy to:

Director, Board of Post Graduate Studies
Egerton University