EFFECTS OF MATHEMATICS BRIDGING COURSE ON STUDENTS' ACHIEVEMENT AND ATTITUDE TOWARDS DEGREE AND DIPLOMA LEVEL MATHEMATICS AND SCIENCE PROGRAMMES: A CASE STUDY OF EGERTON UNIVERSITY, KENYA

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By

Alice Kemunto Gichana

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

August

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This thesis is my original work and has not been previously published or presented for an award of a degree, diploma or other awards in this or any other University.

Signed..... Date 7/08/2006

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RECOMMENDATIONS

This thesis has been submitted for examination with our approval as University supervisors.

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Signed..... Date 11/8/06

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DEDICATION

This work is dedicated to my dear husband, James, and loving children Roselyne, Emanuel, Pauline and Edwin.

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ABSTRACT

Performance in Mathematics at Kenya Certificate of Secondary Education (KCSE) examination level has continued to be poor over the years. Many students who pass with a mean grade of C+ and above and score less than grade C in Mathematics at KCSE examination are required to enrol in a mathematics bridging course and pass with a distinction or credit before gaining university admission. What has, however, not been addressed is how well students who enrolled in mathematics bridging course compete with those who were never enrolled in mathematics bridging course. Bridging courses have for the last five years played a complementary role in giving secondary school leavers a second chance to gain university entry for those who may never have acquired it in Kenya. The purpose of this study was to determine whether enrolling in a mathematics-bridging course has any effect on students' achievement and attitude towards degree or diploma mathematics and science programmes. The research design was ex-post facto. The target population was all the students in Egerton University enrolled in science and mathematics oriented courses while the accessible population was all the second year students enrolled in mathematics and science programmes at Egerton University. Purposive sampling was used to select the second year students in faculties that offer mathematics and science degree or diploma programmes and who enrolled in mathematics bridging course. Proportional stratified random sampling was used to select 96 respondents for this study. Two instruments were used in this study namely: Academic Performance Summary and University Student Attitude Questionnaire (USAQ). The USAQ was pilot tested at Moi University and Cronbach's alpha was used to test its reliability. The reliability coefficient of USAQ: Mathematics attitude questionnaire was 0.87 while that of Science attitude questionnaire was 0.83. Inferential statistics were used for data analyses. Data on achievement and gender differences in achievement were analysed using a t-test while the Wilcoxon rank sum test was used to analyse data on attitude towards Mathematics and Science. Hypotheses were tested at 0.05 significance level. The results showed that increased student's achievement towards university mathematics and science and attitude towards science occurred among students who had enrolled in mathematics bridging course. Their attitude towards science was positive but the student's attitude towards mathematics was still low as compared to those who never enrolled in mathematics bridging course. The findings indicated that mathematics bridging course is effective in raising the standards of students who scored less than a grade C in mathematics at KCSE examination level to that of their contemporaries who had scored grade C and above. The implications of the findings are discussed.

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LIST OF ABBREVIATIONS AND ACRONYMS

ACO	African Curriculum Organisation
CHE	Commission for Higher Education
JAB	Joint Admissions Board
KCSE	Kenya Certificate of Secondary Education
KNEC	Kenya National Examination Council
SMASSE	Strengthening of Mathematics and Sciences at Secondary School Education.
SSP	Self Sponsored Programme
UAPSF	University Academic Performance Summary Form
USAQ	University Student Attitude Questionnaire

CHAPTER ONE

INTRODUCTION

1.1 Background Information

The study of mathematics is of great practical value in science and modern technology. It underpins science that supports technology and society. Therefore there is general agreement in society that every child should study Mathematics at school to acquire skills for adult life (African Curriculum Organisation, 1979; Orton & Wain, 1996). Thus most people regard the study of Mathematics as being essential because of the type of skills and knowledge that learners acquire. In addition, performance in Mathematics is a filter of students into science and related careers (Eshiwani, 1984).

Great changes have taken place in mathematics curriculum throughout the world due to the realisation that Mathematics is a practical subject and a tool for other subjects. There are many countries in the world, Kenya included, where great concern is frequently expressed about attainment in Mathematics because it is regarded as important and children are expected to demonstrate a high level of competence in the subject. Because of its significance, there is greater pressure for children to succeed in Mathematics more than in any other subject (Fraser & Gillan, 1972). 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, and be a service to other academic disciplines as well as to pupils. Mathematics should, therefore, serve as a model for logical thinking.

In the United States of America and Russia and other developed countries, mathematics training has been geared towards societal reforms (ACO, 1979). Therefore the teaching of Mathematics in our society must be a training where development of new techniques and concepts must have economic and social consequences akin to the development needs of the society. Since we cannot have technology without science and neither could we have Science without Mathematics, it is, therefore clear that the social and economic development of a country depends on its development in Mathematics (Kuku, 1990).

According to Mondoh (2001), Mathematics is instrumental in maintaining satisfactory living standards which mean competence in it would become a ticket to career opportunities. Mathematics in our society is a means of communicating quantifiable ideas that are used to represent, explain and to make predictions (ACO, 1979; Cockcroft, 1982). Mathematical theory of aerodynamics for example is required to help design aeroplanes while linear graphs are used in the construction of road networks and can also be used to present information in many ways not only by means of figures and letters but also through the use of tables, charts, diagrams and graphs (Fraser & Gillan, 1972).

In addition, with the introduction of computers, Mathematics is used to design the logical design of computing whereas statistical design and inference in Mathematics is used by workers in Science for data analysis (ACO, 1979). According to the Strengthening of Mathematics and Sciences at Secondary School

Education (SMASSE, 2004) programme, Mathematics has also a recreational value. There are many mathematical games such as playing cards and chess that can be played either in class or out of class. Games help in refreshing and re-invigorating the mind so that performance in ensuing tasks is enhanced.

In Kenya, the major objectives of mathematics education are the development of thinking ability and logical thought (Eshiwani, 1975). Mathematics aims at developing citizens who are powerful communicators, numerate, rational, and useful in the home, society and nation (Frazer & Gillan, 1972; Cockroft, 1982). Mutunga and Breakell (1992) argue that Mathematics is a creation of the human mind concerned with ideas, processes and reasoning. Therefore it cannot be overemphasised that everybody should study this creation and discovery of the human mind. Mathematics compared to other subjects is in a privileged position in the school curriculum. In most countries such as U.K and Australia the study of Mathematics is compulsory at least unto the minimum school leaving age of 16 years (Holton, 2001).

In Kenya mathematics is compulsory at nursery, primary and secondary school levels. As such performance in Mathematics is of great concern to everybody who is a stakeholder in education (KNEC, 1990). Performance of candidates in Mathematics in the Kenya Certificate of Secondary Education (KCSE) examination has been wanting over the years. Furthermore, girls have continued to perform poorly in the subject as compared to boys (Eshiwani, 1984; Muya, 2000; KNEC,

2003). Table 1, shows KCSE mathematics examination mean scores between 1999 and 2002, as an indicator of performance trends, which have very marginal improvement, and below average.

Table 1

Performance of candidates in Mathematics during the Period 1999 – 2002

Year	Candidature	Mean Score (%)	SD
1999	172,879	24.45	24.94
2000	181,947	33.22	31.00
2001	193,702	37.43	34.00
2002	197,118	39.39	37.95

Source: KNEC Analysis Report 2003 (p.33)

Aduda (2001) indicated that only 37.5% of Kenya's Certificate of secondary education candidates are able to achieve a pass mark of D- and above in Mathematics. He attributes this dismal performance to lack of facilities, poor teaching methods and poor attitudes towards the subject. According to Fisher and Rickards (1996), students' attitude depends on many factors among them their relationship with their teachers. Their findings indicated that students' attitude towards Mathematics were positive in classrooms where students perceived their teachers as friendly and understanding. The positive attitude in turn resulted in high achievement scores.

The transition from secondary to university level of learning mathematics and science study involves many adjustments. These include content, the teaching methods, the learning style, and personal and interpersonal adjustments. All these contribute to the student's success or failure at tertiary and university level. How well students acquire mathematical skills and concepts from secondary school and apply them at university is important for their success in their courses (Holton, 2001).

A large number of candidates would like to pursue tertiary and university education in Science and Technology but are hindered by their poor performance in Mathematics at the Kenya Certificate of Secondary Education (KCSE) examination. According to the universities Joint Admissions Board (JAB, 2004), the number of candidates with grade C+ and above in the year 2002/2003 were 22%. Those that applied for admission to universities were 20% and the number admitted was only 28% of those that applied for admission. Several of them missed admission because they had less than a grade C in Mathematics at KCSE examination. To address this problem many Kenyan Colleges and Universities offer bridging courses in Mathematics.

According to Holton (2001), courses offered between secondary school and university are called bridging courses, remedial courses or pre-university courses. In the U.S.A, pre-university courses, is now a large industry. The majority of them are run by Universities or by closely affiliated colleges (Van Tonder, 1996). In

Kenya, bridging courses started with private universities who could not get enough qualified students (with at least C in Mathematics at KCSE) as stipulated by the Commission for Higher Education (CHE). Thus the first approach by those universities was to admit the under qualified students into a one-year make-up course in Mathematics. This proved inconveniencing for students who failed in one or two courses.

When public universities started admitting students into Self-Sponsored Programmes (SSP) in 1998/1999, they required students entering various courses to have certain minimum overall requirements. Rather than putting such students through a one year programme the way the private universities were doing, they opted for bridging courses in specific areas particularly Science and Mathematics. Later, English was added onto the list. The aim was to get students who were weak in the Sciences to the level of JAB admitted students so that they can cope with the requirements of the degree or diploma programmes that they had been admitted into. Smaller colleges picked up the idea and started offering bridging courses as well. As the demand for university education increases, the demand for bridging courses is also bound to increase (D.K. Nassiuma, personal communication, September 16, 2004). The question that needs to be addressed at this point is what is the effect of these bridging courses in Mathematics?

Bridging courses have for a number of years been a means of meeting the particular needs of educationally disadvantaged people (Ellis, Cooper & Sawyer, 2001).

According to Kiriri Women's University of Science and Technology (2003), a mathematics bridging course is intended to equip secondary school leavers who have attained less than grade C in Mathematics with skills that are a pre- requisite for courses at university.

The bridging courses take into account the deficiencies of the secondary school leavers in Mathematics, English and Science subjects and reduce the knowledge gap between their secondary school and the expectation at university. A bridging course is meant to develop and upgrade the knowledge and skills not mastered in secondary schools (Egerton University, 2001). A mathematics bridging course is intended to raise the student's level of mathematical competence to that of their contemporaries who have grade C and above at KCSE mathematics examination.

Holton (2001) has raised the following questions concerning mathematics bridging courses: Are these bridging courses successful in meeting their objectives? Do their graduates succeed in university mathematics and science studies? Establishing the achievement of those who enrolled in mathematics bridging course and those who did not will provide an insight into the effects of these bridging courses. Eshiwani (1984) argues that students who have a positive attitude towards Mathematics and Science work harder than those who have a negative one and this helps them to achieve higher grades.

Aiken (1970) observed that the relationship between attitude and achievement is reciprocal. Attitudes affect achievement and achievement affects attitudes. He argues that feelings lead to particular self-image on the part of the pupil. The self-image influences expectation of future performance and affects actual performance. With this in mind it would be important to empirically determine the trend of achievement of those who enrolled in mathematics bridging course in comparison with those who did not but are enrolled in the same science degree or diploma programme at university.

1.2 Statement of the Problem

At the end of the secondary school cycle, students are expected to have attained grade C and above in Mathematics at KCSE examination level if they have to be considered for university mathematics and science courses. Admission to tertiary institutions as well as selection for most jobs is based on a good pass in mathematics at secondary level (Chacko, 2000). A lot of students who score less than a grade C in Mathematics are therefore required to take a mathematics bridging course and attain a distinction or credit before being admitted into any science based degree or diploma programmes in Kenyan universities. These students who fail to attain grade C in Mathematics in KCSE and go through a mathematics bridging course are expected to perform as well as those who score grade C and above in KCSE Mathematics in the university's mathematics and science oriented programmes. It is not known whether once the students get admitted into university mathematics and science oriented programmes they are

able to achieve as well as those who were admitted without going through mathematics bridging course. The study sought to determine what happens once the students are enrolled in mathematics bridging course so that these students pass with a credit or a distinction. It was also found appropriate to investigate how well these students who enrolled in mathematics bridging course compete with students who never enrolled in mathematics bridging course. Failure in Mathematics has been attributed to many factors among them attitudes (Bolaji, 2000). Attitudes do affect achievement. It has not been established whether students' attitude towards mathematics and science remain the same after going through mathematics bridging course. Bridging courses are relatively new in Kenya. So far no research has been done in this area in Kenya. It was therefore; found appropriate to determine the effects of mathematics bridging course on students' achievement and attitude towards university mathematics and science related courses.

1.3 Purpose of the Study

The purpose of this study was to establish the effects of mathematics bridging course on students' achievement in university mathematics and science programmes. It also was aimed at investigating whether there is a significant difference in attitude towards mathematics and science oriented course between students who enrolled in mathematics bridging course and students who did not.

1.4 Objectives of the Study

The study was guided by the following specific objectives:

(i) To find out whether there is any statistically significant difference between the achievement in Mathematics and Science based degree or diploma programmes by university students who have taken a bridging course in mathematics and those who did not.

(ii) To determine whether there is any significant difference in attitude towards Mathematics and Science between university students who enrolled in mathematics bridging course and those who did not.

(iii) To find out whether there is any significant gender difference in attitude towards Mathematics and Science courses between university students who enrolled in mathematics bridging course and those who did not.

(iv) To find out whether there is a statistically significant gender difference in achievement among university students enrolled in mathematics and science based degree or diploma programmes between those who enrolled in mathematics bridging course and those who did not.

1.5 Hypotheses of the Study

To achieve the objectives of this study the following null hypotheses were tested:

H_O1: There is no statistically significant difference in achievement by university students in mathematics and science-oriented courses between those who have taken a bridging course in mathematics and those who have not.

H_O2: There is no statistically significant difference in attitude towards Mathematics and Science between university students who enrolled in mathematics bridging course and those who did not.

H_O3: There is no statistically significant gender difference in attitude towards Mathematics and Science between university students who enrolled in mathematics bridging course and those who did not.

H_O4: There is no statistically significant gender difference in achievement among university students who enrolled in mathematics and science degree or diploma oriented courses between those who enrolled in mathematics bridging course and those who did not.

1.6 Significance of the Study

In view of the importance of mathematics education in society, it was expected that the findings of this study would enlighten students, parents and universities on the achievement of those students who are admitted to the university's mathematics and science related course after they have undertaken a mathematics bridging course. It was also hoped that the findings would guide the parents on whether to enrol their children for the course or not. The findings would also guide universities on the direction to take with regard to mathematics bridging course. It

was hoped that the findings would help students to appreciate the need for bridging courses in the universities.

1.7 Scope of the Study

The study covered the effects of mathematics bridging course on achievement and attitude towards mathematics and science degree and diploma programmes. The study was carried out at Egerton University in Nakuru District because a considerable number of students after KCSE join either diploma or degree programmes at the University. Secondly, the university offers both diploma and degree programmes the majority of which are science based.

1.8 Assumptions of the Study

It was assumed that the students' level of entry into the mathematics bridging course was the same and that all the university programmes were Mathematics or Science based and the level of effort needed was the same. It was further assumed that lecturers had attained an acceptable level of training.

1.9 Limitation of the Study

Because of time and financial constraints, the study was limited to Egerton University of the Republic of Kenya. The findings of this study may therefore be generalised to similar Universities.

1.10 Definition of Terms

For the purpose of this study, the following operational definitions were used:

Attitude: Mental view, opinions, behaviour towards a certain aspect or occurrence. This was taken to mean students acquired internal state or feeling influencing their choice towards learning. It was measured on a five point Likert scale.

Bridging Course: A remedial course of study offered to upgrade students' understanding of fundamental concepts in a subject.

Gender: This refers to the difference between male and female in a classroom achievement rather than the physical differences.

Achievement: In this study this refers to the students' score in Mathematics or Science in university examinations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews the literature related to performance in science at KCSE level, attitude towards science, and gender differences in science performance. Performance in Mathematics at KCSE examination level and mathematics bridging course for those who want to join tertiary colleges and universities for mathematics and science courses are discussed. Literature on mathematics bridging course and university programmes, and students' attitude towards mathematics, is also reviewed. Finally the conceptual framework of the study is explained.

2.2 Performance in Science

A steady decline in academic performance of high school students in science as well as low enrolment has caused much concern in many countries (Ogunniyi, 1996). Changeiywo (2000) argues that performance in science is still poor compared to other subjects in Kenya irrespective of the various curricula changes that have taken place. This means that students' performance in Science and Mathematics needs to be improved if Kenya has to achieve industrialisation by the year 2020 (Galava, 2000; Wachanga, 2002).

Loxley (1981) in a review of research conducted in the developed countries indicated that the socio-economic background of the child is a more significant

determinant factor of achievement than the school the child attends. Waweru (1982) argued that socio-economic factors have total influence on educational interruption and consequently the performance of the interrupted pupil. However, in developing countries, on the average the type of school that the child attends is a more significant factor than the socio-economic background in determining achievement.

In Kenya, for instance, KCSE results, (KNEC, 2000; KNEC, 2001; KNEC, 2002; KNEC, 2003) indicate that the overall performance of students in science subjects has been low compared to other subjects over the years. Analysis of the results indicates that the performance of girls in science is poorer than that of boys. Performance in KCSE determines how many candidates join public universities (Muya, 2000; Aduda, 2001). This situation has resulted in a steady decline of women's enrolment in professional courses at the university.

Table 2 shows students' performance in science at KCSE examination between 1999 and 2002. It indicates very low mean scores in mathematics and science subjects of the students who sat the examinations in that period. The results show a below average performance.

Table 2

The Mean performance scores in Mathematics and Science during

The period 1999-2002

Subject	Marked out of	1999	2000	2001	2002
Mathematics	200	24.45	33.22	37.43	39.39
Biology	160	49.93	44.50	43.99	36.24
Physics	190	43.07	43.81	35.24	41.55
Chemistry	190	40.50	41.84	30.27	34.27
Biological Science	140	27.71	29.82	34.04	23.79

Source: KNEC (2001 & 2003)

Agutu (2000) attributed the poor performance in Mathematics and Science to inadequate facilities and lack of reference materials, students' negative attitude and lack of motivation among teachers. This study investigated university achievement in science by students who enrolled in mathematics bridging course and those who did not.

2.2.1 Students' Attitude towards Science.

There has been increased societal interest in science education in Kenya in order to improve science performance among pupils. Eshiwani (1980) noted that progress in any society depends to a large extent on science and technology. He claims that lack of adequate scientific and technological expertise have contributed to slow development in many parts of Kenya. McGregor and Bazo (2001) argue that science education in schools should prepare pupils who will study science and technology at university and become scientists. It should also provide all pupils with a general understanding of the nature of scientific knowledge.

According to the Commission for Higher Education (1988) one of the causes of poor standards in science is attitude. Students have a negative attitude towards science subjects at the secondary school level. Thyaka (1997) observed that the attitude of students towards science affects performance. Positive attitudes towards science encourage good performance. Boys are more interested in Science than girls (Aiken, 1970). The poor performance by students in science at KCSE examinations over the years has been blamed on many factors among them a negative attitude of students toward science, lack of teaching resources, vast content area to be covered, heavy teaching loads of teachers and large classes (Agutu, 2000). In this study, the differences in attitude towards the science programmes were investigated between those who enrolled in mathematics bridging course and those who did not.

2.3 Gender Differences in Science Performance

Studies in Canada and the UK have shown that girls continue to under achieve in the sciences (Rathgeber, 1995). In Canada, for example, fewer girls than boys select and stay in science streams of study. This attrition rate becomes increasingly apparent at successively higher levels of education (McGregor & Bazo, 2001). Women choose to enrol in greater proportions in arts, humanities and social sciences more than they do in Mathematics, Science and Technology (Karen, 1995).

Studies conducted in Kenya have also shown that girls underachieve in Science and Mathematics at the secondary school level (Eshiwani, 1984; Githua, 2002; Wachanga, 2002). As such the number of women who join university and other tertiary institutions to study Science and Mathematics are few (Muya, 2000). Both subject selection and performance play a major role in career decisions. Attitudes have been identified as some of the factors contributing to limited number of women in science courses and careers (Wasanga, 1997).

Girls' lack of access to Science and Mathematics limits opportunities to meet their basic needs and improve the quality of their lives and those of their families (McGregor & Bazo, 2001). School science can be said to be unequal because for many decades Science has been almost a male preserve. Recent years have seen an increase in the number of women entering into science fields (Alsop & Hicks, 2001).

Boys tend to have a more positive attitude than girls to science and therefore have higher achievement than girls (Eshiwani, 1983; Kenway & Willis, 1990). Low achievement by girls in science has been attributed to less confidence in their scientific abilities and less positive attitudes (Eshiwani, 1984; Martin, Muttis, Gonzalez & O'Connor, 2001). Eshiwani (1984) argues that some parents and teachers have the misleading perception that Science and Mathematics are "difficult subjects" and not as suitable for girls as for boys. This has contributed to the girls' negative attitudes towards Science and Mathematics and hence their dismal performance.

According to Versey (1990), girls perceive science as a predominantly male pursuit as the examples of Science presented are those that engage interest and motivation in boys. The lack of self-confidence, lack of role models and course material bias can discourage girls from pursuing scientific studies (Eshiwani, 1984; McGregor & Bazo, 2001; Leslie, Rodger & Janet, 2004).

In a classroom situation, teachers will often answer girls questions directly while offering boys information that will allow them to solve the problem themselves (Rathgeber, 1995). Tsuma (1998) argued that there is need to device approaches to teaching mathematics and science subjects that are favourable to girls. Kenway and Willis (1990) state that teachers should use a wide range of approaches to teach and encourage a variety of learning styles in learners. In this study, gender differences in science achievement will be investigated.

2.4 Performance in Mathematics at the K.C.S.E Level

The overall performance in Mathematics in schools in developing countries is generally low (Ogunniyi, 1998). According to KNEC (2001) report the KCSE examination candidates' performance in Mathematics and all the science subjects is very poor when compared to their performance in the other subjects. KNEC (2003) reports that the overall mean score in Mathematics in the year 2002 improved from 37.43 in the year 2001 to 39.39 in the year 2002 but this was still below average.

Factors that affect achievement in Mathematics are many and varied. Changeiywo (2000) pointed out that time allocation, availability of instructional materials, lack of well trained teachers, lack of relevant materials that meet the curriculum needs, nature of attitude of teachers towards the subject, examination pressure and language of instruction used in the subject are factors that affect the performance in Mathematics and Science.

Significant factors for poor performance in Mathematics in Kenya and other countries have been given as availability and use of text books (Fuller, 1985; Psacharopoulos, 1985; Stodolsky, 1988; Eshiwani, 1993; Agutu, 2000); time allocation (Anderson, 1984; KNEC 2000); Class size (Lockheed & Hanusheck, 1993) and teaching methods and classroom environment (Resnick 1985; Hatano & Ingake, 1991; Burton, 1996; Aduda, 2001).

Other factors include students' attitudes and characteristics (Gould, 1981; Eshiwani, 1983; Fuller, 1985; Fisher & Rickards, 1996; Leslie, Rodger & Janet, 2004); teacher quality and perceptions (Anderson, Ryan & Shapiro, 1989; Changeiywo, 2000; McGregor & Bazo, 2001) and Student entry behaviour (Bloom, 1976; Hanusheck, 1989). Eshiwani (1984) and Mwangi (1984) cite school characteristics, teacher characteristics and student characteristics as broad areas, which in many ways form contributing factors to poor performance in Mathematics.

Learning Mathematics requires a language because Mathematics is a subject in which terms are carefully and unambiguously defined and where language must be used with care (Marjoram, 1974). Mathematics therefore has its own linguistic structure which a learner has to use (Deau, 1982). The language used in Mathematics is different from other languages; this includes terms, symbols and structures (Laborde, 1990). Mathematics is a body of knowledge where words and notions different from other languages are used (Davis, 1998). Therefore learning Mathematics requires the development of a mathematical language to reduce abstraction (Curcio, 1990). Mathematical language is the means by which mathematical concepts are communicated to learners. The low achievement in Mathematics at KCSE level is partly due to poor understanding in mathematical language by students (Mbugua, 2004).

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Factors such as inadequate coverage of the curriculum; the quality, relevance, quantity and supply of learning resources; failure to understand questions, theoretical teaching, lack of mastery of concepts and students' negative attitude to the subject have also been attributed to students' poor performance in Mathematics (KNEC, 1990; Aduda, 2001; KNEC, 2002). Over the years, analysis of performance in Mathematics has indicated disparity in favour of boys (Eshiwani, 1984; Muya, 2000; KNEC, 2003).

KNEC (2003) report indicated that the mean scores for girls for the year 2001 and 2002 were 15.83% and 16.44% respectively while the respective means for boys were given as 21.19% and 22.53%. Burton (1996) indicated that girls drop out Mathematics in greater numbers than boys when that choice becomes available. In effect, poor performance in Mathematics is often a barrier for entry into university education (Fennema & Leder, 1990; Karen, 1995; Van Tonder, 1996). Majority of the students after KCSE examination would like to join university but can only do so if they attain a mean grade of C+ and score grade C and above in Mathematics. Those that score less than grade C in Mathematics but have a mean grade of C+ and above at KCSE examination need to enrol in a mathematics bridging course.

2.5 Mathematics Bridging Course

Bridging courses have for a number of years been one means of meeting the particular needs of those who fail to attain certain set standards in education. Bridging courses cater for people who have earlier not had opportunities to

continue with formal education as well as discouraged school leavers (Ellis et al., 2001).

In countries, such as Australia and the Republic of South Africa, political and social goals require greater access to higher education for disadvantaged groups and thus there is great interest in devising bridging courses in most areas (Holton, 2001). Van Tonder (1996) argued that because of the practical preparation in the bridging courses for students and increase in positive attitudes among these students, most institutions in South Africa find that students with the minimum entry requirements apply to enter the bridging courses. This is because students who enrol in bridging courses feel they are better prepared to enter university and have a better chance of success than they would have if they entered university directly from school.

A range of programmes can be called bridging courses because they bridge between the academic needs of school and tertiary education (Holton, 2001). According to Van Tonder (1996), some of the courses are commercialized, they are seen as a way of generating income for the institutions concerned, some are free and some are compulsory. Some last for one year, some for a few months, while others are for a few weeks. Mathematics bridging courses condense years of Mathematics into short courses. Capability of students in science courses is gauged by their score in Mathematics at secondary school level and those who score less than a grade D in Mathematics have a very small chance of even completing a

bridging course and even a smaller chance of successfully completing a science course in university (Kigotho, 2004).

Bridging courses give secondary school leavers a second chance to gain university entry. They have proved their value in providing an alternative pathway to university Education. Bridging courses in mathematics equip students with the concepts and knowledge skills that they need to use in university (Egerton University, 2001; Ellis et al., 2001; Holton, 2001; Kigotho, 2004). The course takes into account the deficiencies of the secondary school leavers and reduces the gap between their secondary school mathematics knowledge and the expectation at the university for the courses that require mathematical skills (Kiriri Women's University of Science and Technology, 2003; Moi University, 2004).

According to Egerton University (2001), mathematics-bridging course takes care of the development of the skills not well mastered at the secondary school level. Traditionally, university admission has been based on students' scores in K.C.S.E examination. However, recent reforms in university education have sent the wrong signals to students and parents (Kigotho, 2004). Bridging courses are not standardized and individual university departments control the curriculum. They therefore differ in content from one university to another (Ellis et al., 2001; Holton, 2001). This means that students who have undertaken a bridging course cannot be admitted to any university other than the one where they undertook the bridging course.

For the majority of the Kenyan universities, the mathematics bridging course consists of five modules namely; Geometry and Vectors, Basic Algebra, Basic Calculus, Business mathematics and Probability and Statistics (Egerton University, 2001; Kiriri Women's University of Science and Technology, 2003; Maseno University, 2004; Moi University, 2004). Each module is defined as the equivalent of thirty-eight lecture hours (Egerton University, 2001). According to Holton (2001), a mathematics bridging course aims to fill gaps in knowledge, to have students review (or study) essential facts and skills that may not have been adequately mastered in school and addressed in the curriculum, concentrating on those topics that are essential for science oriented courses in the university. It seeks to bring the learners up to the level expected (Ellis et al., 2001). Students taking bridging courses may be having enhanced feelings of self-worth and increased confidence which in turn leads to a change in attitude towards Mathematics.

2.5.1 Mathematics Bridging Course and University Programmes

Lack of confidence and self-esteem is itself a major barrier to participation and achievement of students in science and mathematics studies at university (Karen, 1995). Students who enrol in mathematics bridging course have been found to increase confidence and self-esteem. The programme provides students with motivation, stimulation and incentive to strive. It makes them want more in life and students experience gains in assertiveness, self worth and confidence as a result of bridging study (Ellis et al., 2001).

A bridging course prepares students for undergraduate study. It makes the student understand the university expectations before a degree or diploma. Students get the impression that they would start their degree or diploma studies more confidently, having gained new skills and knowledge and the chance of getting future employment (Ellis et al., 2001). This has led to an increase in demand for mathematics bridging course as more students require the skills and as lecturers realise that careful development of skills and attitudes during this bridging course can lead to more effective learning later in tertiary institutions (Holton, 2001).

A number of researches relating to bridging courses have been carried out elsewhere, but the same has not been done in Kenya. This study aims at finding the effects of mathematics bridging course on students' achievement and attitude towards university Mathematics and Science programmes.

2.6 Students' Attitude towards Mathematics

Different people have defined attitudes differently. According to Rummel (1976), an attitude is a mental and neural state of readiness, organized through experience, exerting directive or dynamic influence upon the individual's response to all objects and situations with which it is related. Good and Brophy (1986) argue that attitudes are affective or emotional responses, preferences, likes and dislikes, approach or avoidance tendencies. Attitudes are acquired primarily through exposure to respected models who exhibit the attitudes. Attitudes can also be stimulated through persuasive communication (if the learner accepts rather than

resist the message) and can be conditioned through experience. Attitudes are developed through general socialization mechanisms rather than taught directly through instruction.

Klausmeier (1985) noted that attitudes influence how well students learn and how they behave. Accordingly, teachers' aid students in learning the attitudes that facilitate the subject matter learning and that promote healthy interpersonal relations among students and adults (Chacko, 2000). Attitudes are learned, emotionally toned predispositions to react in a consistent way toward persons, objects and ideas. They may become stronger or may change direction. Attitudes are a mental view, opinions or behaviour towards a certain aspect or occurrence (Aiken, (1970). In this study attitudes were taken to mean students' acquired internal state or feeling influencing their choice towards learning. Blair (1975) argued that attitudes are acquired through experiences that have a pronounced feeling component. Attitudes help determine not only what a person sees but also how the person sees it. Attitudes may be resistant to change. It is therefore important that desirable attitudes be learned early in life. Thus desirable attitudes about Mathematics should be learned early enough.

The kind of attitude the student has will affect learning. If one has positive attitudes about teachers and likes the subject then the student will experience some success and through reinforcement will work more effectively and achieve more (Chacko, 2000). The influence of attitudes on perception leads to the student's

seeing tasks to be learned as pleasant and important or as unpleasant and useless. Attitudes about one are important because they yield to self-confidence, which determines a learner's readiness to learn. Attitudes are wrapped up with a person's feelings, needs and self-concept.

Trow (1970) indicated that teachers should provide an atmosphere in which pupils can learn, develop normally and become what they are capable of becoming. Attitudes in one person have the ability of influencing attitudes in another person. This means that pupils' attitudes will tend to be favourable if the teacher likes the students, likes to help, likes to learn and likes to lead. Chacko (2000) in a research done in Zimbabwe, indicated that secondary school pupils listed Mathematics as one of the subjects they disliked because of a number of reasons among them; poor teaching, negative attitude of teachers to pupils and lack of materials like textbooks. Poor teaching stood out as the reason for this.

Attitudes are developed over a period of time and attitudes do affect achievement. Positive attitudes have been found to encourage learning and higher achievement (Ellis, et al., 2001). Peer influence, teaching approach, attitude towards the teacher, success in the subject, parental support, perception of the utility value of the subject are some of the factors that influence attitude to a school subject. Poor performance in public examinations in Mathematics is something that indirectly support the negative views expressed by the pupils of that level.

One of the objectives of the mathematics curriculum is fostering favourable feelings towards Mathematics as well as imparting cognitive knowledge. Fisher and Rickards (1996) indicated that the personality and behaviour of the teacher is very important in the development of student's attitudes. Bolaji (2000) argued that teacher personality, relations and interactions with students' classroom activities, rewards, assignments and students' work are all directly controlled by the teachers. Thus the teacher must assume a large part of both the responsibility and challenge of development of positive attitudes of students towards Mathematics. Positive relations which involve active learning – teaching process and student participation promote positive attitude towards Mathematics.

Watson (1976) argued that students have negative attitudes towards Mathematics as they move from lower to upper classes. According to Taiwo (1974) and Morris (1990), the students' attitudes decrease as they climb higher because most of them have a general belief that Mathematics is a very difficult subject that can only be understood by bright and hard working students. They question its relevance for themselves and feel that they cannot do it.

Bell (1980) observed that what we learn and how we learn it is closely tied to our attitude towards the subjects that are taught. Negative feelings and attitudes to Mathematics learning is a common factor among the least able pupils in secondary schools (Larcombe, 2004). In their report of 2003, KNEC'S general comments were of the view that candidates demonstrated not only lack of basic skills but also

appeared to have forgotten what they learned in primary schools. This was attributed to poor coverage of the syllabus or lack of interest in the subject.

Psychologists (Brunner, 1966; Skemp, 1971) and educators (Taiwo, 1974; Cockcroft, 1982) agree that attitudes play an important role in the learning process. Teachers and other people who are involved in the education of students have a responsibility in helping to create favourable attitudes towards Mathematics. If the attitudes of appreciation of Mathematics are attained by the student, then the student enjoys the subject, gets satisfaction in understanding it and feels rewarded when he/she attains mathematical competence. Oyaya and Njuguna (2000) argued that many teachers have a negative attitude towards the teaching of Mathematics and Sciences. The consequences are that such a teacher lacks in resourcefulness and the students are poorly motivated as a result of uninspired teaching.

In order for students to achieve higher score in Science and Mathematics, a change of attitude is needed by both teachers and students (Versey, 1990). Attitudes play a major role in achievement. A highly motivated student will perform well in Mathematics. In this study, attitude of students towards Mathematics for those who enrolled in mathematics bridging course and those who did not was investigated.

2.7 Conceptual Framework

The conceptual framework of the study was based on the cognitive, developmental and associationist theories of learning. According to Woolfolk (1987), the cognitive

psychologists believe that learning is to make sense of the world. This is done by using the mental tools. The ways in which one thinks about situations, along with one's expectations and feelings influences how and what one learns. People seek out information, attend to it selectively and reorganise what they need to achieve a new concept in learning. What the individual brings to the learning situation influences the learning process greatly. Thus the role of prior knowledge is important. What one already knows determines to a great extent what one would learn, remember and forget.

Students often bring a great deal of prior knowledge to a learning situation and this prior knowledge forms a framework within which new input is interpreted (Okere, 1996). Students taking a mathematics-bridging course do so when they already know what they want in life. At this stage they are more focused and know the importance of Mathematics in their prospective career. They know that they are learning for transfer. Learning in one situation will influence learning and performance in other situations (Bigge & Hunt, 1980). Therefore students get more interested in what they are learning in the bridging course and the subsequent university programme. Additionally, what they learn in mathematics bridging course is what they had already learned in secondary that would be of much use in most university programmes.

Associationist theories assume that the retention of new learning depends on the nature and strength of association between the new learning and the previous

learning stored in memory (Mackeough, Marini & Lupart, 1995). According to Piaget (1964), a student is ready to learn a new concept when maturation has taken place. The students who enrol in a mathematics-bridging course have attained the maturation required and can therefore learn with zeal.

In this study students' achievement and attitude formed the dependent variables. Students' achievement was represented by marks scored by students in year 2 university examinations. It was determined by the study of the students' achievement records. The independent variables were students' exposure to a mathematics-bridging course and non- exposure to a mathematics-bridging course.

The outcome of the study was influenced by university programmes in which the students were enrolled, students' prior experience, and lecturer training and experience on which assumptions had been made. Others influencing the study were gender and age of student. The researcher was to determine whether there were any gender differences in attitude and achievement. Age of student was controlled for by using year 2 students only. These three sets of variables were assumed to be interrelated in that the independent variables have an influence on the moderator variables, which ultimately influence the students' achievement and attitude in science. The independent variables also affect the dependent variables directly. Figure 1 which is the conceptual framework shows the representation of the relationships among variables.

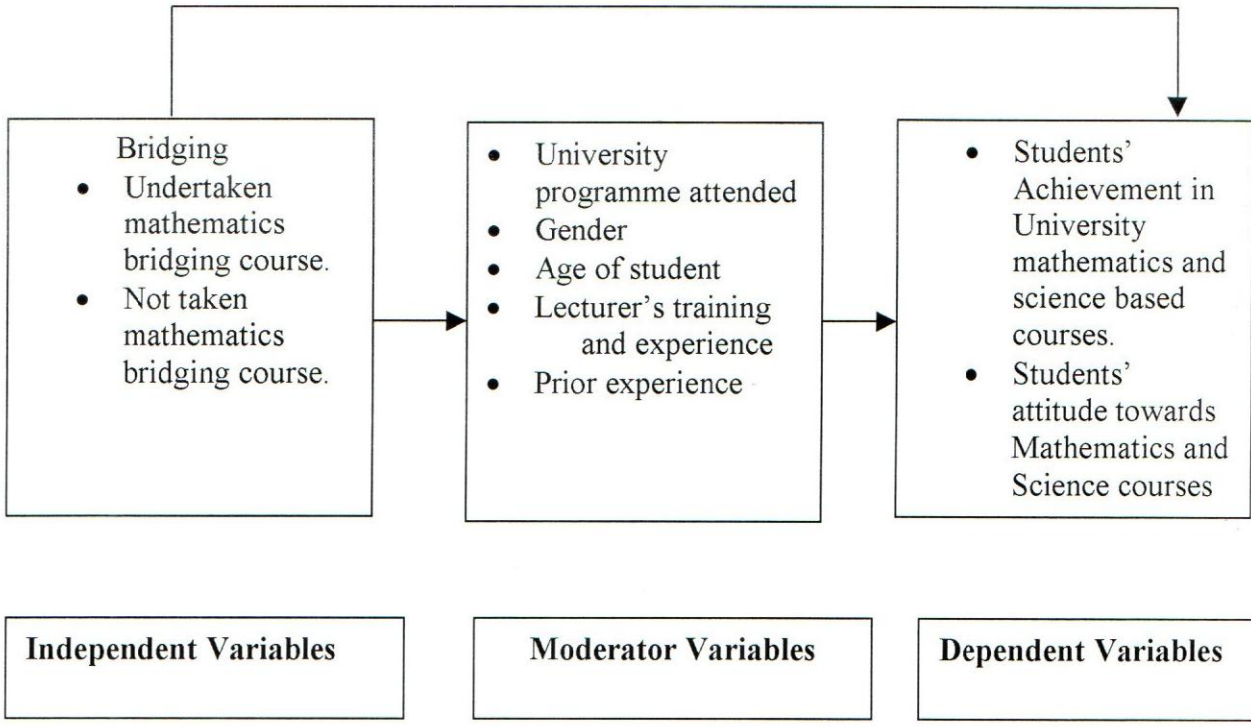


Figure 1: The conceptual Framework for the Study

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This study sought to investigate the effects of mathematics bridging course on students' achievement and attitude towards degree and diploma level mathematics and science programmes. The chapter discusses the research design, describes population, sampling procedure, sample size and instruments used in the investigations. Data collection and data analysis procedures are also discussed. A total of ninety six (34 female and 62 male) university students participated in the study. Forty one students out of the total had enrolled in mathematics bridging course and fifty five had not. Of the forty one students who enrolled in mathematics bridging course, fifteen were females while twenty six were males. Nineteen out of the fifty five students who never enrolled in mathematics bridging course were females while thirty six were males.

3.2 Research Design

This study used the ex-post facto research design. An ex-post facto design explores possible causal relationships among variables that cannot be manipulated by the researcher. The research focused on what had happened differently for comparable groups of subjects, then explored if the subjects in each group were different in some way. Ex-post facto indicates that data are collected after the presumed cause

or causes have occurred. In this study data was collected after the students had enrolled in Mathematics bridging courses.

In this design, the researcher took the effect and examined the data to establish causes, relationships or associations and their meanings. Investigations took things as they were. The subjects here possessed attribute variables which are characteristics possessed by the subjects before the study begun. The research was conducted after variations in the independent variable had already been determined by the natural cause of events (Ary et al., 1979; Kathuri & Pals, 1993). This was a causal comparative study. In this design, the researcher achieved the variation by selection of individuals in whom the variable was present or absent. The two groups were presented with the same perceptual task or compared in achievement. The phenomena under study were investigated the way they were without being manipulated and without changing the state of the environment under which they operated (Mutai, 2000).

The ex-post facto design involves a selection of intact groups. The groups selected were those, which had students who, enrolled in mathematics bridging course. It had two groups (diploma and degree) of students. In each group there were two categories of students. Those with the attribute variable in diploma (E_1) and those without (C_1). The other category in degree courses were with attribute variable (E_2) and without (C_2). The study explored possible causal relationships in achievement

and attitudes between those who enrolled in mathematics bridging course and those who did not.

3.3 Population

The target population of this study was all Egerton university students taking mathematics and science oriented courses who number 4,985 according to the university's admission records in the year 2004 while the accessible population was second year diploma and degree students enrolled in mathematics and science-based programmes at Egerton University. A sample was drawn from the second year diploma and degree students in mathematics and science programmes. The programmes were selected purposively on the basis of students' enrolment in mathematics bridging course. Diploma and degree year two (2003/2004 class) was used because they had students who enrolled in mathematics bridging course. Year one students did not have achievement scores by the time this research was being conducted while year 3 and 4 did not have students who enrolled in a mathematics-bridging course.

3.4 Sampling Procedures

Purposive sampling was used to select the faculties that offered science (both diploma and degree) and also programmes which had students who enrolled in mathematics bridging course. Purposive sampling was used because only faculties that had students who enrolled in mathematics bridging course were required for purposes of this study (Frankel & Wallen, 2000). The researcher purposively

selected students from year two-degree and diploma programmes as they best met the purposes of the study. Students who had enrolled in mathematics bridging course were purposively sampled. The researcher then compiled lists of those who enrolled in mathematics bridging course by degree and diploma. Proportional stratified random sampling by programmes was finally used to select those who had enrolled in mathematics bridging course from every mathematics and science oriented programme that had students who had enrolled in mathematics bridging course as this enabled the researcher to determine to what extent each stratum in the population was represented in the sample (Ary et al., 1979; Mugenda & Mugenda, 1999).

3.5 Sample Size

Kathuri and Pals (1993) state that the general rule is to use the largest sample possible since the main interest is learning about the population from which the samples are drawn. A large sample has a mean and standard deviation which is representative of the population mean and standard deviation. They recommend a minimal sample size of 15 for causal – comparative. For this study, a sample size of 96 subjects was used. Lists of second year diploma and degree groups in the faculties of Science, Education, Health Science and Agriculture were used as the sampling frame. Departments in these faculties that had students who had enrolled in a mathematics-bridging course were purposively sampled. They were sampled as follows:-

with the treatment and those without should be each 0.50. Since those who enrolled in mathematics bridging course were 41, it meant therefore that all the 537 students who never enrolled in mathematics bridging course could not be used. A value close to 41 was used to get similar standard errors for estimated means. Sampling students who never enrolled in mathematics bridging course from each programme proportionately at 10% gave a figure of 55. Therefore for this study a sample size of 96 students was used. Table 4 shows how the students were sampled proportionately from each programme.

Table 4

Year 2003/2004 proportional stratified sampled students

Programme	**Number with bridging course**	Number without bridging course	Total
	Degree programmes		
Bachelor of Education Science	5	19	24
Biomedical Science & Technology	4	5	9
Computer Science	3	10	13
	Diploma programmes		
Clinical Medicine	4	4	8
Horticulture	5	4	**9**
Animal Health	6	2	8
Computer Science	3	1	4
Agricultural Education & Extension	6	7	13
Dairy Technology	5	3	8

3.6 Instrumentation

Two instruments were used to collect the required data from the students. These included; Academic performance summary which was collected using University Academic Performance Summary Form (UAPSF) and University Students' Attitude Questionnaire (USAQ) for all respondents in the study.

3.6.1 University Academic Performance Summary Form (UAPSF)

This was a table with five columns namely; coded students' name, gender, enrolment in mathematics bridging course (Yes or No), mean score in year one University examinations and Examiners use only column. It was used to collect data from all the students in the study. The data was used to test statistical significance in achievement between students who enrolled in mathematics bridging course and those who did not.

3.6.2 University Student Attitude Questionnaire (USAQ)

This was an adaptation of Aikens' (1982) instrument used to collect data on attitudes towards Mathematics and Science. The instrument contained 47 closed – ended items while two were open ended. It sought information on the following areas.

a) Students' biographic data in terms of gender, type of university programme attended and age
b) Students' attitude towards mathematics

c) Students' attitude towards science

d) Mathematics bridging course

Closed–ended questions in the questionnaire were measured on a 5-point Likert scale. Questions with a positive stem strongly agree (SA) were scored highest while strongly disagree (SD) scored lowest (1). The questions with a negative stem strongly agree (SA) scored lowest (1) while strongly disagree scored highest (5). Open –ended questions were analysed descriptively.

Five specialists/experts in educational research assessed the content, construct and face validity of the questionnaire. Cronbanch coefficient alpha was used to test the reliability of the attitude questionnaire. This is because the items were not scored dichotomously and the scores took a range of values.

The following results were obtained as indicated in table 5

Table 5

Reliability of instruments

Questionnaire	Reliability (α)
USAQ: Mathematics attitude questionnaire	0.87
USAQ: Science attitude Questionnaire	0.83

(Critical Value $\alpha \geq 0.70$)

A reliability coefficient of a minimum of 0.7 was considered suitable to make possible group inferences that are accurate enough (Mugenda & Mugenda, 1999; Fraenkel & Wallen, 2000). The alpha (α) value obtained as indicated in Table 5 shows that the instruments are reliable. The significance level was set at 0.05. To avoid contamination of the subjects, piloting was done in Moi University because it has the same characteristics as the university being studied.

3.7 Data Collection

A research permit was obtained from the Ministry of Education, Science and Technology and permission to conduct research at Egerton University was granted by the Vice Chancellor of the institution. To avoid contamination of the subjects, piloting was conducted in Moi University because Moi University has the same characteristics as the university being studied. The researcher started visiting the universities in February 2005 to organise for data collection. Data was collected in the month of May 2005. The researcher administered the student's questionnaire with the assistance of the respective science lecturers. The students' examination results for all students in the study were collected by the researcher using form UAPSF. This data was collected from Egerton university's faculty offices.

3.8 Data Analysis

The study generated quantitative data. Therefore inferential statistics was used for data analysis. The cumulative mean of the student's score at year one university examinations for both those who enrolled in mathematics bridging course and those who did not was calculated so as to establish the trend and compare the performance. The data obtained from the students, were coded, scored and analysed between May and June 2005. The statistical package for social sciences (SPSS) was used to analyse data on achievement and attitude towards mathematics and science oriented programmes .

A t – test, was used to test all the hypotheses on achievement at 0.05 level of significance because two means were used. A t-test was carried out to establish whether there was a statistically significant difference in achievement between the means of those who enrolled in mathematics bridging course and those who did not. Wilcoxon rank sum test, which is a two sample non-parametric test that corresponds to the two-sample t-test, was used to test the hypotheses in attitude towards Science and Mathematics. Attitudinal scores are taken on an ordinal scale of measurement where normality cannot be justified. A distribution free test was thus appropriate (Mugenda & Mugenda, 1999; Nassiuma & Mwangi, 2004). Statistically significant gender difference in achievement between those who enrolled in mathematics bridging course and those who did not were tested using a t-test. The summary of the data analysis procedures is given in Table 6.

Table 6

Summary of Data Analysis Procedure.

Research hypothesis	Independent Variables	Dependent Variables	Method of Analysis
H_O1: There is no statistically significant difference in the students' achievement in mathematics and science-oriented degree or diploma course between University students who have taken a mathematics bridging course and those who have not.	Undertaken Mathematics bridging course	Academic Achievement	t-test
H_O2: There is no statistically significant difference in attitude towards Mathematics and Science between University Students who enrolled in mathematics bridging course and those who did not.	Undertaken Mathematics bridging course	Attitude towards mathematics and science	Wilcoxon rank sum test
H_O3: There is no statistically significant gender difference in attitude towards Mathematics and Science between University students who enrolled in mathematics bridging course and those who did not.	Undertaken Mathematics bridging course and gender	Attitude towards mathematics and science	Wilcoxon rank sum test
H_O4: There is no statistically significant gender difference in achievement of Mathematics and Science between University students who enrolled in mathematics bridging course and those who did not	Undertaken Mathematics bridging course and gender	Achievement	t-test

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

In this chapter, the data obtained from the study has been analysed using descriptive and inferential statistics. The results are presented in the form of tables and short explanations. The Wilcoxon Rank Sum Test and t-test have been used to test the four hypotheses of the study.

The sections that follow contain information on the following areas:-

a) Difference in students' achievement in mathematics and Science.

b) Difference in students' attitude towards Mathematics and Science.

c) Gender difference in attitude towards Mathematics and Science between those who enrolled in mathematics bridging course and those who did not.

d) Gender difference in Mathematics and Science achievement.

The results of each of the four hypotheses of the study are presented in tabular form and finally a conclusion made indicating whether a hypothesis is rejected or accepted at 0.05 level of significance.

4.2 Differences in students' achievement in Mathematics and Science.

In order to determine the effects of the mathematics bridging course on students' achievement in university mathematics and science oriented programmes, an analysis of students' university examination scores was carried out. Hypothesis $H_{O}1$ of the study sought to find out whether there is any statistically significant difference between the achievement of students who enrolled in mathematics bridging course and those who did not.

The mean of all the cumulative means of each student's achievement at year one university examinations for those students who enrolled in mathematics bridging course and those who did not was calculated. Using the two means, the t- value was in return calculated.

Table 7 shows the number of students and mean scores obtained by the students.
The t-result shown in table 7 gives the mean score on achievement in mathematics and science oriented programmes for students who enrolled in mathematics bridging course and those who did not (56.42 and 59.83 respectively). The t-test shows no significant difference in students achievement at $\alpha = 0.05$ level.

Table 7

Achievement for students who bridged in mathematics and those who did not

Bridging	N	Mean	SD	t	df	P-value
Bridged	41	56.42	10.48	1.848	940	0.068
Not bridged	55	59.83	7.61			

Since the p-value (0.068) is greater than the set α =0.05, it implies that there is no statistically significant difference in achievement between students who enrolled in mathematics bridging course and those who did not. This could be attributed to university mathematics motivators and aspects of mathematics bridging that students liked. Hypothesis H_O1 which sought to find out whether there is any statistically significant difference between the achievement of students who enrolled in mathematics bridging course and those of students who did not is thus retained.

Table 8 shows the university mathematics motivators while Table 9 shows the aspects of mathematics bridging course that students liked. Poor achievement in mathematics and science has been attributed to lack of learning facilities, poor teaching methods and poor attitudes towards the subjects. The results in Table 8 show that students in the study indicated that frequent practice and exercise; group discussion, availability of learning facilities and reference materials and positive attitude were some of the motivators to students' achievement in university. Students who enrolled in mathematics bridging course indicated that breaking of

mathematics into modules taught by different lecturers at specific times motivated them as shown in Table 9. In most secondary schools a class is taught mathematics by one teacher from form one to form four.

Table 8

University mathematics motivators

Motivator	Frequency	Percent
1. Frequent practice and exercise	40	41.7
2. Group discussion	39	40.6
3. Availability of learning facilities and reference materials	21	21.9
4. Positive attitude	20	20.8
5. Consultation with Lecturers	19	19.8
6. Seminars	2	2.1

Table 9

Aspects of mathematics bridging course that students liked

Response	Frequency	percent
1. Breaking of mathematics into modules	28	29.2
2. Assigning different lecturers to individual modules	22	22.9
3. Allocation of time to each module	22	22.9

Tables 10 and 11 show mathematics course related factors that contribute to success in bridging and helpful aspects of mathematics bridging course.

From the study, students who enrolled in mathematics bridging course rated competent and dedicated lecturers at 31.7%, availability of learning facilities and reference materials at 31.7% and breaking of mathematics into modules at 19.5% as shown in Table 10. These mathematics were course related factors that contributed to their success in bridging and subsequently in their undergraduate study.

Table 10

Mathematics Course related factors that contribute to success in bridging

Response	Frequency	percent
1. Competent, dedicated and motivated lecturers	13	31.7
2. Availability of learning facilities and reference materials	12	31.7
3. Breaking of mathematics into modules	8	19.5
4. Strict university examination rules	5	12.2

Table 11

Helpful aspects of mathematics bridging course

Aspect	Frequency	percent
1. Help me qualify to join university	26	63.4
2. Refreshed my mathematics knowledge	26	63.4
3. Modules relevant to my current programme	13	31.7
4. None	1	2.4

Other factors that contributed to the students' success in mathematics bridging course were the fact that going through the mathematics bridging course successfully would help the student qualify to join university which scored 63.4%, gaining knowledge 63.4% and breaking mathematics into modules relevant to the students' undergraduate programme 31.7%. All this contributed to the success of students who had enrolled in mathematics bridging course.

The results show that students who enrolled in mathematics bridging course and those who did not had similar achievement scores in mathematics and science oriented courses at the university. This finding implies that enrolling in mathematics bridging course brings one to the level of those who passed KCSE Mathematics with grade C and above.

In an earlier study conducted by Ellis, et al. (2001) on the role of whyalla bridging education in developing life-long learners and providing an expanded range of future opportunities, it was found that the programme improved students'

achievement at university. There was no significant difference in achievement between those students who had enrolled in a bridging course and those who had not. Enrolling in a bridging course raised the students' level of competence to that of their contemporaries who had passed well at KCSE mathematics examination. This means that students would start their degree studies more confidently having gained new skills and knowledge and the chance to join university.

Holton(2001) studied the teaching of mathematics at university level and found that mathematics bridging course prepares students for the academic concepts and skills of their degree programmes. Students enrolled in mathematics bridging course are brought up to the level expected. Ellis, et al. (2001) indicated that the programme had prepared students well for future studies.

The present study was carried out with these issues in mind and consequently the results reveal that students who enrolled in mathematics bridging course achieve a similar level as those who never enrolled in a mathematics bridging course. This was attributed to gaining of mathematics knowledge and skills during bridging in mathematics which was rated at 63.4%, breaking of mathematics into modules relevant to the students' current programme was rated at 31.7% and competent, dedicated and motivated lecturers was rated at 31.7%. This suggests that students who have the recommended level of assumed knowledge of Mathematics compete well in university mathematics and science programmes. Therefore this implies that all efforts should be directed towards raising students' knowledge and skill in

Mathematics at bridging level in order to increase their achievement in university mathematics and science programmes.

4.3 Difference in Students' Attitude towards Mathematics and Science

The University Student Attitude Questionnaires (USAQ): attitude towards Mathematics and attitude toward Science were analysed to determine the relative effects of bridging in mathematics on attitude towards mathematics and science. This was done in order to test hypothesis H_O2.

Table 12 shows the mean rating for various items on mathematics. The mean score for every item in Mathematics attitude Questionnaire was calculated for all those who enrolled in mathematics bridging course and those who did not. Closed–ended questions in the questionnaire were measured on a 5-point Likert scale. Questions with a positive stem strongly agree (SA) were scored highest (5) while strongly disagree (SD) scored lowest (1). The questions with a negative stem strongly agree (SA) scored lowest (1) while strongly disagree scored highest (5). Consequently the overall mean score was calculated using the results obtained. The mean rank of the ratings for students who enrolled in mathematics bridging course and those who did not are shown in Table 13.

Table 12

Mean rating for various items on mathematics attitude

	Bridged Mean	Not bridged Mean
1. Mathematics is not very interesting.	3.78	4.22
2. I want to develop my mathematical skill and study this subject more.	3.85	3.78
3. Mathematics is a very worthwhile and necessary subject.	4.44	4.67
4. Mathematics makes me feel nervous and uncomfortable.	3.85	4.11
5. I like mathematics because it is the best subject.	3.17	3.58
6. I don't want to take any mathematics than I absolutely have to.	3.29	3.44
7. Other subjects are more important to people than mathematics.	3.39	3.78
8. I am very calm and unafraid when studying mathematics.	3.15	3.60
9. I have seldom liked mathematics.	2.95	3.38
10. I am interested in acquiring further knowledge of mathematics.	3.88	3.82
11. I am not willing to take more than the required amount.	3.15	3.58
12. Mathematics helps to develop the mind and helps a person to think.	4.39	4.25

13. Mathematics makes me feel uneasy and confused.	4.20	4.38
14. Mathematics is enjoyable and stimulating to me.	3.44	3.93
15. Mathematics is not especially important in everyday life.	4.46	4.40
16. Mathematics is a dull and boring subject.	4.12	4.53
17. Trying to understand mathematics doesn't make me anxious.	2.88	3.00
18. I plan to take as much mathematics as I possibly can during my education.	3.17	3.44
19. Mathematics has contributed greatly to the progress of civilisation.	4.34	4.27
20. Mathematics is one of my worst subjects.	3.88	4.45
21. I like to solve new problems in mathematics.	3.59	3.87
22. I am motivated to work very hard on mathematics problems.	3.66	4.07
23. Mathematics is not one of the most important subjects for people to study.	4.20	4.53
24. I do not get upset when trying to work mathematics problems.	3.49	3.56
USAQ: Mathematics Overall Mean scores	**3.70**	**3.94**

Table 12 shows the means of students' attitude towards mathematics. The overall mean scores were 3.70 (74%) and 3.94(78.8%) out of the possible maximum mean score of 5 points (100%). This means that both attitude scores are high but students who never enrolled in mathematics bridging course have a higher score compared to those who enrolled in the course.

A wilcoxon rank sum test was carried out to find out whether there was a statistically significant difference in attitude towards Mathematics between those who enrolled in mathematics bridging course and those who did not. Table 13 gives the Sum of ranks of the mathematics attitude ratings for students who enrolled in mathematics bridging course and those who did not (1679.50 and 2976.50 respectively) and the number of cases on which these ratings are based on Wilcoxon sum of ranks test.

Table 13

Difference in attitude towards mathematics between students who bridged and those who had not bridged in mathematics

	N	Mean Rank	Sum of Ranks	W	p-value
Not Bridged	55	54.12	2976.50	1679.50	0.022
Bridged	41	40.96	1679.50		
Total	96				

A z- statistic of -2.290 was generated with a test statistic T of 1679.50 and a two tailed significance level of 0.022. From the analysis the p- value is less than 0.05 which implies that there is a statistically significant difference in attitude towards mathematics between students who enrolled in mathematics bridging course and those who did not. Students who did not enrol in mathematics bridging course

were therefore rated more highly on attitude towards mathematics. This could be attributed to the challenges students who enrolled in mathematics bridging course encountered as shown in Table 14. The students who enrolled in mathematics bridging course were demoralised and portrayed as failures. This factor exerted a strong negative attitude towards mathematics. As a result, during data collection, these students feared coming out in the open to say that they enrolled in mathematics bridging course.

Students who enrolled in mathematics bridging course experienced a number of challenges, some of which were rated highly in this study. Table14 shows these challenges.

Table 14

Students' challenges in undertaking mathematics bridging course

Factor	Frequency	percent
1. Strict university examination rules	13	31.7
2. Demoralised and portrayed as failures	11	26.8
3. Lack of commitment by some lecturers	10	24.4
4. Limited time	08	19.5
5. Economic constraints	05	12.2

The challenges ranged from strict university examination rules which was reported by 31.7% of the respondents, being demoralized and portrayed as failures was reported by 26.8%, lack of commitment by some lecturers 24.4%, limited time

allocation 19.5% to economic constraints 12.2%. Strict university examination rules, demoralized and portrayed as failures and lack of commitment by some lecturers rated highly. These factors had a negative effect on students' attitude towards mathematics.

Enrolling in mathematics bridging course had positive impacts too on students' performance and also on their attitude as shown on Tables 15 and 16.

Table 15

Positive impact of mathematics bridging course

Response	Frequency	percent
1. Changed attitude and confidence	24	58.5
2. Help students qualify to join university	23	56.1
3. Improve grade in mathematics	10	24.4
4. No positive impact	1	2.4

For students who enrolled in mathematics bridging course, the course impacted positively as shown on Table 15. Some of these impacts rated highly in this study. Those that scored highly were changed attitude and confidence 58.5%, helping students to join University 56.1% and improve mathematics grade 24.4%. This had the effect of raising the level of attitude towards mathematics.

Table 16

Personal factors that contribute to success in mathematics bridging course

Factor	Frequency	percent
1. Positive attitude, determination, and hard work	35	85.4
2. Self confidence, practice and commitment	18	43.9
3. Support from other students	3	7.3

The personal factors listed in Table 16 also contributed to raising the attitude level of students' who had enrolled in mathematics bridging course. Determination, positive attitude and hard work; and self confidence, practice and commitment were some of the factors that featured highly scoring 85.4% and 43.9% respectively. These had the effect of influencing the students' attitude positively.

From the analysis, the effects of the challenges which students encountered such as being demoralized and portrayed as failures as shown in Table 14 far outweighed the positive impacts of the bridging course and the personal factors that contributed to the success of the bridging course. Therefore hypothesis H_O2 which sought to find out whether there is any statistically significant difference in attitude towards mathematics is thus not retained at $\alpha = 0.05$ level. There is a statistically significant difference in attitude towards mathematics between those who enrolled in mathematics bridging course and those who did not.

Table 17 shows the mean rating for the 23 items on science attitude. The mean score for every item in USAQ: Science attitude questionnaire was calculated for all those who enrolled in mathematics bridging course and those who did not. Using these means the overall mean score was calculated. The difference in science attitude is shown on Table 18.

Table 17

Students' Mean rating on various items on science attitude

	Bridged Mean	Not bridged Mean
1. I don't get upset when trying to work science problems.	3.85	4.22
2. Science is very worthwhile and necessary.	4.69	4.75
3. I like science.	4.41	4.55
4. Science is dull and boring.	4.41	4.38
5. I like to solve problems in science	4.15	4.05
6. Science is especially important in everyday life.	4.62	4.55
7. Trying to understand science doesn't make me anxious.	2.51	3.07
8. Science is not one of the most important subjects for people to study	4.54	4.47
9. Science has contributed greatly to the progress of civilisation	4.59	4.51
10. Other subjects are more important to people than science.	3.87	4.09

11. Science is not interesting	4.36	4.42
12. I have seldom liked studying science	3.15	3.64
13. I usually enjoy studying science	4.21	3.31
14. I am very calm and unafraid when studying science	3.72	3.69
15. Science helps to develop the mind and teaches a person how to think	4.64	4.24
16. I feel bad every time I have a science lecture.	4.54	4.49
17. My success in science is just due to lack.	4.46	4.33
18. I don't want to take any more science than I absolutely have to.	4.10	4.24
19. Science makes me feel nervous and uncomfortable.	4.28	4.27
20. I am interested in acquiring further knowledge of science.	4.26	4.42
21. I plan to take as much science as I possibly can.	4.03	4.22
22. I want to develop my science skills and study this subject more.	4.23	4.33
23. I am not motivated to work very hard science problems.	3.97	4.29
USAQ: Science Overall Mean Scores	**4.16**	**4.24**

Table 17 shows means for students' attitude towards science. The overall mean score for university students' attitude towards science were 4.16 (83.2%) and 4.24 (84.8%) out of a possible maximum score of 5 (100%) points. Both scores are quite high which implies that the attitude level is more positive.

A wilcoxon rank sum test was carried out to find out whether there was a statistically significant difference in attitude towards Science between those who enrolled in mathematics bridging course and those who did not. The sum of ranks of the science attitude ratings for students who enrolled in mathematics bridging course and those who did not was ranked. Table 18 shows that students who did not enrol in mathematics bridging course had a Sum of ranks of 2742.00 compared to those who had enrolled in mathematics bridging course at 1723.00. A z-statistic of -.995 generated is not significant at $\alpha = 0.05$ as indicated by the two tailed significance level of 0.320. The p- value is greater than 0.05 ($p>0.05$) and this implies that although students who did not enrol in mathematics bridging course rated relatively high on science attitude, the difference is not statistically significant at 0.05 significance level. Therefore, there is no statistically significant difference in attitude towards science between those students who enrolled in mathematics bridging course and those who did not. Therefore, hypothesis HO_2 for attitude towards Science is retained.

Table 18

Attitude towards science

	N	Mean Rank	Sum of Ranks	W	P- value
Not bridged	55	49.85	2742.00	1723.00	0.320
Bridged	41	44.18	1723.00		
Total	96				

Ellis, *et. al.* (2001) found that a bridging course increased students' confidence and self-esteem. Many students identified enhanced feelings of self-worth, increased confidence and broadened interests attributable to their involvement in a bridging programme. The programme provided students with the motivation, stimulation and incentive to strive to achieve.

The findings of this study show that there is a statistically significant difference ($\alpha = 0.05$) and ($p= 0.022$) in students attitude towards mathematics between those who enrolled in mathematics bridging course and those who did not. This was attributed to the fact that students who enrolled in mathematics bridging course were perceived as failures as can be seen from Table 14. This demoralised the students, impacting negatively on their attitude towards mathematics.

The contrary is seen on students' attitude towards university science programmes. The findings of this study indicate that there is no statistically significant difference ($p>0.05$) in attitude towards science between those who enrolled in mathematics

bridging course and those who did not. The findings are consistent with those in Australia by Ellis, et. al. (2001), Holton (2001) and in South Africa by Van Tonder (1996) which showed that enrolling in mathematics bridging course results in students positive attitude to get more out of life. It increases the students' confidence and self-esteem.

The findings of this study also concur with the arguments of Karen (1995) that positive attitude is an essential component of learning and higher achievement in Mathematics and Science. Chacko (2000) in a research done in Zimbabwe indicated that attitudes do affect achievement. The kind of attitude the student has will affect learning. Blair (1975) emphasizes that, students with positive attitudes experience more success than those with negative attitudes. That is why there is no difference in achievement.

4.4 Gender Differences in Attitude Towards Mathematics and Science.

A Wilcoxon Rank Sum test was carried out to test hypothesis H_o3 which sought to establish whether there was a gender difference in attitude towards Mathematics and Science between those who enrolled in mathematics bridging course and between those who did not. Table 19 shows gender attitude towards mathematics for those who enrolled in mathematics bridging course and those who did not.

The sum of ranks of mathematics attitude ratings for males and females who enrolled in mathematics bridging course were each ranked. The results indicate that

for those students who enrolled in mathematics bridging course, male students had a higher sum of ranks on the rated attitude towards Mathematics than their female counterparts (544.00 and 236.00 respectively). However the p- value of 0.064 is greater than 0.05. Therefore this means that there is no statistically significant gender difference in attitude towards mathematics between those students who enrolled in mathematics bridging course.

Table 19

Attitude towards mathematics for students who bridged and those who never bridged by gender

Bridged					
Gender	N	Mean Ranks	Sum of Ranks	W	p- value
Male	24	22.67	544.00	236.00	0.064
Female	17	15.73	236.00		
Total	41				
Not Bridged					
Gender					
Male	36	26.88	967.50	967.50	0.473
Female	19	30.13	572.50		
Total	55				

A z- statistic of -1.849 generated is not significant at 0.05. This is indicated by the two tailed significance level of 0.064. This implies that male and female students who enrolled in mathematics bridging course had same attitude towards Mathematics. This could be attributed to the fact that students who enrolled in Mathematics bridging course were exposed to the same experiences. Experiences help determine what a person sees.

Table 19 also shows the gender attitude sum of ranks towards Mathematics for those who did not enrol in mathematics bridging course. The sum of ranks of mathematics attitude ratings for males and females who never enrolled in mathematics bridging course were each ranked. The results indicate that female students who did not enrol in mathematics bridging course have relatively lower sum of ranks on mathematics attitude as compared to their male counterparts (572.50 and 967.50 respectively). A z- statistic value of -.718 generated has a significance level of 0.473. However, the P-value of 0.473 is far greater than 0.05. This means the difference in mathematics attitude is not statistically significant. Therefore male and female students who did not enrol in mathematics bridging course have no statistically significant difference in attitude towards mathematics.

Table 20

Attitude towards Mathematics between males who bridged and males who never bridged

	N	Mean Rank	Sum of Ranks	W	P- value
Not bridged	36	33.22	1196.00	757.00	0.376
Bridged	26	29.22	757.00		
Total	62				

A z-statistic value of -.885 was generated. It had a significant level of 0.376 which is far greater than 0.05 level of significance. This means that the difference in mathematics attitude is not statistically significant. Therefore male students who enrolled in mathematics bridging course and male students who did not, have no statistically significant difference in attitude towards mathematics.

Table 21

Attitude towards mathematics between females who bridged and females who never bridged

	N	Mean Rank	Sum of Ranks	W	P- value
Not bridged	19	20.89	397.00	198.00	0.025
Bridged	15	13.20	198.00		
Total	34				

A z-statistic value of -2.24 was generated with a significance level of 0.025. However, the p-value of 0.025 is less than 0.05 level of significance. This implies that there is a statistically significant difference in attitude towards mathematics between females who enrolled in mathematics bridging course and those who did not. This result could be attributed to the kind of attitude the females who enrolled in mathematics bridging course possessed. Some attitudes people hold are very weak and therefore are not durable and have little impact on them. Attitudes formed on the basis of direct experience are difficult to change. Such attitudes tend to exert stronger influence on behaviour (Rummel, 1976). The females who enrolled in mathematics bridging course could have had a very low attitude towards mathematics bridging course compared to the females who never enrolled in mathematics bridging course. After the bridging course this attitude towards mathematics was still low as can be seen from the mean of ranks (13.20 and 20.89 respectively).

A wilcoxon rank sum test was carried out to find out whether there was a statistically significant gender difference on students' attitude towards science for those that enrolled in mathematics bridging course. The sum of ranks of science attitude ratings for males and females who enrolled in mathematics bridging course were each ranked. Table 22 shows gender attitude towards science for those students who enrolled in mathematics bridging course and for those who did not enrol in mathematics bridging course.

Table 22

Attitude towards science for students who bridged and those who never bridged by gender

Bridged					
Gender	N	Mean Ranks	Sum of Ranks	W	p- value
Male	24	18.19	436.50	436.50	0.208
Female	17	22.90	343.50		
Total	41				
Not Bridged					
Gender					
Male	36	28.31	1019.00	521.00	0.845
Female	19	27.42	521.00		
Total	55				

The table shows that male students who went through mathematics bridging course had a relatively higher sum of ranks on the science attitude rating. A z-statistic of -1.259 was generated with a significance level of 0.208. However, the P- value is greater than 0.05 and thus the difference in the sum of ranks is not statistically significant. This implies that male and female students who went through a mathematics bridging course do not have a statistically significant difference in attitude towards science.

Further the sum of ranks of science attitude ratings for males and females who did not enrol in mathematics bridging course were ranked. The sum of ranks on attitude towards science for male and female students who did not enrol in mathematics bridging course are given as 1019.00 and 521.00 respectively as shown in Table 22. A z-statistic of -.195 was generated with a significance level of 0.845. The p-Value is significantly greater than 0.05 thus the difference is not statistically significant. This implies that male and female students who do not enrol in mathematics bridging course do not have a statistically significant difference in attitude towards science.

Table 23

Attitude towards Science between males who bridged and males who never bridged

	N	Mean Rank	Sum of Ranks	W	P- value
Not bridged	36	32.79	1180.50	649.50	0.213
Bridged	26	27.06	649.50		
Total	62				

The sum of ranks of science attitude ratings for males who enrolled in mathematics bridging course and males who did not was ranked. The mean of ranks for those who enrolled in mathematics bridging course and those who did not was 27.06 and 32.79 respectively. A z-statistic of -1.247 was generated with a significance level of 0.213. This value of 0.213 is greater than 0.05 level of significance. Therefore the

difference is not statistically significant. This implies that males who enrolled in mathematics bridging course and males who did not enrol in mathematics bridging course do not exhibit a statistically significant difference attitude towards Science.

Table 24

Attitude towards Science between females who bridged and females who never bridged

	N	Mean Rank	Sum of Ranks	W	P- value
Not bridged	19	17.11	325.00	325.00	0.794
Bridged	15	18.00	270.00		
Total	34				

A sum of ranks of science attitude ratings for females who enrolled in mathematics bridging course and those females who did not was ranked. Their respective sum of ranks is given as 270.00 and 325.00. A z-statistic of-.261 was generated with a significance level of 0.794. The p-value is significantly greater than 0.05 thus the difference is not statistically significant. This implies that females who enrolled in mathematics bridging course and females who did not enrol in mathematics bridging course do not have a statistically significant difference in attitude towards science. The results given in Tables 19, 20, 22, 23 and 24 indicate that attitude towards Mathematics and Science are not influenced by gender.

Blair (1975) argued that attitudes are acquired through experience and help to determine what a person sees and how the person sees it. Thus since both male and female students are exposed to the same experiences during bridging in Mathematics and consequently during the university mathematics and science programmes, there is no significant gender difference in attitude towards university mathematics and science programmes. Ellis, et al. (2001) indicated that students who went through mathematics bridging course believed that they would start their university studies more confidently, having gained new skills and knowledge and the chance of getting future employment.

The present study, found that 56.1% of students believed that enrolling in mathematics bridging course would enable them join university, 58.5% believed that it changed their attitude and improved their confidence while 43.9% said it increased their commitment as shown in Tables 15 and 16.

In effect students' experiences and expectations are similar thus leading to positive attitudes, determination and hard work. This results show that there is no statistically significant gender difference in students' attitude towards university mathematics and science programmes.

4.5 Gender difference in mathematics and science achievement

Hypothesis four ($H_0$4) of the study sought to find out whether there is a statistically significant gender difference in students achievement in mathematics and science oriented programmes between those who enrolled in mathematics bridging course and those who did not.

Table 25 gives the mean and p-value of achievement scores for those who enrolled in mathematics bridging course.

Table 25

Gender difference in achievement for those who bridged

Gender	N	Mean	SD	t	df	p- value
Male	26	57.15	10.23	0.58	39	0.565
Female	15	55.16	11.14			

The results show that male students who enrolled in mathematics bridging course have a relatively higher mean achievement (57.15) than their female counterparts (55.16). However, the t-test statistic is not significant at 0.05 meaning that the difference in achievement is not statistically significant. This implies that male and female students who enrolled in mathematics bridging course do not depict any statistically significant gender difference in achievement in Mathematics and Science courses.

Table 26

Gender difference in achievement for those who did not bridge

Gender	N	Mean	SD	t	Df	p- value
Male	36	60.12	7.56	0.38	53	0.703
Female	19	59.29	7.88			

Male students who did not enrol in mathematics bridging course have a relatively higher mean score in science and mathematics achievement than their female counterparts as shown in Table 26. However the t-test statistic is not significant at 0.05 implying that the difference in achievement is not statistically significant. Male and female students who did not enrol in mathematics bridging course have similar achievement in mathematics and science oriented university courses. Thus the null hypothesis (H_o4) which sought to find out whether there is a statistically significant gender difference in students achievement in mathematics and science oriented programmes between students who enrolled in Mathematics bridging course and those who did not is retained.

Table 27

Difference in achievement between males who bridged and males who never bridged

Gender	N	Mean	SD	t	Df	p- value
Not bridged	36	60.12	7.56	1.32	60	0.193
Bridged	26	57.15	10.23			
Total	62					

The results in Table 27 indicate that male students who never enrolled in mathematics bridging course have a relatively higher mean achievement (60.12) than their male counterparts who never enrolled in mathematics bridging course (57.15). However, the t-test statistic of 1.32 is not significant at 0.05 level. This implies that males who enrolled in mathematics bridging and males who did not enrol in mathematics bridging course do not have any statistically significant difference in achievement in university mathematics and science programmes.

Table 28

Difference in achievement between females who bridged and females who never bridged

Gender	N	Mean	SD	t	Df	p- value
Not bridged	19	59.29	7.88	1.27	32	0.215
Bridged	15	55.16	11.14			
Total	34					

Female students who did not enrol in mathematics bridging course have a relatively higher mean score in science and mathematics achievement as shown in Table 28. However, the t-test statistic of 1.27 is not significant at 0.05 level of significance. This implies that the difference in achievement is not statistically significant. This means that the null hypothesis (H_o4) which sought to find out whether there is a statistically significant gender difference in students' achievement in mathematics and science oriented programmes between students who enrolled in mathematics bridging course and students who did not is thus retained.

This study has shown that there are no significant gender differences in achievement both between those who enrolled in mathematics bridging course and those that did not. Karen (1995) indicated that lack of confidence and self esteem is itself a major barrier to achievement in university. In this study, enrolling in mathematics bridging course was found to result in increased confidence and self-esteem. Thus leading to an increase in achievement for both males and females.

Fennema (2000) argues that variance in intelligence and cognitive abilities are both as a result of genes and environmental factors. Thus both male and female are both affected leading to no significant gender difference in students' achievement in university mathematics and science oriented programmes between students who enrolled in mathematics bridging course and those who did not.

Since enrolling in mathematics bridging course is effective in motivating female students, it would be recommended for use in raising the level of achievement of all students who score less than grade C in mathematics at KSCE examination level.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The present study investigated the effects of mathematics bridging course on students' achievement and attitude towards degree and diploma level mathematics and science programmes. The purpose of this chapter is to present the summary of major findings, the conclusions and recommendations. Areas warranting further investigation are also highlighted.

5.2 Summary

Based on the results of the analysis presented in chapter four, the following are the major findings of this study: -

i) Achievement in Mathematics and Science courses by students who enrolled in mathematics bridging course is not statistically significantly different from that of those who never enrolled in a mathematics bridging course.

ii) Students who enrolled in mathematics bridging course have a less positive attitude towards Mathematics.

iii) Girls who enrolled in mathematics bridging course have a less positive attitude towards Mathematics.

iv) Students' attitude towards science is significantly related to enrolling in mathematics bridging course. Students who enrolled in mathematics

bridging course have an equally positive attitude towards Science as those who did not.

v) There were no statistically significant gender differences in attitude towards university mathematics and science oriented programmes between students who enrolled in mathematics bridging course and those who did not.

vi) Both female and male students who are exposed to mathematics bridging course and those who were not exposed do not exhibit any statistically significant gender difference in achievement in university mathematics and science oriented programmes.

5.3 Conclusions

On the basis of this study, the following conclusions are made.

i) The mathematics bridging course raises the level of achievement of students who score less than grade C in Mathematics at KCSE level examination to that of those who scored grade C and above at the same level.

ii) Low attitude towards Mathematics of students who enrolled in mathematics bridging course could be improved by changing the perception where they are viewed as failures by other students in the university.

iii) The mathematics-bridging course improves students' attitude towards university science oriented programmes.

iv) There are no gender differences in attitude towards university science oriented programmes. Students who are exposed to mathematics bridging

course are exposed to same experiences and expectations. Thus both male and female that go through this course experience increased confidence and self-esteem. In effect there is no statistically significant gender difference in students' attitude towards the science programmes for both those who enrolled in mathematics bridging course and those who did not.

v) No gender differences were detected in students' achievement both for those students that had enrolled in mathematics bridging course and those that did not.

5.4 Recommendations

Students who enrolled in mathematics bridging course experienced gains in self-worth and confidence as a result of the bridging course. Similarly students identified changes in terms of gaining and valuing knowledge and achievement. It is apparent that many students during the bridging period do more than just accumulate useful knowledge and study skills. The development of inner strength and flexibility are all essential for effective university study. However, the results of this study indicate that students who enrol in mathematics bridging course face many challenges. Therefore achievement and attitude towards mathematics bridging course could be improved if:

- The time allocated to the modules needs to be increased so that the students are not rushed through the lectures. The pace of delivery was found to be too fast and thus should slow down.
- University community needs sensitization so as not to view students who enrolled in bridging courses as failures.
- Publicize the course so that all students who do not pass Mathematics at KCSE examination level have a second chance. The universities could organize a workshop for parents and students on the importance of mathematics bridging course.
- Universities should standardize the content and length of study so that after completing the course, one can seek admission in any university.
- The cost of mathematics bridging course should be made affordable for the course to be accessible to all students who may require it.
- High school Mathematics could be divided into modules that could be taught by different teachers as is done in mathematics bridging course. This has the effect of impacting positively on the students' achievement and attitude towards mathematics.

5.5 Suggestions for Future Research

The present study shows that enrolling in mathematics bridging course is effective in improving students' achievement and attitude towards degree and diploma level mathematics and science programmes. However, there are areas that warrant further research such as the following: -

1. An investigation to determine the degree of achievement at the end of university programme for the students who enrolled in mathematics bridging course.
2. A study aimed at determining the factors that contribute to a similar achievement between female and male students at the university level.
3. A study should be conducted to find out whether students' attitude to learn mathematics and science and their achievement can be improved through interventions in Kenya's secondary schools with the view of adopting some of the methods used in bridging courses.

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APPENDIX A-1

UNIVERSITY STUDENT ATTITUDE QUESTIONNAIRE (USAQ): MATHEMATICS ATTITUDE QUESTIONNAIRE

This questionnaire has questions on mathematics bridging course and your attitude towards mathematics. Please read each question carefully and provide the appropriate answer. All the information supplied will be confidential.

Provide information about yourself by filling the spaces provided.

Admission No.----------

University _____ Faculty _____

Department_____ Degree e.g. B.Ed (SCI.)_____

Year of study _____ Sex _____ Age _____

Please read the given questions carefully before you supply the answer. Indicate the extent to which you agree by circling the correct answer in each question. Circle the letters that best describe your level of agreement.

Key

SD= STRONGLY DISAGREE

D= DISAGREE

U= UNDECIDED

A=AGREE

SA= STRONGLY AGREE

EXAMPLE: Mathematics is a simple subject. SD D U(A) AS

In the example the respondent agreed with the statement and circled the letter A. use the key provided to indicate your level of agreement with each of the statements given.

ITEMS	SD	D	U	A	SA
1. Mathematics is not very interesting.	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 like mathematics because it is the best subject.	SD	D	U	A	SA
6. I don't want to take any 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. I am not willing to take more than the required amount.	SD	D	U	A	SA
12. Mathematics helps to develop the mind and helps a person to think.	SD	D	U	A	SA
13. Mathematics makes me feel uneasy and confused.	SD	D	U	A	SA
14. Mathematics is enjoyable and stimulating to me.	SD	D	U	A	SA
15. Mathematics is not especially important in everyday life.	SD	D	U	A	SA
16. Mathematics is a dull and boring subject.	SD	D	U	A	SA
17. Trying to understand mathematics doesn't make me anxious.	SD	D	U	A	SA

18. I plan to take as much mathematics as I possibly can during my education.	SD	D	U	A	SA
19. Mathematics has contributed greatly to the progress of civilisation.	SD	D	U	A	SA
20. Mathematics is one of my worst subjects.	SD	D	U	A	SA
21. I like to solve new problems in mathematics.	SD	D	U	A	SA
22. I am 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 do not get upset when trying to work mathematics problems.	SD	D	U	A	SA

25. In your own words compare your current feelings at University and secondary school you attended in terms of;

(a) There are some activities both at secondary school and at university, which you feel motivated you to perform well in mathematics examinations. **List** those activities which **motivated** you in each institution

	Secondary school University
(i)	(i)
(ii)	(ii)
(iii)	(iii)
(iv)	(iv)

(b) How did the environment of secondary school and university motivate you?

_____

_____

_____

_____

(c) What did you like about mathematics bridging course?

_____

_____

_____

_____

_____

(d) Do you think Mathematics is useful in your current programme at university?

_____

List the ways in which it is useful

_____

26. This question is on mathematics bridging course. Please in your own words answer all the parts by **writing** your response to all the sections.

(a) What influence has bridging study in mathematics had on your life (personal, study, other)?

(i) Negative impacts

(ii) Positive impacts

(b) What aspects contributed to your success in bridging mathematics?

(i) Personal factors

(ii) Course related factors

c) What challenges did you experience in your bridging course?

d) How well did the mathematics bridging course prepare you for your subsequent university study?

(i) Helpful aspects of the mathematics bridging course

(ii) Problem areas of the mathematics bridging course

(iii) Suggestions for the improvement of the mathematics bridging course

APPENDIX A-2

UNIVERSITY STUDENT ATTITUDE QUESTIONNAIRE (USAQ): SCIENCE ATTITUDE QUESTIONNAIRE.

Please read each question carefully and provide the appropriate answer by circling.

ITEMS	SD	D	U	A	SA
1. I don't get upset when trying to work science problems.	**SD**	D	U	A	SA
2. Science is very worthwhile and necessary.	SD	D	U	A	SA
3. I like science.	SD	D	U	A	SA
4. Science is dull and boring.	SD	D	U	A	SA
5. I like to solve problems in science	SD	D	U	A	SA
6. Science is especially important in everyday life.	SD	D	U	A	**SA**
7. Trying to understand science doesn't make me anxious.	SD	D	U	A	SA
8. Science is not one of the most important subjects for people to study	SD	D	U	A	SA
9. Science has contributed greatly to the progress of civilisation	SD	D	U	A	SA
10. Other subjects are more important to people than science.	SD	D	U	A	SA
11. Science is not interesting	SD	D	U	A	SA
12. I have seldom liked studying science	SD	D	U	A	SA
13. I usually enjoy studying science	SD	D	U	A	SA
14. I am very calm and unafraid when studying science	SD	D	U	A	SA
15. Science helps to develop the mind and teaches a person how to think	SD	D	U	A	SA
16. I feel bad every time I have a science lecture.	SD	D	U	A	SA

17. My success in science is just due to lack.	SD	D	U	A	SA
18. I don't want to take any more science than I absolutely have to.	SD	D	U	A	SA
19. Science makes me feel nervous and uncomfortable.	SD	D	U	A	SA
20. I am interested in acquiring further knowledge of science.	SD	D	U	A	SA
21. I plan to take as much science as I possibly can.	SD	D	U	A	SA
22. I want to develop my science skills and study this subject more.	SD	D	U	A	SA
23. I am not motivated to work very hard science problems.	SD	D	U	A	SA

APPENDIX B

UNIVERSITY ACADEMIC PERFORMANCE SUMMARY FORM (UAPSF)

The researcher will fill the information required in this form from the examination office for each respondent in this study.

Name of student_____ Admission Number

_____

Degree or diploma course _____ Sex

_____

Students' name	Sex	Enrolled in Mathematics Bridging course (Yes/No)	Mean score in year one	Examiners use only
Example: **XY**	Female	Yes	65.7	

APPENDIX C

RESEARCH AUTHORIZATION

MINISTRY OF EDUCATION, SCIENCE & TECHNOLOGY

Telegrams: EDUCATION", Nairobi

Fax No.
Telephone: 318581
When replying please quote

REPUBLIC OF KENYA

JOGOO HOUSE
HARAMBEE AVENUE
P. O. Box 30040
NAIROBI
KENYA

MOEST 13/001/35C 358/2

14th July, 2005

Alice K. Gichana
Egerton University
P.O. BOX 536
NJORO

Dear Madam

RE: RESEARCH AUTHORIZATION

Following your application for authority to conduct research on "Effects of Mathematics Bridging course on students achievement and attitude towards Degree and Diploma level Mathematics and Science and Science Programmes: A case of Egerton University".
I am pleased to inform you that you have been authorized to carry out research in Egerton University for a period ending 30th September, 2005.

You are advised to report to the Vice-Chancellor, Egerton University before embarking on your research project.

Upon completion of your research, you are expected to submit two copies of your research findings to this Office.

Yours faithfully

EGERTON UNIVERSITY LIBRARY

B. O. ADEWA
FOR: PERMANENT SECRETARY

Cc
The Vice-Chancellor
Egerton University
P.O. BOX 536
NJORO