IMPACT OF SMASSE INSET ON STUDENTS' ATTITUDE AND PERFORMANCE IN MATHEMATICS IN SECONDARY SCHOOLS IN BOMET DISTRICT

BY

LANGAT RICHARD KIPNG'ETICH

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF PHILOSOPHY IN MATHEMATICS EDUCATION

DEPARTMENT OF CURRICULUM, INSTRUCTION AND EDUCATIONAL MEDIA

SCHOOL OF EDUCATION

MOI UNIVERSITY

ELDORET

NOVEMBER 2009

DECLARATION

DECLARATION BY THE CANDIDATE

This Thesis is my original work and has not been presented for a degree award in any University. No part should be reproduced by any other person without the permission of the author/ Moi University.

_____ _____

RICHARD K. LANGAT **DATE**

REG NO: EDU/PGCM/13/06

DECLARATION BY THE SUPERVISORS

This Thesis has been produced with our approval as university supervisors

_____ _____

PROFESSOR CHRIS WEKESA MUKWA **DATE**
Senior Lecturer
Department of Curriculum, Instruction
and Educational Media,
Moi University.

_____ _____

DR JACKSON KIPROP TOO **DATE**
Head Of Department
Curriculum, Instruction and Educational Media,
Moi University.

DEDICATION

To my beloved wife, Emmy, and our great kids, Faith, Caleb, Joan and Eddah, thanks for all your support, love and encouragement

ACKNOWLEGEMENT

Many people have undoubtedly contributed to the success of this work. Therefore I owe them many debts of gratitude. Firstly, I would like to express my deep sense of gratitude to my two supervisors ,Prof Chris Wekesa Mukwa and Dr Jackson Kiprop Too , for their invaluable guidance and contribution towards the success of this work. Their interest in my work, commitment and constant encouragement gave me the stamina and morale to work harder.

I express my sincere gratitude to all the Principals, Mathematics Heads of Departments and Mathematics teachers of the various secondary schools I visited for their co-operation and support during the process of data collection. In the same vein, I thank the Form four students who participated in answering the questionnaires that were very useful in my study.

I owe many thanks to my beloved wife whose inspiration, moral and financial support enabled me accomplish my studies, and also our children for enduring my long absence throughout the period of my study.

While it may not be possible to mention the names of all those who contributed, in one way or another, to the success of this work, I register my sincere gratitude to all of them, and may God shower them with abundant blessings.

Last but not least, I thank the Almighty God for His guidance and grace that was sufficient throughout my study programme.

ABSTRACT

Performance in mathematics has been steadily deteriorating over the last few years. This prompted the researcher to investigate the impact of SMASSE INSET on students' attitudes and performance in mathematics. The objectives of the study were to investigate whether SMASSE INSET has changed the students' attitudes, improved the performance and the teaching approaches and methodology in mathematics. This study was based on the theory of Reasoned action and the theory of Planned behaviour as proposed by Ajzen and Fishbein (1975 and 1980).

This was a field study that was conducted in Bomet district. A descriptive survey design was adopted for the study. The respondents of the study were selected from the Form four students of the year 2008. A sample of 371 students, 20 mathematics Heads of Department and 20 Mathematics teachers were selected using both stratified and simple random sampling.

Data was collected through the use of students' questionnaire, HOD Mathematics Questionnaire and Teacher's Questionnaire. Analysis of data was done using both descriptive and inferential statistics. For descriptive statistics, frequency tables, means and standard deviations were used. Analysis of variance (ANOVA), t- test and Chi-Square (χ^2) were employed for the inferential statistics.

The study established that the students' attitudes towards mathematics have greatly improved as a result of SMASSE INSET. The study also found out that teacher's teaching approaches and methodology have greatly improved as a result of SMASSE INSET. However the attitude and teaching approaches could not translate to good performance. In order to make SMASSE INSET more effective in schools and in the teaching of mathematics, it could be included in the programmes of Teacher Education at the level of teacher preparation.

LIST OF ABBREVIATIONS / ACRONYMS

ASEI	Activity, Students, Experiment, Improvisation
CEMASTEA	Centre for Mathematics, Science and Technology Education in Africa
INSET	In-service Education and Training
SMASSE	Strengthening of Mathematics and Science in Secondary Education
JICA	Japan International Co-operation Agency
KNEC	Kenya National Examination Council
MOEST	Ministry of Education Science and Technology
NCTM	National Council of Teachers of Mathematics
PDSI	Plan, Do, See, Improve
SMASSE-WECSA	Strengthening of Mathematics and Science in Secondary Education in Western, Eastern Central and Southern Africa
TIMSS	Third International Mathematics and Science Study
TPB	Theory of Planned Behaviour
TRA	Theory of Reasoned Action
UCSMP	University of Chicago School Mathematics Project

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER ONE

1.0 INTRODUCTION TO THE STUDY

1.1 Background to the study

The idea that the attitude towards mathematics is relevant in the teaching and learning process is shared in the mathematics education research community, but research on attitude is characterized by many problems, more or less investigated. Amongst them the problem of a clear and shared terminology (Pekhonen and Furinghetti, 2002) and the problem of designing and experimenting observational tools that are consistent with theory (Di Martino and Zen, 2001: Di Martino 2004).

Generating positive attitudes towards mathematics among students is an important goal of mathematics education in many jurisdictions. To gain some understanding of eighth-graders' views about the utility and their enjoyment of it as a subject, third international mathematics and science study (TIMSS) created an index of positive attitudes towards mathematics (PATM).

Poor attitude towards mathematics has often been cited as one factor that has contributed to lower participation of girls in mathematics courses and less success in those courses (Fullarton, 1993).

The conceptions, attitudes and expectation of the students regarding mathematics and mathematics teaching have been considered to be very significant factor underlying their school experience and achievement (Borasi, 1990, Shoenfeld 1985).

There has always been an interest in the development of positive students' attitude towards mathematics. The objective of any mathematics curriculum includes fostering favourable feelings towards mathematics as well as imparting cognitive knowledge (KIE, 2002). While Bolaji (1996) has provided an overview of many aspects of attitudes towards mathematics including a review of instrumentation, it is still unclear how the school environment affects the development of students' attitudes towards mathematics.

A baseline survey carried out by SMASSE personnel in 1998, isolated the following problems in the teaching and learning of mathematics and science at the secondary level that contributed to poor performance:

- Attitudinal factors

1. Poor teaching methodology
2. Lack of content mastery
3. Lack of a professional forum for teachers to share their experiences
4. Inadequate development of appropriate teaching/ learning materials
5. Administrative factors.
6. Gender disparity

SMASSE project was therefore formulated as an intervention measure to address the problem. The overall goal of the SMASSE project is to "upgrade the capability of young Kenyans in mathematics and science".

In order to realize this goal, the project was designed with the following project purpose, that is to "strengthen mathematics and science Education at Secondary school level through the INSET of serving teachers in Kenya".

SMASSE came into being when the consistently poor performance in mathematics and Science (Biology, Chemistry and Physics) became a matter of serious concern. Broad curricula, lack of facilities and inadequate staffing were always cited as the major causes of the problem. Although dismal performance in these subjects had almost been accepted as the norm in some schools, the ministry of Education Science and Technology (MOEST) and other stakeholders felt there had to be an intervention, hence the SMASSE project.

The SMASSE team conducted a baseline survey in the nine pilot districts (Kajiado, Gucha, Kakamega, Lugari, Butere- Mumias, Kisii, Muranga, Maragua and Makueni) with additional six district (Meru south, Kilifi, Taita-Taveta, Baringo, Kiambu and Garissa) being brought on board in the year 2001 after mid- term evaluation of the project. The survey was to determine the areas that needed intervention and come up with a strategic plan of operation. Upon the end of phase I in May 2003, phase II was launched to cover the whole country.

The INSET programme was organized into four cycles of ten days each with the following INSET objectives:

1. Cycle one targets attitude change
2. Cycle two targets ASEI planning and hands- on activities with bridging
3. Cycle three targets actualization and practice in the classroom
4. Cycle four targets students growth and impact transfer

In this study, the impact of SMASSE INSET on students' attitude and performance in mathematics in secondary schools was chosen because before the implementation of the SMASSE project, the students used to have a negative attitude towards mathematics as revealed by poor performance in KCSE Examinations (KNEC,1998).

1.2 Statement of the problem.

The fields of technological and professional education require a strong foundation consisting of sound background knowledge of mathematics. Thus mathematics is of necessity a strategic subject and a prerequisite for studying science and technology. As technology develops and reaches more and more into all levels of industry and commerce, so more mathematics will be needed at all these levels.

The government acknowledges the importance of mathematics. It is consistently emphasizing the study of mathematics at all levels. Infact mathematics is one of the compulsory subjects in both primary and secondary school levels (KIE syllabus, 2002).

Students in higher levels of education are also encouraged to study some mathematics as a necessary prerequisite for such subjects as physics, chemistry, economics, engineering and others.

The Kenyan government has been working to improve the science and mathematics education in primary and secondary schools, which has been set as a major challenge from the perspective of developing human resources capable of promoting industrialization. For five years since July 1998, Japan has been extending support in training in-service teachers for science and mathematics in pilot regions of Kenya (SMASSE1).Based on the achievement of SMASSE I,SMASSE II has been implemented to cover the whole country since July 2003 as a five year project.

The overall research problem addressed in this study is that despite the launching of the SMASSE INSET to cover the whole country in the year 2003, the performance of secondary school students in mathematics at KCSE level has been very low as shown in Table 1.1(P.6).This prompted the researcher to investigate the impact of SMASSE INSET on students' attitudes and performance in Mathematics Bomet District

Table 1.1 KCSE Mathematics results Analysis

Year	Candidates	Mean score %
2002	197,118	19.73
2003	205,232	19.31
2004	221,295	18.60
2005	259,280	15.96
2006	238,684	19.04
2007	274,120	19.74

Source: KNEC (2006-2008)

The current study therefore endeavours to establish whether the SMASSE INSET has had any impact on attitude change and improved performance in mathematics in secondary schools in Bomet District.

1.3 Purpose of the study

The main purpose of this study was to investigate the impact of SMASSE INSET on students' attitude change and performance in mathematics in secondary schools in Bomet district.

1.4 Objectives of the study

The objectives of this study were:

(1) To establish whether SMASSE INSET has changed the students' attitudes towards mathematics

(2) To find out whether SMASSE INSET has improved the performance in mathematics

(3) To determine whether SMASSE INSET has improved the teaching approaches and methodology

1.5 Research Questions

The following research questions were used to guide the study:

(1) Does SMASSE INSET have any impact on students' attitudes towards mathematics?

(2) Does SMASSE INSET have any impact on performance in mathematics?

(3) Does SMASSE INSET have any impact on teacher's teaching approaches and methodology?

1.6 Research hypotheses

The following research hypotheses, as derived from the research questions and stated in their null form, were tested using the ANOVA and Chi-square (χ^2) at alpha level of significance 0.05.

HO_1 There is no significant difference between SMASSE INSET and students' attitudes towards mathematics.

HO_2 There is no significant difference between SMASSE INSET and performance in mathematics

HO_3 There is no significant difference between SMASSE INSET and the teacher's teaching approaches and methodology.

1.7 Assumptions of the study

In this study, the following assumptions were made:

(1) All the schools that were selected for the study had qualified teachers who had attended the SMASSE INSET

(2) Teachers in all the schools selected for the study had fully implemented the new skills acquired in teaching approaches and methodology

(3) The responses that the respondents gave constitute a true record of their opinion and views.

(4) The respondents were able to do the written tasks that were given to them without interacting with one another.

1.8 Significance of the study

It is hoped that the findings of this study will be useful in the following ways:

(1) The study will be of benefit to the district planning committee (DPC) in assessing the effectiveness of the SMASSE INSET implementation at the district level.

(2) The findings of the study will assist the Quality Assurance and Standard officers (QASOS) both at the district and the national levels in doing the follow up of SMASSE INSET so as to give more advices and guidance to mathematics teachers on how to improve on their teaching approaches and methodology.

(3) The findings of this study will contribute new knowledge which will provide the ministry of education officials with better ways of carrying out the INSET activities in future.

(4) The findings of this study will hopefully be used to improve the performance of mathematics in secondary schools in Bomet district.

According to the Kenya National Examinations council report (1998), students' overall performance in mathematics and science subjects has been declining over the years. It has been argued that one way of addressing the difficulties students experience in Kenya mathematics and science classrooms is through appropriate teaching interventions that can be realized through professional development of science teachers (SMASSE project, 1998).

It is hoped that professional development programs for mathematics and science teachers will equip teachers with appropriate teaching skills and instruction strategies that are necessary to effectively implement mathematics and science curricula in schools.
By so doing, the Kenyan authorities with assistance from the government of Japan hope to strengthen a pilot project called "strengthening mathematics and science in secondary education (SMASSE)".

The SMASSE project was implemented in July 1998 and was to run up to July 2003. Four senior teachers in each subject (Mathematics, Physics, Chemistry and Biology) were selected from the original 9 pilot districts in 5 pilot provinces through interviews to be trained at the national level. Those trained at the national level were to train their colleagues at the district level in their respective areas. The outcomes of 5- year SMASSE project were to be used in seeing whether there was a possibility of starting all year round national in-service teacher education course for science teachers by the end of the project period in July 2003. Phase II of SMASSE project was launched to cover the whole country in may 2003.

Since the Kenya government and the Japanese government have put a lot of resources into the SMASSE project at National and District INSET centres, this study is worth carrying out since it is aimed at establishing the impact the project has had in our education system.

1.9 Scope and Limitations of the study

This study was conducted in Bomet District. This area was selected because over the last few years, the performance in mathematics has been on a downward trend (Education Insight, May-June 2007, Issue 12).

This study encountered the following challenges:

(1) Financial limitations. This study required a lot of money required for stationery, piloting and travel plus accommodation expenses.

(2) Time- the study required enough time so as to collect comprehensive data required for the study

(3) Unanticipated occurrences- this study was carried out in February and March. Post election violence delayed the data collection exercise.

(4) Attitude of the respondents-Some of the respondents were not willing to give the correct required information. Some wanted to give their responses just to please the researcher.

1.10 Theoretical framework

This study was based on the Theory of Reasoned Action (TRA) and the Theory of Planned Behaviour (TPB). Derived from the social psychology setting, the theory of reasoned action (TRA) was first proposed by Ajzen and Fishbein (1975 and 1980).

The components of TRA are three general constructs:

(1) behavioural intention

(2) Attitude and

(3) Subjective norm

TRA suggest that a person's behavioural intention depend on a person's attitude about the behaviour and subjective norms.

BI = A + SN

If a person intends to do behaviour then it is likely that the person will do it.

Furthermore, a person's intentions are themselves guided by two things: the person's attitude towards the behaviour and the subjective norms. Behavioural intention measures a person's relative strength of intention to perform behaviour.

Attitude is comprised of beliefs about the consequences of performing the behaviour multiplied by his or her valuation of these consequences. Subjective norm is seen as a combination of perceived expectations from relevant individual or groups along with intentions to comply with these expectations. In other words, “the person's perception that most people who are important to him or her think he should or should not perform the behaviour in question" (Ajzen and Fishbein, 1980).

To predict someone's intentions, knowing their beliefs can be as important as knowing the person's attitudes. Perceived behavioural control influences intentions. Perceived behavioural control refers to people's perceptions of their ability to perform a given behaviour. These predictors lead to intention. A general rule, the more favourable the perceived control, the stronger should be the person's intention to perform the behaviour in question.

The theory of planned behaviour is a theory which predicts deliberate behaviour, because behaviour can be deliberative and planned. The theory of planned behaviour holds that only specific attitudes toward the behaviour in question can be expected to predict that behaviour (Ajzen, 1991).

In psychology, the Theory of Planned Behaviour (TPB) is a theory about the link between attitudes and behaviour. It was proposed by Icek Ajzen as an extension of the theory of reasoned action (TRA). It is one of the most predictive persuation theories. It has been applied to studies of the relations among beliefs, attitudes, behavioural intentions and behaviours in various fields such as advertising, public relations, campaigns health care etc. TPB can cover people's voluntary behaviour which cannot be explained by TRA. An individual's behavioural intention cannot be exclusive determinant of behaviour where an individual's control over the behaviour is incomplete. By adding perceived behavioural control, theory of planned behaviour can explain relationship between behavioural intention and the actual behaviour.

All the above views concerning the theory of reasoned action and the theory of planned behaviour helped the researcher in establishing the impact of SMASSE INSET on the student's attitude and performance in mathematics in secondary schools.

1.11 Operational definition of terms

There are few terms used in this study which merit some definition:

Attitude toward behaviour: An individual positive or negative evaluation of Self-Performance of the particular behaviour. The concept is the degree to which performance of the behaviour is positively or negatively valued. It is determined by the total set of accessible behavioural beliefs linking the behaviour to various outcomes and other attributes

Attitude: This is taken to mean the student's acquired internal state or feeling influencing their choice towards learning.

Behavioural belief : An individual's belief about consequences of particular behaviour. The concept is based on the subjective probability that the behaviour will produce a given outcome

Behaviour: An individual's observable response in a given situation with respect to a given target

Behavioural intention: An indication of an individual's readiness to perform a given behaviour

Control beliefs: An individual's beliefs about the presence of factor that may facilitate or impede performance of the behaviour

District INSET centre: An institution which has been chosen as a centre for in servicing of mathematics and science teachers at the district level

Impact : Any effect, whether anticipated or unanticipated, positive or negative, brought about by an intervention .

National INSET Centre: This is the headquarters of the SMASSE project in Kenya. It is normally referred to as CEMASTEA (centre for mathematics, science and technology Education in Africa).

Normative belief : An individual's perception about particular behaviour, which is influenced by the judgment of significant others (e.g. parents, spouse, friends, teachers).

Perceived behavioural control: An individual's perceived ease or difficulty of performing the particular behaviour. It is assumed that perceived behavioural control is determined by the total set of accessible control beliefs.

Performance: This refers to the status of students with respect to acquired skills and knowledge as compared with other students or other schools, adopted standards or national educational standards.

Secondary school: An institution of learning that offers four years of formal schooling preceding university education. The education offered at this level is based on the four year curriculum which is broad based and builds on concepts, principles, skills and attitudes established at the primary level.

Subjective norm: An individual's perception of social normative pressures, or relevant others beliefs that he or she should or should not perform such behaviour.

1.12 Summary

This chapter has outlined the background to the study, statement of the problem, objectives of the study, research questions, research hypotheses, theoretical framework, significance, assumptions, scope and limitations of the study. It also presented the operational definition of terms. In the next chapter, a review of related literature is presented.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter has reviewed literature that is general in nature and some which are more specific to SMASSE INSET. Review of related literature has been done extensively, covering g both local and international research studies. Some of the literature reviewed was obtained from several websites on the internet.

The study sought to investigate the impact of SMASSE INSET on students' attitudes and performance in mathematics in secondary schools.

2.2 General Review of literature

2.2.1 The learning gap and the need to improve

There is always room for improvement, no matter how well our students are doing now; it would be foolish not to try to improve. Interest in international studies has grown since publication of "The learning Gap", heightened recently by release of the results of the "Third International mathematics and Science study (TIMSS)". As the name implies, this was the third in a series of international studies. The first was conducted in 1960s and the second in the early 1980s. In both of these studies, USA students performed quite poorly compared with their peers in most Asian and many European countries.

But neither of these two earlier studies came close to matching the size and quality of the TIMSS, by far the most comprehensive and methodologically sophisticated cross-national comparison of achievement ever completed. TIMSS investigated mathematics and science achievement among fourth, eighth and twelfth grade students in 41 nations. In the eighth grade mathematics 20 of the 41 nations scored significantly higher, on average, than the United States. The seven nations scoring lower than the United states were Luthuania , Cyprus, Portugal, Iran, Kuwait, Columbia and south Africa. Nations scoring significantly higher than the United States included Singapore, Korea, Japan, Canada, France, Australia, Hungary and Ireland (Stigler and Hiebert , 1999).

American mathematics teaching is extremely limited, focused for the most part on a very narrow band of procedural skills. Whether students are in rows working individually or sitting in groups, whether they have access to the latest technology or are working only with paper and pencil, they spend most of their time acquiring isolated skills through repeated practice. Japanese classrooms spend as much time solving challenging problems and discussing mathematical concepts as they do practicing skills (Stigler & Hiebert , 1999).

Many teachers in the United States have replaced the chalkboard with the overhead projector, whereas Japanese teachers have not. In US classrooms, Visual aids functions to guide and control students' attention. The overhead projector is preferred because it gives teachers even more control over what students are attending to. Within the Japanese system of teaching, visual aids serve a different function.

They are not used to control attention but provide a cumulative record of the lessons activities and their results. Japanese teachers do not use the overhead projector because it is not possible to fit the cumulative record on an overhead transparency.

US teachers appear to feel responsible for shaping the task into pieces that are manageable for most students, providing all the information needed to complete the task and assigning plenty of practice. Teachers act as if confusion and frustration are signs that they have not done their job. When they notice confusion, they quickly assist students by providing whatever information it takes to get students back on track.

Japanese teachers apparently believe they are responsible for different aspects of classroom activity. They often choose a challenging problem to begin the lesson, and they help students understand and present the problem so they can begin working on a solution. While students are working, the teachers monitor their solution methods so they can organize the follow-up discussion when students share solutions. They also encourage students to keep struggling in the face of difficulty, sometimes offering hints to support students' progress. Rarely would teachers show students how to solve the problem mid-way through the lesson. Japanese teachers lead class discussions, asking questions about the solutions methods presented, pointing out important features of student's methods and presenting methods themselves. Because they seem to believe that learning mathematics means constructing relationships between facts, procedures and ideas, they try to create a visual record of these different methods as the lesson proceeds (Stigler and Hiebert , 1999).

2.2.2 The development of student achievement in mathematics during middle and high school in USA

Twenty four years ago, secretary Bell's National Commission on Excellence in Education declared the United States to be a "nation at risk" because of its troubled and failing educational system (NCEE, 1983). Since 1983, the educational system has been scrutinized by numerous groups and more than a hundred reports have been published. During recent years the National Science Foundation (NSF) has invested billions of dollars in projects to enhance curricula and instructional materials and train teachers. Given this level of efforts it would be reasonable to expect some indicators of improvement in students learning of mathematics (Miller, 1999).

The recent results from the third international mathematics and science study (TIMSS) indicate the US fourth-grade students are closer to the international mean in mathematics achievement than either American 8^{th}- grade or 12the grade students, and that the distance between the US mean mathematics achievement and the international mean increases with continued schooling (Beaton et al 1996, Mulis et al 1999). The National centre for education statistics summary of student mathematics achievement among 8^{th} grade students in the United State and other countries is clear and succinct:

> Compared to their international counterparts US students are somewhat below the international average of 41 TIMSS countries in mathematics. In mathematics, students in 20 countries outperform our eighth grades.
>
> Students in 13 countries are not significantly different than ours and the US students out perform their counterparts in 7 nations. We can say with confidence

> that the US outperformed four countries in mathematics; Lithuania, Cyprus , Portugal, Iran. The US also outperformed Kuwait Columbia and South Africa, but due to deviations in their administrations of TIMSS, we have less confidence in their scores. These seven countries are the only ones that we outperformed in mathematics. (Department of Education 1996, pp 19, 23-24).

This is hardly what was expected after millions of hours of curriculum development and teacher training and billions of dollars. By identifying the background and developmental factors that account for high and low mathematics achievement scores, it will be possible to think about possible interventions and strategies for influencing the overall level of mathematics achievement in the United States. (Miller, 1999).

2.3 Review of literature related to Attitudes

Attitudes largely determine what students learn and their willingness to learn. Lingren (1980) supported this view by stressing the importance of students holding favourable attitudes if learning experiences are to be successful.

Several definitions have been offered as to what attitudes are. Fishbein and Ajzen (1975) stated that an attitude is one's general feeling of favour or otherwise toward some stimulus objects. A similar definition was offered by Thorndike and Hagen (1975) and Richardson (1977). They added that this judgement or feeling is towards an individual, a group ,an object, an institutions or a proposition.

However, caution must be taken as to what attitudes students have as fears passed on to students stay with them for the rest of their education (Philips, 1980).

Extending this further, Tobias, (1978:54) stated that "negative attitudes can powerfully inhibit intellect and curiosity and can keep us from learning what is well within our power to understand".

In the secondary school, Fakuede (1973) found that it is common knowledge that the majority of the students in Nigerian Secondary schools dislike mathematics when comparing the two sexes. Internationally females have been noted to have more negative attitudes (Iben, 1991; Dike, 1984; Omuoha, 1982; Oyewole, 1982; Tobias, and Weissbroad, 1980; Preece, 1979; Fennema and Sherman, 1977; Bassa, 1976). The differences between the attitudes of males and females increase as students' progress in school (Lewy, 1982).

According to Mukherjee and Umar (1989) of Kano state polytechnic, Nigeria, attitudes can be changed as theories of attitude change have shown. Research on attitudes change of individuals and their subsequent behaviour has been mainly in fields other than education. Attitudes like values are products of the social interactions a child is likely to experience with his parents, teachers and neighbourhood community. Successful interactions depend on positive reinforcements, which in their turn lead to ego-involvement of the persons concerned.

2.3.1 Mathematics Teaching in Nigeria

A study of factors influencing student's attitudes towards mathematics in the Junior secondary schools

There has always been an interest in the development of positive students' attitudes towards mathematics. The objectives of any mathematics curriculum include fostering favourable feelings toward mathematics as well as imparting cognitive knowledge. While Bolaji (1996) has provided an overview of much aspect of attitudes towards mathematics including a review of instrumentation, it is still unclear how the school environment affects the development of students' attitudes towards mathematics.

Some researches have been done on the relationship between school variables and students attitudes towards mathematics. Several investigations have found a small but positive correlation between some schools factors and attitudes (Jacobs, 1974, Fields, 1975; Evans 1978, Paul, 1986), although these studies do not examine the influence of specific variables. Gordon (1975), cooper (1988) and MC Maham (1992) provide evidence that aspects of the classroom learning environment, or climate, are positively related to mathematics attitudes. An environment lower in intellectual demands, difficulty and amount of frictions or conflicts is likely to show more students positive attitude (Armstrong, 1985). A number of studies have indicated that the personality and behaviour of the teachers is very important in the formation of students' attitudes, with one notable exception by Fennema (1990). Anderson (1991) found that it is important for teachers to be enthusiastic and use more indirect teaching behaviours.

Ninth grade pupils interests in mathematics was found by Reed (1968) to increase with teachers who are warm and who utilized student's intrinsic motivation. Fennema and Sherman (1995) found that students of teachers who were well- organized, achievement-oriented and enthusiastic tended to have more positive mathematics attitudes.

In support by other studies concerning the effect of the teacher, the students mentioned the teacher, in both personality and interrelationships with students as a crucial variable in attitude formation (Bolaji Caleb, 1996). The findings of the study carried out by Bolaji (1996) suggests that the assessment of mathematics attitudes needs to differentiate enjoyment from usefulness and indicates the importance of students investment through effort in developing positive attitudes towards mathematics. Teacher personality, relations and interactions with students' classroom activities, rewards, assignments and students work are all controlled b the teachers. The results from this study suggests the need for the teachers to develop positive relations with students, to stress classroom activities which involve active- teaching process and student participation and to engage students meaningfully in the subject, so that a fruitful and satisfying results is assured.

2.4 The process of planned change: A theory of innovation

According to Bishop (1986) any process of innovation involves the following four major factors:

(1) **The Change agent**- the Innovator, the person or group e.g. the headmaster, or individual teachers, or local authority, or national government) that decides upon and initiates the innovation or educational change.

(2) **The Innovation or change itself**, e.g. an integrated approach to learning - teaching; or new mathematics in place of the old, or a comprehensive system of education as against the more traditional tripartite system of grammar school/ Secondary, modern/ technical educational; programmed instruction; education by television etc.

(3) **The user system**- the person or group at which the innovation is directed or targeted. These three key factors answer the simple question:

Who (the change agent) says

What (the innovation)

To whom (the user)

To ignore or underestimate the importance of any one of these key factors would be courting trouble. It is important to bear in mind too, that these three factors interact with, change and are changed by each other during the process of innovation.

(4) **Time**, innovation is essentially a social process and so takes place over a period of time.

The change agent system

Any change agent or innovator will be obviously involved with:

1. The process of innovation
2. The planning of innovation
3. Strategies of innovation

Considering these under the change agent system does not imply that the user system is not involved. It sometimes happens that the change agent and the user are in opposition. But for any innovation to success the two must co-operate and collaborate. So, while considering what the change agent does, one must remember that ideally , the user will also be closely involved in the change agents activities.

The process of innovation

Most innovations go through something approaching these logical phases:

1) There is some problem, some dissatisfaction, some need, that requires attention
2) Some possible solutions are considered
3) A particular solution (innovation) is selected as being the most likely to meet the solution
4) This optimum solution is trialed and evaluated
5) If promising the solution is implemented on a wide scale
6) The solution is absorbed into the system, it is institutionalized

(1) **The problem**

Before any innovation begins there must be some problem, some situation which is causing dissatisfaction and which it is hoped some innovation will solve or at least ameliorate. Otherwise why introduce any innovation?

The difficulty is often to identify the real problem, which is the one that is the root cause of the dissatisfaction.

(2) Possible solutions

Having identified the real problem, the next phase involves considering possible solutions, bearing in mind the economic, social and cultural limitations. An innovation is a deliberate intrusion into the fabric of a culture. Often this entails a change in the existing order of things. Any solutions and innovations preferred must not only be feasible in terms of cost but must also be compatible with existing values.

Social system and innovation systems ought to exist for the people and their welfare not the other way round. And just because something is new or different it need not necessarily be better than the system it is transplanting. Remember too that over-ambitions, cloud- cuckoo' solutions seldom get into orbit.

(3) The innovation

From the possible solutions the change agent (e.g. a government planning unit, a ministry, a head teacher etc will select that solution, innovation, educational change, that it considers will best achieve the desired results with the greatest effectiveness and at a reasonable cost.

(4) Piloting

The next task of the change agent is to develop and introduce this innovation, this optimum solution, into the client/user system on a trial basis.

This will involve promoting awareness and interest in the innovation, adjusting internal organizational procedures and arrangements, location and arranging appropriate resources, providing training courses (and possible incentives), setting up monitoring and feedback procedures to assess the relevance and effectiveness of the inn ovation.

(5) Implementation

For effective planning and execution of an innovation the implementation phase should be regarded as a distinct process from the earlier trial phase.

It is not merely an extension of the earlier 'trial or development phase, implementation entails new and distinctive issues and problems that call for new and distinctive approaches.

Initial acceptance of an innovation, even enthusiasm, is not enough to ensure implementation, as Pratt points out: 'more good curricula sink without trace on the shoals of implementation than on any other point'. Innovation is a process, a continuous and complex negotiation between people involved in establishing new ideas and practices. Most innovations require considerable change in the usual pattern of teacher behaviour. To break away from old modes of behaviour and begin to act in an entirely different way is far from easy and takes time.

6) Institutionalization

An essential ingredient for large scale adoption and institutionalization of educational innovations is a national capacity and commitment to carry out after the initial 'trial' and development period.

Massive change can rapidly be initiated but they cannot rapidly be adopted on a stable or permanent basis. This is due to the fact that a system, be it an individual an institution or a series of individuals or institutions is unable to assimilate rapidly a great number and variety of new elements or behaviours which are unfamiliar.

The final task for the manager (change agent) of an innovation process is to take steps to stabilize or institutionalize the innovation that is get it absorbed and structurally integrated into the system. To do this he/ she must make provision for continuing maintenance of the innovation, and for ensuring that the innovation can be adapted to meeting changing needs.

The planning of innovation

The problems of innovation are very complex and nowadays can no longer be solved by mere intuitive judgments or educated guesses. If innovation is not to be a hit or miss affair, it must be planned.

As innovation is always a risk affair, the effective planner (change agent) minimizes the risks not only by anticipating as many future events as possible but also by providing 'fail- safe' mechanisms to cover unforeseen events and in this way help to nip in the bud any potential disaster. A good plan allows any imperfections that occur to be remedied easily.

For effective planning of innovation Adams and Chen enumerate eleven elements which must be considered at each of the six stages of any innovation process. These elements are:

1) The personnel to be employed (who)

At all stages of an innovation process, there must be people available all along the lines that have the expertise and capacity to carry out their allotted tasks.

(2) The specification of what the actual tasks is (what);

That is, what has to be done, what the innovation in action will consist of, its size and its scope, the role of teachers, of researchers etc.

Whether the specifications are detailed or more open depends on the capabilities of those who carry out the tasks. The purpose of task specification is to provide a sufficient basis for getting into the action of innovation.

(3) The method (strategy or procedure to undertake the task)

(4) The equipment needed (with what)

(5) The plant, building or environment (where).

When equipment and plant are part and parcel of an innovation, then means must be found for producing and delivering them.

(6) The cost entailed.

One must face up to the costs, not only of initial trials, but also the full implementation costs of any innovation.

(7) Other people or rather other social contexts on which the innovation impinges.

It is wise and essential to gain the co-operation of interested parties especially if they are powerful, who might otherwise regard their territory or prerogatives as being violated or threatened. Failure to involve or at least inform interest sections can prove an innovation's undoing.

(8) The time involved (when and for how long)

Innovations take time. People and social systems are generally slow to welcome changes, which they often regard with suspicion.

(9) The scheduling or sequencing or co-coordinating of activities (in what manner)

Time spent in planning the sequencing and co-coordinating of events is time well spent. The more precise the co-ordination, the faster the process of innovation.

(10) The rationale for undertaking the innovation (why).

What are the justifications for the particular approaches used in the operational phase?

(11) The evaluation of the consequence or effects resulting (with what effects)

This is the moment of truth when either a 'thumbs up' or a 'thumb down' decision has to be taken on whether or not to go ahead with the innovation. Whether an innovation is implemented on a wide scale depends on at least three factors:

- The political climate, in a national sense and in an institutional or local sense;

- Whether there is sufficient (energy) in the form of material and human resources to sustain it (any proposal that adds to cost is generally viewed unfavorably)
- Its place in the general array of priorities.

2.5 Review of literature related to SMASSE INSET

2.5.1 Impact of SMASSE INSET on shift in teaching strategies .

In 1985, Kenya changed her education system from 7-4-2-3 (seven years of primary, 4 years of ordinary secondary, 2 years of Advance secondary level and a minimum of 3 years of university education depending on the course taken) to the current 8-4-4 education system (8 years of primary, 4 years of secondary and a minimum of 4 years of university education depending on the course taken) (Mackay report 1981). The changeover made science subjects compulsory in all Kenyan public schools. The new education policy found many schools ill- equipped to start science classes coupled with the extra demand for science teachers. The new education system's high demand for science facilities and teachers hardly gave room for teachers' professional development of how to implement the new curriculum. This has remained so for sometimes now. However, students in Kenya sit for national examinations that are centrally set, moderated, marked and graded (KNEC, 1998).

According to the KNEC (1998), student's overall performance in science subjects has been declining over the years. It has been argued that one way of addressing the difficulties students experience in Kenya science classrooms is through appropriate

teaching interventions that can be realized through professional development of science teachers (SMASSE project, 1998). It is hoped that professional development programs for science teachers will equip teachers with appropriate teaching skills and instruction strategies that are necessary to effectively implement science curricula in schools.

By so doing, the Kenyan authorities with assistance from the government of Japan hope to strengthen the teaching and learning of mathematics and science education in public schools through a pilot project called "Strengthening Mathematics and Science in Secondary Education (SMASSE)".

SMASSE targeted teachers first because of the time they spend with students. The attitude of the teacher impacts negatively on students. Negative attitude among students is manifested in untidy incomplete homework, frequent absenteeism, lack of attention in class, poor performance and low enrolment in optional science subjects, especially physics (Wambui and Wahome , 2006).

2.5.2 Rationale for SMASSE In-service Education and Training (INSET)

The following are some of the factors that may disturb the education system equilibrium thereby making it necessary for teachers to undergo INSET (SMASSE Project 1998):

(1) Curriculum change

Curriculum requirements of any education system do not remain constant but are ever changing with time. This may for instance be as a result of changing education policy to respond to contemporary societal needs. For example in Kenya there has been a shift of emphasis for education for "white collar job" to education for "self- reliance". Under such circumstances, in-service training becomes necessary if the new curriculum is to be effectively and efficiently implemented.

INSET would provide the necessary forum where the policy makers and implementers would deliberate on matters pertaining to new aims and objectives, content, sequencing, modalities of implementation etc and reach a consensus.

(2) Change in Teaching Approaches/ Methodologies

Changes in curriculum bring about a need for re-examination of pedagogical aspects. New teaching methods/ approaches may be required to teach new curricula. Other than new curricula there is continuous research on effectiveness of teaching/ learning methods/ approaches and as such practicing teachers need to be updated on the current trends. For example, there has been a strong recommendation by educators for a shift from a teacher- centered approach to student- centered approach of teaching.

Without in-service training during which such developments are articulated, teachers may find it difficult to discard old practices for the new ones.

(3) Teacher's Professional Development

A considerable amount of in- service education for teachers is conducted in the absence of particular curricula changes. Such INSET is provided due to the potential benefits to the teachers' professional growth.

Its degree of success is judged by the competencies that the teacher acquires or by improvement in the teacher's classroom practices but not in terms of its contribution to some overall curricula or instructional direction established for a school or program.

(4) Follow-up

Much of the good practices taught and learned in college are soon undone because of lack of follow-up. Newly posted teachers very soon after entering the profession resort to outdated teaching practices most likely due to discouragement by colleagues that much of what is taught in college is theoretical and don't work in actual practice. Another factor could be frustrations encountered in the course of duty, etc. INSET thus provides a good opportunity to make a follow-up and undo retrogressive acts, attitudes and practices. It may be true to some extent that most teacher trainers, especially in the universities are out of touch with the realities of the classroom and that some courses are generally theoretical. It is more for such reasons that INSET, during which pre-service training can be harmonized with the realities of educational practice, becomes essential.

(5) Rising Cost of Education

The cost of providing quality education is ever rising in terms of money and time. As such it is important to get out of it the best value for the investment.

Facilities and resources meant for education must therefore be utilized optimally. Priority must be given to academic programmes whenever there is competition for resources in educational institutions. Teachers can be best sensitized and exposed to suitable approaches/ practices to achieve this during INSET.

(6) Technological Advancement

Technological advancement has brought with it the information technology (IT) revolution. It is becoming evident that any society that will be left out of this revolution risks total isolation from the global family. Technology has also found considerable use in education. However, not many teachers have the necessary IT knowledge and skills. Capacity building in this critical area can be achieved through INSET.

(7) Emerging Issues

The dynamism of society ensures that passage of time always brings along with it issues that need to be addressed urgently without having to wait for curriculum change. For example, the AIDS pandemic, drug abuse, deviant behaviour, unrest in schools, etc, issues that if left unattended have the high potential of disrupting the system. As such INSET becomes necessary where teachers, especially head teachers and those in charge of guidance and counselling are equipped with skills and competencies to deal with such situations.

(8) Conclusion

It is becoming widely acceptable among educators that pre- service Training (PRESET) is but only an induction into the teaching profession. On starting to teach, the teachers put into practice theories, teaching methods and student management styles as learnt at pre-service training. However, these have to be continually reviewed in the light of prevailing conditions, circumstances prevailing on the ground and of new discoveries.

INSET is thus important for professional development through sharing of experiences and continuous exposure to new ideas to keep abreast with new developments in the teaching profession, pedagogical, content, and administrative and policy issues can be handled during the interactive forum that INSET provides.

2.5.3 The ASEI Movement and the PDSI Approach

The activity,student,experiment and improvisation(ASEI) movement is a SMASSE initiative whose focus is to assist teachers to reflect on their teaching strategies and acquire skills for effective teaching and efficient learning to occur. It also aims at encouraging teachers to focus on instructional strategies that will support meaningful learning and make lessons interesting to the learners. Through improvisation, the teacher is able to demystify conventional experiments by scaling down experiments, thereby relating mathematics and science to real life situations. The learner is the focus of attention and activities are planned for the learners through the development of ASEI lessons. In these lessons, a bridge is created to enable learners to relate and integrate practical activities with theoretical knowledge.

This movement advocates a shift in both the teacher's thinking and practice from teachers centred approaches to student centred approaches.

In this approach teaching is for the student and the emphasis is on teaching for understanding by actively engaging the learners in the construction of knowledge (SMASSE INSET Cycle I, 2004).

The ASEI movement's strength lies in the recognition that, meaningful learning only takes place in an environment in which students are actively engaged in focused and sequenced activities of acquisition of skills and knowledge. It further recognizes the power of improvisation in which the teacher carefully identifies and selects teaching/ learning materials from the local environment. The movement considers the quality of classroom activities as critical to achieving effective teaching and learning. The activities here can be hands-on (psychomotor i.e. manipulative skills), minds-on (cognitive i.e. intellectual thinking, reasoning), hearts- on (the affective aspects i.e. those that stir up the learner's interest/ feelings about the subject) and mouths -on (communicative skills i.e. discussions).

These activities should be students- centred i.e. designed to increase the participation of the learner. They should be carefully selected, sequenced and directed to provide meaningful experiences to the learners.

Plan ,do, see and improve (PDSI)is the vehicle that carries the ASEI movement and involves:

(1) **Planning**, where teachers are encouraged to take time when planning to reflect on the most appropriate activities that will enhance effective learning using the resources available.

(2) **Doing** is shared between the teacher and the learners where the teacher's role is facilitation and not the dispenser of knowledge

(3) **Seeing** encourages the teachers to include a feedback mechanism in their lessons and teaching functions. Lesson evaluation is seen as the key to improvement of lesson delivery.

(4) **Improvement** should be done by incorporating information obtained from feedback during and after lessons. This is a continuous activity which ensures that the teacher's skills improve and confidence increases as the instructional programs are enriched.

2.5.4 Study on Mathematical Achievement Using the Climbing Learning Methods in Kenyan Secondary Schools

Many African countries envision being industrialized by the year 2030 and Kenya is no exception. However, looking at the performance of mathematics and science subjects at secondary education level in Kenya the vision to be industrialized is in doubt because the performance by the students in these subjects has been very poor.

Improving the performance of mathematics and science education is a great societal need in Kenya not only for industrialization of the country but also for producing scientifically empowered citizens.

Research by one of the key stakeholders in secondary education in Kenya, the Strengthening of Mathematics and Science in Secondary Education (SMASSE) project in 1998 has shown that consistent failure and negative attitude by students, towards mathematics continues to characterize the classroom. Based on this same research, teachers have been found to present lessons that are too much teacher- centred with the teacher as the main actor and sometimes the only actor in the classroom as students remain passive recipients. Mathematics lessons have been found to be difficult, boring and lacking in effective teaching/ learning materials. The challenge thus has been how to make mathematics more "alive", more "real "and more "accessible". It is, therefore strongly felt that students' involvement during lessons must be enhanced to increase motivation, effective teaching /learning materials used and lessons should be made more interesting.

Wambui (2002) realized that a student- centred lesson should be enhanced from two complimentary elements:

1) placing more responsibility in the hands of the students, and
2) Requiring the teacher to serve as a mentor and facilitator in presenting knowledge especially to students and fellow teachers in the teaching/ learning process.

Wambui has been a national INSET trainer in mathematics since 2000 and proceeded for further study in Japan in 2002. During her study in Japan, she learned" climbing learning method" which could be applicable and more effective in the Kenyan classroom.

This brings about a pedagogic paradigm shift from teacher- centred teaching/ learning practice to students- centred teaching/ learning practice. The shift also aims at shifting from theoretical approach to activity focused approach.

"Climbing learning methods" is a method which places emphasis on developing abilities while regarding the mathematics learning process as an information creation and transmission process. Knowledge must be organized structurally and functionally.

If on creating knowledge, knowledge is tightly organized structurally and functionally, one can then utilize and apply the stored knowledge in the brain. Climbing learning method therefore propagates the use of a functional network by means of the structurally and functionally organizing knowledge in the students' brains. The learning elements in the teachers' brains are firmly tied structurally and functionally to each other. But learning elements within the student's brain may not be firmly tied structurally and functionally to each other and may be existing as separate entities to each other.

Climbing approach utilizes a learning structural chart referred to as concept map where the students are supposed to fill in the spaces provided, the explanation of the learning elements, the formula, examples and self made problems and answers. In the process the students understand the content and meaning of each learning elements tightly thereby extending the existing knowledge and reconstructing it. The filling in, of the concept map is assigned as homework.

To overcome the challenge of making mathematics more "alive" and more "real", Wambui used activity focused teaching/ learning. Activities here refer to minds on and hands- on activities. This is with the understanding that increased use of senses enhances understanding and promotes retention by learners.

With the use of activities, mathematics is made more real, and this arouses students' interest and curiosity as they relate mathematics to their real life experiences.

The use of hands- on and minds –on activities during the teaching/ learning process as applied in the research is yet another paradigm shift from theoretical, chalk and talk, talk and talk and knowledge/ content based approach to activity focused teaching/ learning. The Kenyan traditional method of teaching mathematics implies instruction, practice and evaluation as the simple patterns of activities in the classroom.

Wambui compared the students' mathematics cognitions and attitude before and after being exposed to the following methods of teaching and learning mathematics:

1) Traditional method of teaching and learning mathematics in Kenya
2) The climbing learning method.

Since the results of her findings showed a great improvement in students' cognition and attitude towards mathematics with the climbing learning method, she recommends that Kenyan teachers implement these methods in the classroom as an alternative teaching method that will assist learners in:

1) Achieving higher cognition
2) Instilling the right attitudes to students thus having an increased student interest, confidence and enthusiasm towards learning mathematics.

2.5.5 SMASSE Project Impact Assessment Survey Results

In September 2004, SMASSE project undertook a nationwide survey to assess the impact of INSET. The aim was to find out how SMASSE activities are practiced in the classroom and how they translate in achievement.

It was conducted in form two classes of selected schools, teachers taking the classes in mathematics and science subjects and principals of the schools.

The students had two sets of questionnaires, one dealing with their learning of mathematics in general, their attitudes towards the subjects and their participation in class during learning (Wambui and Wahome , 2006).

The following were observations on the teachers and the learners after being exposed to the INSET:

Net Impact on teachers:

1. They plan better and more consistently.
2. They attend to student's needs more regularly.
3. They are more open to team work.
4. They are more confident to carry out practical activities and experiments previously thought to be difficult or dangerous.
5. They try out new methods.

6. They can face the challenges arising from lack of resources better.
7. They can face the challenge of large classes better.

Net impact on students:

1. They are actively involved in class work
2. They show great interest and responsiveness.
3. They attend lessons more punctually and regularly.
4. They do their assignment more neatly and promptly
5. They carry out discussions beyond class time
6. They ask questions in and out of class.
7. Their curiosity is aroused and sustained as they relate mathematics to their real life experiences.
8. It encourages team work but allow individual participation for the students.
9. It provides students with opportunities to develop key competencies such as problem- solving, analysis, synthesis and application of relevant information.
10. It demystifies mathematics because of relating it to students' real life experiences.
11. Their attitudes towards mathematics gradually become positive.

Reforms expected:

The kinds of reforms expected out of these practices are like some of the positive impacts already mentioned as noted in the teachers and learners. It is also expected that:

1. Attitude will be positive for teachers and students
2. Teachers will practice more effective teaching methodologies
3. Teachers will develop effective teaching/ learning materials

4. There will be better administration and management in schools

In essence the students should become active in the learning process while the teacher carefully guides the process and there will be more meaningful activities in the mathematics classrooms.

2.6 Critical review of literature

The overall literature suggests that teacher-related variables are most important to the development of students' attitudes towards mathematics. The present study is structured to probe the most important school related determinants of liking or not liking mathematics from the point of view of each student.

According to Bishop (1986), major factors of innovation are the change agent, the innovation itself, the user system and the time. The process of innovation involves six processes. By looking at SMASSE INSET as an innovation, it is evident that the SMASSE INSET followed all the six processes as given by Bishop. However, the time factor was not given much attention by the SMASSE INSET. According to Bishop, an innovation takes place over a period of time. The change agent and the user must co-operate and collaborate so as to avoid any opposition. The present study will address the issue of how the SMASSE INSET should be strengthened and sustained so as to withstand the test of time.

The SMASSE INSET was organized into four cycles of two weeks each. Cycle one targeted attitude change, cycle two targeted ASEI/ PDSI approach to teaching, cycle three targeted actualization and practice in the classroom whereas cycle four targeted student's growth and impact transfer.

Rather than spending large amount of time on the philosophy and theories of teaching, teachers need help in learning practical techniques of effective classroom instruction. Good mathematics teachers develop over a long time and their development must be given greater attention. Opportunities for observing and emulating the practices of outstanding models and for practicing under the supervision of skilled teachers would provide the kinds of experience that all good professionals need. SMASSE INSET gave little attention to actualization and classroom practice. Much time should have been allocated to cycle three.

In-service training is essential for a new curriculum. The aim of in-service training must be commitment by teachers to the new goals and scripts. Change to teaching may be even more difficult since it involves change in behaviour and acquisition of new skills as well as a change in beliefs. A key to change is ownership. Teachers will persevere with an innovation if they belief that it is their innovation, not one that an outsider has imposed on them. SMASSE INSET was introduced and presented to teachers as final forms to which they have had no input. Although the curricula can cause some change in the teaching of mathematics, teachers adapting them to their existing methods reduce their effect. The teachers' scripts do not change much at all.

It has been documented in several studies that teachers asked to change features of their teaching often modify the features to fit within their pre- existing system instead of changing the system itself. The system assimilates individual changes and swallows them up. Thus although surface features appear to change, the fundamental nature of the instruction does not. When this happens, anticipated improvements in students' learning fail and everyone wonders why.

The present study will address the issue of how mathematics teachers can be made to own the in-service training that will be organized in future.From the review of the related literature, it is therefore evident that there are research gaps which the present study will fill.

2.7 Summary

This section has reviewed literature covering the general literature review, review of literature related to attitudes, literature review related to SMASSE, some researched work on the impact of SMASSE in some pilot areas and critical review of related literature. The next chapter presents the Research Design and Methodology that was used in the study.

CHAPTER THREE

3.0 RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter focuses on the research design and methodology that was used in this study. It specifically focuses on the research design, study area, study population, sample and sampling procedures, study variables, research instruments, validity and reliability of the research instruments, pilot study and the summary of the chapter.

3.2 Research Design

This study adopted a descriptive survey design. According to Gay (1981) a descriptive research is a process of collecting data in order to test hypotheses or to answer questions concerning the current status of the subjects in the study. Descriptive survey designs are used in preliminary and exploratory studies to allow researchers to gather information, summarize, present and interpret for the purpose of clarification (Orodho, 2002). Borg and Gall (1989:5) note that descriptive survey research is intended to produce statistical information about aspects of education that interest policy makers and educators. The survey research was therefore useful because of the economy of taking a sample of the population to generalize results for the whole population.

Descriptive survey design was employed because it guarantees breadth of observation and also provide for the accurate descriptive analysis of characteristics of a sample which can be used to make inferences about population (Popham, 1967, Kerlinger, 1973).

Descriptive survey is a method of collecting information by interviewing or administering a questionnaire to a sample of individuals (Orodho, 2003). It can be used when collecting information about people's attitudes, opinions, habits or any of the variety of education or social issues (Orodho and Kombo, 2002). For example, teachers in schools can carry out a survey to find out student's attitudes towards their teaching styles or discipline.

3.3. The Study Area

This study was carried out in Bomet district of Rift Valley province. It is bordered by Bureti, Transmara, Nyamira, Narok and Nakuru districts.

The district was selected for the study due to the fact that the performance at KCSE level is still low as compared to some of the districts in the Rift valley such as Nakuru (Education Insight May-June 2007, Issue 12). At the same time, Bomet district has two SMASSE INSET centres, one at Tenwek High School and the other at Moi Girls Siongiroi.

3.4 The Study Population

Bomet district has 97 secondary schools with student population of 15,556. There are 5 Boys', 8 Girls' and 84 mixed secondary schools all distributed in the six divisions of Bomet district (MOEST, 2007).

A sample of 30% of the schools in the district was selected for the study. The study however covered all the six divisions of Bomet District.

The schools in the six divisions were categorized into boys' boarding schools, girls' boarding Schools and Mixed Schools. Thereafter schools from each of the three categories were randomly selected.

To calculate the number of sampled schools by category, the total number of schools in each category was multiplied by the ratio of schools sampled to the total number of secondary schools in the Districts. Therefore from 27 schools to be sampled, 2 Boys, 3 Girls and 25 Mixed schools were selected. This was done to ensure that there is an adequate representation of the different categories of schools.

3.5 Sample and Sampling Procedures

Sampling is the procedure a researcher uses to gather people, places or things to study. It is a process of selecting a number of individual or objects from a population such that the selected group contains elements representative of the characteristics found in the entire group (Orodho and Kombo, 2002). A sample is finite part of a statistical population where properties are studied to gain information about the whole (Webster, 1985).

The subjects of this study were drawn from Form four students. The choice of form four students was based on the assumption that they had a longer experience in learning mathematics soon after the SMASSE INSET was implemented in August 2004. The current Form four students joined form I in January 2005.

It was also assumed that the form four students would be more mature in their opinions and attitudes towards mathematics.Sample of 375 students were used comprising of Girls and Boys from Boys' boarding schools, Girls' boarding schools and mixed Schools. This figure was arrived at by using a generalized scientific guideline for sample size decision by Krejcie, and Morgan (1970).

The two Boys' schools and the three Girls' school were selected using simple random sampling. The 25 mixed schools were distributed throughout all the six divisions. A sample of at least 4 schools from each division were chosen by use of simple random sampling. This was done by placing the names of schools in a container and then picking the required number of schools at random. The purpose of these strata is to ensure that each category of school is represented in the study as the selection was made from these categories.

Stratified random sampling was used in selecting the subjects for the study. In stratified random sampling, the population is divided into two or more groups using a given criterion and then a given numbers of cases are randomly selected from each population sub group (Mugenda and Mugenda , 2003). To use stratified random sampling, one must first decide on the criteria under which the population and hence the sample will be stratified. The actual method of sampling from each sub group of the population can be proportionate random sampling.

The obvious advantage in stratified random sampling is that it ensures inclusion, in the sample of sub group, which otherwise would be omitted entirely by other sampling methods because of their small numbers in the population (Mugenda & Mugenda , 2003).

The researcher also gathered information from mathematics teachers of the schools that participated in the study. Their information was hoped to strengthen the validity of the results. A total of 27 mathematics teachers and 27 heads of mathematics department were selected for the interview.

3.6 Study Variables

The study variables were grouped into two categories, namely independent variables and the dependent variable.

The independent variable is the SMASSE INSET.

The dependent variables are the students' attitudes toward mathematics and performance in mathematics.

3.7 Research Instruments.

In the study, the following instruments and techniques will be used.

(a) student's questionnaire (SQ)

(b) Teacher's questionnaire (TQ)

(c) HOD Mathematics Questionnaire

The three instruments were used to supplement each other and to give a deeper and wider exploration into research perspective which gave the research more quality.

3.7.1 Student's Questionnaire (SQ)

Tuckman (1987) says that a questionnaire is a way of getting data about persons by asking them rather than watch them behave. A questionnaire is a research tool whereby the respondent gives the responses to the questions asked through the written mode. The use of questionnaire as a tool in research is quite efficient because through them the researcher is able to obtain personal views from the respondents. In this questionnaire closed ended questions were used. Closed ended questions were used with the aim of helping the researcher to obtain the personal views of the respondents (Appendix I).

For closed ended questionnaire, five-point likert scale was used to measure attitudes and experiences associated with mathematics. The higher the score the more positive the attitude towards mathematics, with the exception of questions which are negative and should show a lower score to indicate a more positive attitude. Responses from negatively worded items were reversed before inclusion in the computation of the average value.

3.7.2 Teacher's Questionnaire (TQ)

Teachers questionnaire in this study sought information on the following items : teaching experiences, in-services courses attended apart from the SMASSE INSET, experiences gained after undergoing the SMASSE INSET and frequency of in-service courses among others (Appendix II).

3.7.3 HOD Mathematics Questionnaire

HOD mathematics questionnaire in this study sought information on the performance in mathematics at KCSE level from the year 2002 to 2006.One way analysis of variance (ANOVA) and t-test were applied to find out whether there were any significant differences in performance two years before SMASSE and two years after SMASSE (Appendix III).

3.8 Validity of the Research Instruments

Validity is the extent to which the instrument measures what it appears to measure according to the researcher's subjective assessment (Nachmias: 158). Validity deals with the adequacy of the instruments for example, the researcher needs to have adequate questions in the written task in order to collect the required data for analysis that can be used to draw conclusion.

Frenekel (1993) suggest that the individual who is supposed to render an intelligent judgment about the adequacy of the instruments should be given the instruments before the actual research is carried out. The instruments were amended according to the expert's comments and recommendations before being administered. In this study, the researcher sought help from the supervisors and lecturers in the school of education to judge the validity of the questionnaire and the questions in the written task.

3.9 Reliability of the research instruments.

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda and Mugenda : 95).

According to Seliger and Shohamy (1989) reliability is the extent to which data collection procedures and research tools are consistent and accurate.In a research study, a reliability coefficient can be computed to indicate how reliable data are. A coefficient of 0.80 or more implies that there is a higher degree of reliability of the data (Mugenda and Mugenda , 2003). Reliability of the data is in fact a very important aspect of a research study and should be addressed early in the research process and also reported in the final document.

In this study, the Test-retest method was employed to assess the reliability of the research instruments. The results were used to compute the correlation coefficient. The Pearson's product moment formula for the test- retest was employed in order to establish the extent to which the contents of the questionnaire elicit the same responses every time the instruments are used.

3.10 Piloting of the Research Instruments

Piloting is trying out of research instruments on the respondents who will not be used in the main study.

Groll (1986:50) notes that a pilot study is necessary because" a researcher embarking on classroom research for the first time will find it valuable to spend some time in the classroom using one or more established systems and looking at the kind of issues which will arise in turning his/ her own research questions into a set of criteria and definition for use in the classroom." It is important for a pilot study to be carried out before any research is done as stated by Peter (1994:88).

He states" even the most carefully constructed instrument cannot guarantee to obtain a hundred percent reliable data". Therefore it was necessary to pretest the instruments of the research on a small sample of respondents in a preparatory exercise to find out if there is any weakness so that it can be corrected.

Pilot study was meant to assess reliability by checking for consistency. This helped in ensuring that the data which was expected to be produced was in line with the study objectives. Research instruments may be pre-tested on a small sample of at least ten respondents (Mulusa 1990:172).

In this study, two schools that did not take part in the main study were selected for piloting. A sample of 20 students and 4 mathematics teachers were used for piloting. The test- retest method was employed within an interval of two weeks .The responses to the items in the questionnaire were assigned numerical values .

The correlation coefficient between the scores of the responses from the questionnaire administered on the two different occasions were used to calculate the reliability coefficient using the Pearson product moment correlation coefficient formula. The reliability coefficient for the students' questionnaire was 0.73 and the teachers' questionnaire was 0.68.According to Kerlinger (1973) and Koul (1984), a positive correlation coefficient, r of 0.5 and above is a strong one and hence the research instruments were deemed reliable.

3.11 Data Collection and Analysis

Before the data collection process, the researcher had to obtain a letter from Moi University which was used to seek a permit from the Ministry of Education Headquarters and a letter of introduction to the District Education officer and District Commissioner so as to be allowed to carry on with the research in Bomet District.

The data collected was analyzed using both descriptive and inferential statistical techniques. Frequencies, percentages, means and standard deviations were employed for the descriptive statistics while the one way analysis of variances (ANOVA) and Chi-square (χ^2) were employed for inferential statistics. The significance was tested by computing the P- value at a significance or alpha level of 0.05.

After getting a research permit and a letter of research authorization from the ministry of education, the researcher first of all had to report to the District Commissioner and District Education officer before embarking on the research project. The two gave the researcher authorization letters to conduct the research within Bomet District (Appendixes VII, VIII, IX, X and XI).

The researcher visited each school that was selected from the population. He first of all consulted the principals and explained to them the purpose of the visit. The research took place in the months of February and March. The principals called the Mathematics Heads of Department to their offices. The researcher explained to them what the study was all about and how they were going to participate.

The respondents were informed by the researcher that the information gathered was to be used in improving the teaching and learning of mathematics and that whatever information they gave was to be kept confidential.

The researcher gave the questionnaires to mathematics Heads of Department and the mathematics teachers who had undergone SMASSE INSET. Class teachers of form four assisted the researcher in administering the students' questionnaire. Whenever it was not possible to administer questionnaire at the time of visit, the researcher left them with the class teacher so as to go back to collect them after two or three days.

The researcher encountered some challenges in the process of data collection. Some mathematics teachers were not willing to fill the questionnaire. On some occasions, the KCSE mathematics results for the years 2002- 2006 were not available in schools. Such challenges inconvenience the researcher and hindered the smooth flow of the study. There was no problem with student's questionnaire. Out of 375 questionnaires delivered for students, 371 questionnaires were returned.

That represented 98.9% response rate, which was very good. For the teacher's questionnaires, 27 questionnaires were delivered but only 20 were returned. That represented 74.1 % response rate, which was fairly good.

3 .12 Summary

This chapter has presented the procedures that were followed in carrying out the research. It has outlined the research design, the study area, the study population, sample and sampling procedures, the study variables, research instruments, validity and reliability of the research instruments, piloting of the research instruments, data collection and analysis. The next chapter presents data analysis, presentation and discussion of results.

CHAPTER FOUR

4.0 DATA ANALYSIS, PRESENTATION AND DISCUSSION OF RESULTS

4.1 Introduction

Data analysis refers to examining what has been collected in a survey or experiment and making deductions and inferences. It involves uncovering underlying structures; extracting important variables, detecting any anomalies and testing any underlying assumptions. It involves scrutinizing the acquired information and making inference (Kombo and Tromp, 2006).

The study investigated students' attitudes and performance in mathematics. Data collected was analyzed to get the overall picture of students' attitude towards mathematics. Specifically data was analyzed to determine whether:

1) SMASSE INSET has changed the students' attitudes towards mathematics.
2) SMASSE INSET has improved the performance in mathematics
3) SMASSE INSET has improved the teachers teaching approach and methodology.

As stated in chapter three, the main research instruments were students' questionnaire, teachers' questionnaire and HOD mathematics questionnaire. Three research hypotheses were tested. The independent variable, SMASSE INSET was considered against students' attitudes, performance in mathematics and teacher's teaching approaches and methodology. Both descriptive and inferential statistics were used to analyze the data.

For descriptive statistics, frequencies, means, standard deviation and percentages were used while for the inferential statistics, the analysis for variance (ANOVA) and chi-square (χ^2)were used to test the hypotheses at alpha, ά= 0.05 level of significance and appropriate degrees of freedom.

4.2 SMASSE INSET and Student's attitude towards mathematics.

The data collected in students attitude was analyzed so as to give a general picture about the students' attitude towards mathematics after the implementation of SMASSE INSET. Before the implementation of SMASSE INSET, students used to have negative attitude towards mathematics (Baseline findings, 1998).

There were 15 items that were testing students' attitudes towards mathematics. The summary of the results are as shown in table 4.1 (p. 63). The grand mean of all the items is 4.1003. This is a high positive value on the Likert scale. The grand mean therefore shows that the students' attitude towards mathematics has greatly improved with the introduction of SMASSE INSET. This can be attributed to the practical teaching of mathematics as opposed to the traditional methods of lecture. Students now enjoy the learning of mathematics because of its practical activities which are involved.

As much as the student's attitude has greatly improved with the introduction of SMASSE INSET there are some items which students still have some negative attitude. Such items are to do with problem- solving skills and confidence in mathematics. Quite a number of the students expressed lack of good background in mathematics when dealing with new mathematical situations.

Table 4.1: Students' overall analysis on attitudes towards mathematics

	Statement	N	SUM	MEAN
1	Mathematics is very interesting to me and I enjoy my mathematics course	371	1630.00	4.3935
2	My mind goes blank and I am unable to think clearly when doing mathematics	371	1577.00	4.2507
3	If I am confronted with a new mathematics situation, I can cope with it because I have a good background in mathematics	371	1418.00	3.8221
4	I can draw upon a wide variety of mathematical techniques to solve a particular problem,	371	1489.00	4.0135
5	I do not feel that is have a good working knowledge of the mathematics course I have taken so far	371	1493.00	4.0243
6	I learn mathematics by understanding the underlying logical principles, not by memorizing the rules	371	1473.00	3.9704
7	If I cannot solve a mathematics problem, at least I know a general method of attacking it	371	1290.00	3.4771
8	Mathematics problems are a challenge, solving problems provides satisfactions similar to those of winning a battle	371	1558.00	4.1995
9	I have more confidence in my ability to deal with mathematics than in my ability to deal with other academic subjects	371	1228.00	3.3100
10	Mathematics classes provide the opportunity to learn values that are useful in other parts of daily living	371	1626.00	4.3827
11	Mathematics is a very difficult subject to study in school	371	1671.00	4.5040
12	People who have studied mathematics get good jobs	371	1612.00	4.3450
13	Mathematics require thinking, not just memorizing terminologies formulae and concepts	371	1657.00	4.4663
14	Mathematics is one of easiest subject	371	1419.00	3.8248
15	Mathematics develop critical thinking in solving problems	371	1677.00	4.5202
		371	22,818	4.1003

$\overline{\overline{X}} = 4.100$

NB: $\overline{\overline{X}}$= grand mean (mean of means)

A number of them also expressed lack of confidence in dealing with mathematics as compared to other academic subjects.

Table 4.2 (p.66) shows the comparison of students' attitude towards mathematics by gender. The results in the table show that generally, there is a positive attitude which has been developed by students towards mathematics. However the areas of confidence and problem- solving show some negative attitudes. In item number 3, the mean of the males is 3.726 whereas that of females is 3.923. This seems that the female students can cope with a new mathematical situation more than their male counterparts.

In item number 7, the mean of the male students is 3.332 whereas that of the females is 3.630. This shows that females had a higher mean than males. This seems that females at least have an idea of attacking a mathematics problem more than boys even if they cannot solve it.

Item number 9 gave the mean of males to be 3.321 and that of females is 3.300. This seems that males have more confidence in their ability to deal with mathematics than in their ability to deal with other academic subjects as compared to females.

Item number 14 gave the mean of males as 3.721 and that of females as 3.934. This shows that females had a higher mean than males. Females view mathematics more as one of the easiest subjects as compared to the males.

Table 4.3 (p.67) shows the summary of the means of males and females for all the 15 items. The grand mean for the males is 4.08 whereas that of females is 4.119.

This is higher than that of males. This seems to suggest that the female students have developed more positive attitudes towards mathematics as compared to the male students. The results of table 4.3 were subjected to the t- test to determine whether the differences in the means were statically significant. The results are shown in table 4.4. (p. 68). The t- test gave a p- value of 0.627. Since the p- value (o.6270) > 0.05, it shows that the differences in means of males and females are not statistically significant. This suggests that SMASSE INSET has improved the attitudes of both males and females. The slight differences shown are not significant.

Table 4.2: Analysis of students' attitudes towards mathematics by gender

Item number	Statement	Gender	N	Mean $\bar{x}$
1.	Mathematics is very interesting to me and I enjoy my mathematics course	Male Female	190 181	4.342 4.448
2.	My mind goes blank and I am unable to think clearly when doing mathematics	Male Female	190 181	4.347 4.149
3.	If I am confronted with a new mathematics situation, I can cope with it because I have a good background in mathematics	Male Female	190 181	3.726 3.923
4.	I can draw upon a wide variety of mathematical techniques to solve a particular problem,	Male Female	190 181	4.011 4.017
5.	I do not feel that is have a good working knowledge of the mathematics course I have taken so far	Male Female	190 181	4.100 3.945
6.	I learn mathematics by understanding the underlying logical principles, not by memorizing the rules	Male Female	190 181	3.884 4.061
7.	If I cannot solve a mathematics problem, at least I know a general method of attacking it	Male Female	190 181	3.332 3.639
8.	Mathematics problems are a challenge, solving problems provides satisfactions similar to those of winning a battle	Male Female	190 181	4.168 4.232
9.	I have more confidence in my ability to deal with mathematics than in my ability to deal with other academic subjects	Male Female	190 181	3.321 3.300
10.	Mathematics classes provide the opportunity to learn values that are useful in other parts of daily living	Male Female	190 181	4.400 4.365
11.	Mathematics is a very difficult subject to study in school	Male Female	190 181	4.484 4.492
12.	People who have studied mathematics get good jobs	Male Female	190 181	4.216 4.481
13.	Mathematics require thinking, not just memorizing terminologies formulae and concepts	Male Female	190 181	4.542 4.387
14.	Mathematics is one of easiest subject	Male Female	190 181	3.721 3.934
15.	Mathematics develop critical thinking in solving problems	Male Female	190 181	4.605 4.431

Table 4.3: Further analysis of students' attitudes toward mathematics by gender.

	Statement	N	Mean of Males ($\bar{x}_1$)	Mean of females ($\bar{x}_2$)
1.	Mathematics is very interesting to me and I enjoy my mathematics course	371	4.342	4.448
2.	My mind goes blank and I am unable to think clearly when doing mathematics	371	4.347	4.149
3.	If I am confronted with a new mathematics situation, I can cope with it because I have a good background in mathematics	371	3.726	3.923
4.	I can draw upon a wide variety of mathematical techniques to solve a particular problem,	371	4.011	4.017
5.	I do not feel that is have a good working knowledge of the mathematics course I have taken so far	371	4.100	3.945
6.	I learn mathematics by understanding the underlying logical principles, not by memorizing the rules	371	3.884	4.061
7.	If I cannot solve a mathematics problem, at least I know a general method of attacking it	371	3.332	3.630
8.	Mathematics problems are a challenge, solving problems provides satisfactions similar to those of winning a battle	371	4.168	4.232
9.	I have more confidence in my ability to deal with mathematics than in my ability to deal with other academic subjects	371	3.321	3.300
10.	Mathematics classes provide the opportunity to learn values that are useful in other parts of daily living	371	4.400	4.365
11.	Mathematics is a very difficult subject to study in school	371	4.484	4.492
12.	People who have studied mathematics get good jobs	371	4.216	4.481
13.	Mathematics require thinking, not just memorizing terminologies formulae and concepts	371	4.542	4.387
14.	Mathematics is one of easiest subject	371	3.721	3.934
15.	Mathematics develop critical thinking in solving problems	371	4.605	4.431
Key: $\bar{\bar{X}}_1$ = grand mean of males $\bar{\bar{X}}_2$ = grand mean of females			$\bar{\bar{X}}_1$= 4.08	$\bar{\bar{X}}_2$= 4.119

Table 4.4: Independent samples t- test for students' attitudes towards mathematics by gender

	t-test for Equality of means		
	T	df	Sig. (2-tailed
Equal variances Assumed	-0.491	28	0.627
Equal variances Not assumed	-0.491	27.888	0.627

Table 4.5 (p. 70) shows the analysis of students' attitude towards mathematics as per school category. Generally, the attitude towards mathematics has improved in all the school categories. In item number 3, the mean of boys' school is 4.073, the mean of girls' schools in 3.927 and that of mixed school is 3.363. This shows that students in single sex schools rated the item higher than those in co- educational schools. It suggests that students in co-educational schools are disadvantaged when it comes to having a good background in mathematics. A good number of them seem not to cope with a new mathematical situation.

Item number 7 gave the mean of boys' schools as 3.500, girls' schools as 3.700 and that of mixed schools as 3.324. Again, the mean of the single sex schools is higher than that of co-educational schools. Students in single sex schools are better equipped in having at least a general idea of attacking a mathematics problem than those in co-educational schools.

In item number 9, the mean of boys' schools is 3.134, that of girls' schools is 3.445 and that of mixed schools is 3.307. The means for this item is the lowest for all the 15 items. This suggests that generally, students have not developed more confidence in their ability to deal with mathematics than in their ability to deal with other academic subjects.

In item number 14, the mean for boys' schools is 3.585, that of girls' schools is 4.018 and that of mixed schools is 3.816. This shows that girls' schools had the highest rating of mathematics as one of the easiest subjects as compared to boys' schools or co-educational schools.

Table 4.6 (p. 71) gives a summary for the means of 15 items as per the school category. The grand means for boys' schools is 4.128, that of girls' schools is 4.190 and that of mixed schools is 4.011. This shows that girls' schools had the highest mean. This implies that SMASSE INSET has resulted more in an improved attitude towards mathematics in girls' school as compared to either boys' schools or co-educational schools.

The results of Table 4.6 were subjected to one way ANOVA to determine whether there is any significant difference among the three groups of the school category. The results are as shown in Table 4.7 (p. 72).

One way ANOVA gave a p- value of 0.464. Since the p- value (0.464) > 0.05, it shows that the differences in means in the three categories of schools are not statistically significant. This suggests that SMASSE INSET has improved the attitudes of students towards mathematics in all the three categories of schools.

Table 4.5: An analysis of students' attitude towards mathematics by school category

Item number	Statement	School category	N	Mean $\bar{x}$
1	Mathematics is very interesting to me and I enjoy my mathematics course	Boy's School Girls School Mixed school	82 110 179	4.205 4.500 4.369
2	My mind goes blank and I am unable to think clearly when doing mathematics	Boy's School Girls School Mixed school	82 110 179	4.354 4.164 4.257
3	If I am confronted with a new mathematics situation, I can cope with it because I have a good background in mathematics	Boy's School Girls School Mixed school	82 110 179	4.073 3.927 3.363
4	I can draw upon a wide variety of mathematical techniques to solve a particular problem,	Boy's School Girls School Mixed school	82 110 179	3.939 3.982 4.067
5	I do not feel that is have a good working knowledge of the mathematics course I have taken so far	Boy's School Girls School Mixed school	82 110 179	4.183 4.027 3.950
6	I learn mathematics by understanding the underlying logical principles, not by memorizing the rules	Boy's School Girls School Mixed school	82 110 179	4.037 4.164 3.821
7	If I cannot solve a mathematics problem, at least I know a general method of attacking it	Boy's School Girls School Mixed school	82 110 179	3.500 3.709 3.324
8	Mathematics problems are a challenge, solving problems provides satisfactions similar to those of winning a battle	Boy's School Girls School Mixed school	82 110 179	4.244 4.164 4.201
9	I have more confidence in my ability to deal with mathematics than in my ability to deal with other academic subjects	Boy's School Girls School Mixed school	82 110 179	3.134 3.445 3.307
10	Mathematics classes provide the opportunity to learn values that are useful in other parts of daily living	Boy's School Girls School Mixed school	82 110 179	4.378 4.500 4.313
11	Mathematics is a very difficult subject to study in school	Boy's School Girls School Mixed school	82 110 179	4.561 4.600 4.385
12	People who have studied mathematics get good jobs	Boy's School Girls School Mixed school	82 110 179	4.354 4.555 4.212
13	Mathematics require thinking, not just memorizing terminologies formulae and concepts	Boy's School Girls School Mixed school	82 110 179	4.646 4.564 4.324
14	Mathematics is one of easiest subject	Boy's School Girls School Mixed school	82 110 179	3.585 4.018 3.816
15	Mathematics develop critical thinking in solving problems	Boy's School Girls School Mixed school	82 110 179	4.634 4.536 4.458

Table 4. 6: Further analysis of students' attitudes towards mathematics by school category

	Statement	Mean of Boys school ($\underline{X_1}$)	Means of girls school ($\underline{X_2}$)	Means of mixed school ($\underline{X_3}$)
1	Mathematics is very interesting to me and I enjoy my mathematics course	4.205	4.500	4.369
2	My mind goes blank and I am unable to think clearly when doing mathematics	4.354	4.164	4.257
3	If I am confronted with a new mathematics situation, I can cope with it because I have a good background in mathematics	4.073	3.927	3.363
4	I can draw upon a wide variety of mathematical techniques to solve a particular problem,	3.939	3.982	4.067
5	I do not feel that is have a good working knowledge of the mathematics course I have taken so far	4.183	4.027	3.950
6	I learn mathematics by understanding the underlying logical principles, not by memorizing the rules	4.037	4.164	3.821
7	If I cannot solve a mathematics problem, at least I know a general method of attacking it	3.500	3.709	3.324
8	Mathematics problems are a challenge, solving problems provides satisfactions similar to those of winning a battle	4.244	4.164	4.201
9	I have more confidence in my ability to deal with mathematics than in my ability to deal with other academic subjects	3.134	3.445	3.307
10	Mathematics classes provide the opportunity to learn values that are useful in other parts of daily living	4.378	4.500	4.313
11	Mathematics is a very difficult subject to study in school	4.561	4.600	4.385
12	People who have studied mathematics get good jobs	4.354	4.555	4.212
13	Mathematics require thinking, not just memorizing terminologies formulae and concepts	4.646	4.564	4.324
14	Mathematics is one of easiest subject	3.585	4.018	3.816
15	Mathematics develop critical thinking in solving problems	4.634	4.536	4.458
KEY: $\bar{\bar{X}}_1$=Grand mean of boys schools $\bar{\bar{X}}_2$= Grand mean of girls schools $\bar{\bar{X}}_3$ = Grand mean of Mixed schools		$\bar{\bar{X}}_1$=4.128	$\bar{\bar{X}}_2$=4.190	$\bar{\bar{X}}_3$=4.011

Table 4.7: One way ANOVA of student's attitude towards mathematics by school category

	Sum of squares	**Df**	**Mean squares**	**F**	**Sig.**
Between Groups	.245	2	.123	.781	.464
Within Groups	6.595	42	.157		
Total	6.841	44			

All the attitude variables were subjected to a chi- square test of relationship between gender of students and attitudes towards mathematics. The findings show that only one item (item 2) was statistically different in terms of gender. Boys and Girls rated item number 2 differently. This suggests that the two categories of students have different opinions in their minds when doing mathematics. Girls seem to have a lower opinion in their minds when they are doing mathematics. This can be attributed to the stereotypes widely held about mathematics as being a masculine subject. All the other items were not statistically significant. The results are as shown in table 4.8 (p. 73). This implies that there is no significant difference between student's attitude towards mathematics and the gender of the student.

Table 4.8: Analysis of chi- square tests of relationship between gender of Students and attitudes towards mathematics

	Statement	χ^2- value	Df	Sig.	Remarks	S or NS
1	Mathematics is very interesting to me and I enjoy my mathematics course	3.971	4	0.410	P>0.05	NS
2	My mind goes blank and I am unable to think clearly when doing mathematics	13.724	4	0.008	P<0.05	S
3	If I am confronted with a new mathematics situation, I can cope with it because I have a good background in mathematics	3.469	4	0.483	P>0.05	NS
4	I can draw upon a wide variety of mathematical techniques to solve a particular problem,	4.502	4	0.342	P>0.05	NS
5	I do not feel that is have a good working knowledge of the mathematics course I have taken so far	4.361	4	0.359	P>0.05	NS
6	I learn mathematics by understanding the underlying logical principles, not by memorizing the rules	33.660	4	0.454	P>0.05	NS
7	If I cannot solve a mathematics problem, at least I know a general method of attacking it	6.443	4	0.168	P>0.05	NS
8	Mathematics problems are a challenge, solving problems provides satisfactions similar to those of winning a battle	2.288	4	0.683	P>0.05	NS
9	I have more confidence in my ability to deal with mathematics than in my ability to deal with other academic subjects	6.361	4	0.174	P>0.05	NS
10	Mathematics classes provide the opportunity to learn values that are useful in other parts of daily living	8.165	4	0.086	P>0.05	NS
11	Mathematics is a very difficult subject to study in school	3.121	4	0.681	P>0.05	NS
12	People who have studied mathematics get good jobs	7.593	4	0.108	P>0.05	NS
13	Mathematics require thinking, not just memorizing terminologies formulae and concepts	8.338	4	0.080	P>0.05	NS
14	Mathematics is one of easiest subject	6.581	4	0.160	P>0.05	NS
15	Mathematics develop critical thinking in solving problems	7.986	4	0.092	P>0.05	NS

Key:

Df- degrees of freedom
χ^2 - chi- square
S- Significant
NS- Not significant

Table 4.9 (p.75) gives the results of the chi- square tests of relationship between school category and attitude towards mathematics. When the chi- square test was subjected to school category and students' attitude toward mathematics, only items 2, 3 and 10 were significant. In item number 2, the opinions expressed by the three categories of students concerning to their perceptions when they are doing mathematics are statistically different. Boys' schools are more positive to this item when compared to girls schools or mixed schools. In item number 3, the mean for boy schools is higher than that of girls' or mixed schools. This item tested the background in mathematics. Boys' schools tend to like mathematics because of the belief that it is a masculine subject. Girls' schools faired well more than the mixed schools. This tends to suggest that when the girls are on their own, they tend to develop an interest in mathematics unlike when they are put together with boys. Girls tend to work harder when they are on their own. In item number 10, girls had a higher mean compared to either boys' schools or mixed schools. This suggests that girls have started appreciating the importance of mathematics in other parts of daily living.

The other items were statistically not significant. This suggests that generally, there are no significant difference between attitudes toward mathematics and the school category.

Table 4.9: Analysis of Chi- square tests of relationship between school category and attitudes towards mathematics

	Statement	χ^2- value	Df	Sig.	Remarks	S or NS
1	Mathematics is very interesting to me and I enjoy my mathematics course	5.964	8	0.651	P>0.05	NS
2	My mind goes blank and I am unable to think clearly when doing mathematics	27.135	8	0.001	P<0.05	S
3	If I am confronted with a new mathematics situation, I can cope with it because I have a good background in mathematics	16.967	8	0.030	P<0.05	S
4	I can draw upon a wide variety of mathematical techniques to solve a particular problem,	7.044	8	0.532	P>0.05	NS
5	I do not feel that is have a good working knowledge of the mathematics course I have taken so far	11.007	8	0.201	P>0.05	NS
6	I learn mathematics by understanding the underlying logical principles, not by memorizing the rules	9.930	8	0.270	P>0.05	NS
7	If I cannot solve a mathematics problem, at least I know a general method of attacking it	14.780	8	0.064	P>0.05	NS
8	Mathematics problems are a challenge, solving problems provides satisfactions similar to those of winning a battle	8..708	8	0.368	P>0.05	NS
9	I have more confidence in my ability to deal with mathematics than in my ability to deal with other academic subjects	9.739	8	0.284	P>0.05	NS
10	Mathematics classes provide the opportunity to learn values that are useful in other parts of daily living	18.506	8	0.018	P<0.05	S
11	Mathematics is a very difficult subject to study in school	16.360	8	0.090	P>0.05	NS
12	People who have studied mathematics get good jobs	10.539	8	0.229	P>0.05	NS
13	Mathematics require thinking, not just memorizing terminologies formulae and concepts	14.898	8	0.061	P>0.05	NS
14	Mathematics is one of easiest subject	13.816	8	0.087	P>0.05	NS
15	Mathematics develop critical thinking in solving problems	7.907	8	0.443	P>0.05	NS

Key:

DF- degrees of freedom χ^2- chi- square

S- Significant NS- Not significant

From the research findings that have been presented, it can be concluded that the introduction of the SMASSE INSET has had a positive impact on students' attitude towards mathematics. The introduction of SMASSE project in Bomet District has resulted in students' positive attitude towards mathematics. The hypothesis was HO_1: There is no significant difference between SMASSE INSET and students' attitudes towards mathematics. From the research findings that have been presented, it can be concluded that there is significant relationship between SMASSE INSET and students' attitude towards mathematic. The null hypothesis was therefore rejected.

The students' attitude towards mathematics has improved because of the new approach of teaching which has been introduced by the SMASSE INSET. Cycle one of SMASSE INSET targeted attitude change. Attitude change targeted mathematics and science teachers first. It is hoped that the teachers will start the change of attitude from themselves and eventually cascade it to the students that they teach. Teachers should be able to realize the attitude of the students towards mathematics from their behavioural manifestations of these attitudes and, if the attitude is negative do all that is professionally possible to motivate them. If the attitude is positive, they should also try to maintain that disposition. Mathematics teachers should also be in a position to interact with colleagues teaching other subjects, school administrators, parents and other key stakeholders in attempt to change their attitude towards mathematics.

4.3 SMASSE INSET and Students Performance in KCSE Mathematics Examinations.

Data collected was analyzed from the year 2002 up to the year 2006. The year 2004 was taken as the base year. This was the time when SMASSE INSET was introduced in Bomet District. The aim of collecting the data was to investigate the students' performance in mathematics two years before SMASSE INSET was introduced and the effect of SMASSE INSET on students' performance two years after SMASSE INSET was introduced in the whole district.

The overall performance of students' performance in mathematics is as shown in Table 4.10, (p. 79). Mean scores and mean grade were used to gauge the overall performance. From Table 4.10, the analysis of the results shows that two years before SMASSE INSET was introduced, the students performance was 4.018 (D+) and 4.060 (D+) respectively. Two years after SMASSE was introduced the students performance was 3.372 (D) and 3.562 (D+). The analysis clearly shows that the performance in KCSE has been declining even with the introduction of SMASSE INSET. One of the reasons why SMASSE was introduced was to improve the poor performance in mathematics which had almost been accepted to be the order of the day. The ministry of education science and technology and other stakeholders felt there had to be an intervention measures hence the SMASSE project.

In the year 2006, the first group of students sat their exams under a new curriculum that was introduced in the year 2003. Students may not have done well due to fear and anxiety of the new curriculum.

It is hoped that as time goes by, the students are expected to do well since the two papers examined clearly shows the areas to be examined. Paper 1 mainly covers forms 1 and 2 work whereas paper 2 covers mainly forms 3 and 4 work.

TABLE 4:10: KCSE MATHEMATICS RESULTS ANALYSIS FOR SAMPLED SCHOOLS BEFORE SMASSE AND AFTER SMASSE.

		12	11	10	9	8	7	6	5	4	3	2	1		
	ENTRY	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	MS	MG
2002	457	5	6	4	20	20	22	35	45	49	98	98	55	4.018	D+
2003	417	11	3	8	13	18	28	31	35	45	66	93	66	4.060	D+
2004	601	6	6	12	14	16	31	38	35	52	97	129	165	3.418	D
2005	712	11	5	19	13	21	25	42	39	59	111	181	186	3.372	D
2006	569	10	9	17	12	15	23	33	36	36	102	145	131	3.562	D+

Source: KCSE results from 2002- 2006

Percentage of students who scored C+ and above

Year	Number	Percentage
2002	77	16%
2003	81	19%
2004	85	14%
2005	94	13%
2006	86	15%

Two years before SMASSE was introduced the percentage of students who score C+ and above was 16% and 19% respectively. Two years after the introduction of SMASSE INSET the percentage of students who had scored a grade of C+ and above was 13% and 15% respectively. This clearly shows that the quality grades have declined with the introduction of SMASSE INSET.

Analysis was further done to determine the effect of SMASSE INSET on students' performance as per the school category. Analysis was done on Boys secondary school, girls' secondary school and mixed schools. The results are shown in Table 4.11 (p. 81). Two years before SMASSE INSET was introduced, the performance was 4.785 (C-) and 4.967 (C-) respectively. Two years after SMASSE INSET was introduced the performance was 4.546 (C-) and 4.98 (C-). The analysis shows that there is no much difference in performance before and after SMASSE INSET was introduced. The mean grade over the years has almost remained the same. Table 4.12 (p. 82) shows the percentage of students who scored C+ and above. In terms of the quality grades, the students who scored C+ and above two years before SMASSE was 25.1% and 27.2% respectively. Two years after SMASSE was introduced, the percentage of students who scored C+ and above was 28.7% and 31.5% respectively. The analysis shows that there is a slight improvement of the quality grades in Boys' schools with the introduction of SMASSE INSET.

Table 4.11: KCSE MATHEMATICS RESULTS ANALYSIS FOR SAMPLED SCHOOLS AS PER SCHOOL CATEGORY

YEAR	SCHOOL	ENTRY	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	MS	MG
2002	Boys sch	219	5	4	3	14	14	15	19	27	25	48	33	12	4.785	C-
	Girls sch	126	0	1	0	4	4	7	9	9	122	27	37	16	3.540	D+
	Mixed sc.	112	0	1	1	2	2	0	7	9	12	23	28	27	3.054	D
2003	Boys sch	180	9	1	4	8		17	18	22	26	25	25	15	4.967	C-
	Girls sch	86	1	1	2	3		7	8	6	11	21	17	4	4.441	D+
	Mixed sc.	151	1	1	1	2		4	5	7	8	20	51	47	2.762	D
2004	Boys sch	271	6	5	9	10		16	24	19	24	45	55	48	4.159	D+
	Girls sch	111	0	1	1	2		7	7	7	12	17	19	36	3.189	D
	Mixed sc.	219	0	0	2	2		8	7	9	16	35	55	81	2.616	D
2005	Boys sch	251	9	4	11	9		16	25	25	21	33	39	46	4.546	C-
	Girls sch	225	1	1	6	3		4	9	10	23	45	69	50	3.062	D
	Mixed sc.	236	1	0	2	1		5	8	4	15	33	73	90	2.419	D-
2006	Boys sch.	200	10	7	14	10		11	15	16	11	28	39	28	4.98	C-
	Girls sch.	199	0	2	2	2		7	15	15	18	47	49	40	3.221	D
	Mixed sc.	170	0	0	1	0		5	3	5	7	27	57	63	3.294	D-

SOURCE: KCSE RESULTS 2002-2006

Table 4.12: Percentage of students who scored C+ and above

Year	School category	Entry	Number	percentage
2002	Boys sch Girls sch Mixed sch.	219 126 112	55 16 6	25.1% 12.7% 5.36%
2003	Boys sch Girls sch Mixed sch.	180 86 151	49 19 13	27.1% 21.1% 8.60%
2004	Boys sch Girls sch Mixed sch.	271 111 219	56 13 16	20.7% 11.7% 7.3%
2005	Boys sch Girls sch Mixed sch.	251 225 236	72 19 13	28.7% 8.40% 5.50%
2006	Boys sch Girls sch Mixed sch.	200 199 170	63 15 8	31.5% 7.50% 4.70%

Two years before SMASSE INSET the mean grades for girls 'schools were 3.540 (D+) and 4.441 (D+) respectively. Two years after SMASSE INSET, the mean grades for girls were 3.062 (D) and 3.221 (D) respectively.

The analysis clearly shows that there is a decline in girl's performance with the introduction of SMASSE INSET. The introduction of SMASSE INSET had a negative impact on the performance of girls' schools in Bomet district. The percentage of students who had C+ and above before the introduction of SMASSE INSET was 12.7% and 22.1% respectively. Two years after the SMASSE INSET was introduced, students who had a grade of C+ and above were 8.4% and 7.5% respectively. This clearly suggests that there is a decline of quality grades with the introduction of SMASSE INSET. The decline in the quality grades can partly be attributed to the introduction of the new curriculum which was examined for the first time in 2006.

Two years before the SMASSE INSET the mean grades of students were 3.054 (D) and 2.762 (D) respectively. Two years after SMASSE, the mean grades in mixed school were 2.419 (D-) and 2.294 (D-) respectively. The analysis clearly shows that there is a decline in mathematics performance in mixed schools with the introduction of SMASSE INSET. The percentage of students who scored C+ and above before the introduction of SMASSE INSET were 5.36% and 8.60% respectively.

Two years after SMASSE INSET was introduced the percentage of students who scored C+ and above were 5.50% and 4.70% respectively.

This clearly shows that there is a decline in quality grades with the introduction of SMASSE INSET.

According to the Kenya National Examinations report released on February 28 (2008), the students overall mean in mathematics was 19.74%. A total of 274, 120 students sat for mathematics exam in 2007. A total of 125, 248 female candidates sat for the exam and had a mean of 15.74% whereas a total of 148, 872 male candidates sat for the exam and had a mean of 23.10. The analysis shows that mathematics is the poorly performed subject out of the twenty 22 subjects that were offered in the curriculum. The results are as shown in Table 4.13 (p. 85)

On further analysis of the data collected, one way analysis of variance (ANOVA) and T-test were used to find out whether there were significant differences in students' performance before SMASSE INSET and after SMASSE INSET. The details of the findings are presented in Tables 4.14 and 4.15 (on pages 86 & 87) respectively. The hypothesis was HO_2: There is no significant difference between SMASSE INSET and students' performance in mathematics.

Table 4.13 2007 overall candidates means performance by subject and gender

		OVERALL		FEMALE		MALE	
	SUBJECT CODE & NAME	NO. SAT	MEAN %	NO. SAT	MEAN %	NO. SAT	MEAN %
1	101 English	272,897	39.70	124,718	39.65	148,179	39.74
2	102 Kiswahili	272, 992	45.76	124,745	45.53	148,247	45.95
3	**121 Mathematics**	**274,120**	**19.74**	**125,248**	**15.74**	**148,872**	**23.10**
4	211 Biology	246, 662	41.95	118,745	38.99	127,917	44.70
5	212 Physics	83.387	41.32	23,788	39.04	59,599	42.23
6	213 Chemistry	268,001	25.38	123,078	22.65	144,923	27.69
7	216 Biology for the blind	37	24.84	12	24.17	25	25.16
8	311 History & Gov't	164,695	50.93	72,913	46.31	91,782	54.60
9	312 Geography	103,252	46.82	42,575	42.74	60,677	49.66
10	313 CRE	165.751	62.40	93,445	62.40	72,306	62.39
11	314 IRE	7,120	61.41	2,611	59.38	4,509	62.58
12	315 HRE	7	48.43	3	64.67	4	36.25
13	414 Home science	11,336	49.37	10,554	49.91	782	42.05
14	412 Art and Design	986	58.67	342	60.00	644	57.95
15	413 Agriculture	120,107	43.67	52,135	40.54	67,972	46.06
16	450 Aviation techn.	53	54.08			53	54.08
17	451 Computer stud	4,770	54.93	2,151	51.66	2,619	57.61
18	501 French	2,136	47.28	1,341	46.28	795	48.97
19	502 German	418	59.18	307	60.20	111	56.32
20	503 Arabic	1,134	67.49	339	64.58	795	68.73
21	511 Music	1,300	53.08	737	53.79	563	52.13
22	565 Business studies	117,395	55.14	52,638	51.49	64,757	58.11

Source: Kenya National Examinations council (2008).

Table 4.14: One-way ANOVA for KCSE results before SMASSE and After SMASSE

		Sum of squares	Df	Mean Square	F	Sig.
Boys' results	Between groups Within groups	638.021 55469.792	1 46	638.021 1205.865	.529	.471
Girls' results	Between groups Within groups	5250.083 51695.833	1 46	5250.083 1123.822	4.672	.036
Mixed schools' results	Between groups Within groups	768.000 50293.917	1 46	768.000 1093.346	.702	.406
Overall Results	Between groups Within groups	16837.521 245109.0	1 46	16837.521 5328.456	3.160	.082

Tables 4.14 and 4.15 show the results of the inferential test undertaken and they indicate that on the overall, the differences are not significant at 0.05 significant level. This means that indeed, there is no significant difference between SMASSE INSET and students' performance in mathematics.

Table 4.15: Independent Samples t-test for KCSE Results Before SMASSE and after SMASSE.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
									95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
Boys' Results	Equal variances assumed	5.913	.019	-.727	46	.471	-7.2917	10.02441	-27.46975	12.88642
	Equal variances not assumed			-.727	41.434	.471	-7.2917	10.02441	-27.52993	12.94660
Mixed Schools' Results	Equal variances assumed	5.218	.027	-.838	46	.406	-8.0000	9.54527	-27.21363	11.21363
	Equal variances not assumed			-.838	37.920	.407	-8.0000	9.54527	-27.32473	11.32473
Girls' Results	Equal variances assumed	7.793	.008	-2.161	46	.036	-20.9167	9.67739	-40.39624	-1.43709
	Equal variances not assumed			-2.161	35.153	.038	-20.9167	9.67739	-40.55975	-1.27358
Overall Results	Equal variances assumed	.029	.865	-1.778	46	.082	-37.4583	21.07221	-79.87449	4.95782
	Equal variances not assumed			-1.778	45.263	.082	-37.4583	21.07221	-79.89315	4.97648

Since the P- value (0.082) > 0.05, the null hypothesis was therefore accepted. When the boy's results were analyzed separately, the p- value (o.471) > 0.05. The null hypothesis was accepted. This means that there is no significance difference between the SMASSE INSET and boys' performance in mathematics. Analysis of girls results gave a P- value (0.036) < 0.05. The null hypothesis was therefore rejected. This means that there is a significant difference between SMASSE INSET and girls' performance in mathematics. The drop in girls' performance as shown by the mean score after SMASSE INSET was introduced is actually significant.

The analysis of students' results in mixed schools gave a P- value (0.406) >0.05. The null hypothesis was accepted. This means that there is no significant difference between SMASSE INSET and student's performance in mathematics.

The findings from this study are similar to the KNEC report (2006) which revealed that the performance of students in KCSE mathematics examinations has been declining from 2002 up to 2005. The report revealed that the syllabus coverage is inadequate. Seemingly this scenario adversely affects topics that appear at the end of the syllabus. Such topics are navigation, linear programming and calculus. The report recommends that teachers should strive to cover the whole syllabus within the allocated time and have ample time for revision so as to improve performance in the subject. From the KNEC report and the research findings, it seems the implementation of SMASSE INSET has not assisted in the adequate coverage of the mathematics syllabus. Poor syllabus coverage in mathematics could be one of the contributory factors to poor performance in this subject.

In the questionnaires that were administered to teachers who had undergone SMASSE INSET, a number of them (45%) pointed out that full implementation of SMASSE project does not assist in syllabus coverage because of too many practical activities that are involved. Mathematics syllabus is at the same time very broad. Our curriculum is examination oriented whereas SMASSE approach is practical oriented. The examination papers in mathematics are not practical oriented. It seems therefore that there is a contrast between the SMASSE approach and the examination council. The SMASSE approach does not emphasize the performance in mathematics but its main emphasis is on student-centred teaching and ASEI/ PDSI approach to teaching.

What is measured by the KNEC test papers is what matters. The general public, as well as those professionally involved in education, seems genuinely interested in finding out what cognitive skills and knowledge students have acquired in school. Since affective and manipulative outcomes of a school are never measured or tested, teachers' efforts are not directed to affective or manipulative teaching. Affective or manipulative domains have significant impact on academic performance and should therefore be given attention and equal weight. The emphasis should be on the development of a whole person.

The research findings also revealed that whenever a teacher is teaching mathematics and another science subject, he/ she tend to concentrate more on the science subject at the expense of mathematics. This is because all the science subjects have practical activities which have been suggested for the teacher.

However, for mathematics, there are rarely any practical activities suggested for the teacher. Teaching mathematics therefore demands a lot of creativity.

Mathematics teachers have to come up with their own practical activities unlike their science counterparts. Mathematics is given a superficial treatment unlike other science subjects. It is a high time the ministry look into how the mathematics teachers can be motivated so as to put extra effort in their teaching.

SMASSE approach emphasizes a lot of improvisation in the teaching of mathematics and science. As much as a teacher can improvise from his/ her environment, there are certain teaching/ learning resources which cannot be improvised. Such resources include calculator, mathematical tables, geometrical instruments, graph papers and textbooks. Some head teachers have capitalized on the idea of improvisation at the expense of spending money to buy the essential teaching/ learning resources.

Mathematics teachers should encourage their students to have a positive self- image in mathematics. Negative self- image acts as a block to thinking even if a student has the ability to perform very well in mathematics. Success in mathematics requires a lot of practice and the right attitude.

In mathematics, learners are expected to master the lower order skills before being introduced to the higher order ones. If the lower skills are not well mastered, then the hierarchical nature of mathematics makes the mastery of higher order skills difficult. It is for this reason that teachers need to diagnose the students' weakness early and monitor their progress as they move from one form to the other.

Teachers should have regular diagnostic tests aimed at finding out the problems students have at every stage in mathematics because in mathematics, it is a matter of building blocks and if one block is missed out, such a problem cannot be solved easily during the next stage.

According to Maritim (2001), one reasonable hypothesis is that the low performance in mathematics is due in part to the curriculum in use. He asserts that while we are able to blame student's external and internal factors on poor performance in mathematics, the issue that we have all ignored is the contribution of the curriculum.

The questions we should ask ourselves are:

1. Why students of Kenya are performing poorly in mathematics? (Table 4.13 p. 84).
2. Do the people of this country lack mathematical abilities? In KCE and KACE examinations, mathematics was still poorly done (Eshiwani, 1986).
3. Is there a problem with the curriculum?

During the Cambridge school certificate days, the teaching of mathematics was in three separate parts, namely: Algebra, Arithmetic and Geometry. When the teaching was in separate parts the student's performance was high. When the three parts were combined into one, low performance emerged. The problem could be related to:

1. Lack of the sequence in presentation.

2. Children failure to build conceptualize framework when the mathematical parts are combined, that is, children failure to build sequential and cumulative knowledge. The government should therefore re-consider the present mathematics curriculum and revert to separate teaching of Algebra, Arithmetic and Geometry.

4.4 SMASSE INSET and teacher's teaching Approach and Methodology

The overall goal of the SMASSE INSET was to upgrade the capability of young Kenyans in mathematics and sciences. In this study questionnaires were administered to students so as to get information on what goes on in classroom during a mathematics lesson.

Students were used to assess their teachers on the ASEI movement and the PDSI approach to lesson innovation. The aim was to gauge the teachers' implementation of the new skills acquired and the new approach to teaching of mathematics.

There were 15 items in students' questionnaire. The analysis of all the 15 items gave a grand mean of 4.1303. The results are shown in Table 4.16 (p. 94). The results clearly show that teacher's teaching approaches have greatly improved as a result of SMASSE INSET. There were only three items which showed some weaknesses in the side of teachers. These are items number 21, 22 and 28. Mathematics teachers should be very innovative and creative in coming up with the practical activities for the lesson.

Improvisation should be practiced where possible when coming up with the practical activities for the lesson. Through improvisation the teacher is able to demystify conventional experiments by scaling down experiments, thereby relating mathematics to real life situations. Teachers should focus on instructional strategies that will support meaningful learning and make lessons interesting to the learners.

Mathematics teachers should incorporate the student's ideas when teaching. Students will be motivated and they will always want to look for more ideas on the subject. Questions posed by the students should first of all be directed to the whole class. Teachers should not rush to answering students questions in mathematics. By redirecting the questions to the whole class, students will be made to think and become active in the learning process.

Table 4.16: Analysis of students' response to the teaching in the classroom.

Item number	Statement	N	Sum	Mean
16.	Mathematics teacher starts a lesson by reminding us of what was taught in the previous lesson	371	1637.00	4.4124
17.	Mathematics teachers explains what is to be covered during the lesson	371	1514.00	4.0809
18.	Mathematics teachers usually demonstrates to help explain some ideas and concepts	371	1589.00	4.2830
19.	Mathematics teachers adequately guides us in the use of mathematics materials and Resources	371	1612.00	4.3450
20.	Mathematics teachers use the locally available materials to teach us mathematics	371	1483.00	3.9973
21.	Mathematics teachers give us experiment/ practical activities when teaching us mathematics.	371	1333.00	3.5930
22.	Mathematics teachers use our ideas and suggestions when teaching	371	1253.00	3.3774
23.	Mathematics teachers assist us in group work	371	1498.00	4.0377
24.	Mathematics teachers allow us to do work on the chalk board	371	1555.00	4.1914
25.	Mathematics teachers give a summary of what has been taught in the lesson	371	1517.00	4.0889
26.	Mathematics teachers assist students with difficulties in understanding	371	1578.00	4.2534
27.	mathematics teachers mark assignments	371	1523.00	4.1051
28.	Mathematics teachers involve students when answering our questions	371	1467.00	3.9542
29.	Mathematics teachers encourage us to perform well	371	1740.00	4.6900
30.	Mathematics teacher like and enjoy teaching the subject	371	1686.00	4.5445
			22,985	4.1303

$\bar{\bar{X}}$= 4.1303

$\bar{\bar{X}}$= Grand mean (mean of means)

Table 4.17 (p. 97) gives the analysis of students' understanding about teaching in classroom as per gender. The results in the table show that generally, there is an improvement of teacher's teaching approach and methodology.

In item number 20, the mean for males is 3.868 and that of females is 4.133. This shows that the mean of females is higher than that of males. This suggests that female students rated their teachers highly as far as the implementation of SMASSE in the classroom is concerned. Mathematics teachers in schools seem to adequately guide the female students more in the use of mathematics materials and resources as compared to their male counter parts.

The analysis of item 20 seems to point out that teachers tend to concentrate more on practical activities when teaching girls' schools. This could be because girls are thought to be inferior in mathematics and therefore are given much attention. Boys are generally believed to be good in mathematics and therefore do not receive a lot of attention as compared to girls.

In item number 22, boys had a mean of 3.426, whereas girls had a mean of 3.326. For this item, boys rated their teachers higher when it comes to using students' ideas and suggesting while teaching in class. This item has the lowest mean when compared to the others. This seems to suggest that the teacher is still the main actor in class and rarely involve students in class. Boys seem to be better than girls in this item. Their ideas and suggestions are often used more when compared to the girls.

In item number 21, the mean for males is 3.611 and that of females is 3.575. This item is rated among the least of all the 15 items. This suggests that mathematics teachers are not giving enough experiments/ practical activities when teaching mathematics. Both gender seems to rate their teachers almost equally on this item.

Table 4.18 (p. 98) gives a summary of the means of all items as per gender. The grand mean of males is 4.087 whereas that of females is 4.175. The analysis of the girl's response was higher than that of boys. This suggests that generally, the girls rated their teachers highly as far as the implementation of SMASSE in the classroom is concerned.

The results in Table 4.18 suggest that during mathematics lessons, girls seem to be given more attention as compared to boys. The fact that their grand mean (4.175) is higher than that of boys (4.087) could be attributed to the generally held belief that girls are not endowed in mathematics. Because of this belief, they tend to receive much attention. Since boys are generally believed to be good in mathematics, teachers do not concentrate on a lot of practical activities when teaching them.

The results in table 4.18 were subjected to the t- test to determine whether the difference in the means were statistically significant. The results are shown in table 4.19 (p. 99).

The t- test gave a p- value of 0.410. Since the p- value (0.410) > 0.05, it shows that the differences in means of males and females are not statically significant. This means that SMASSE INSET has improved the teachers teaching approach and methodology.

The rating of teachers about teaching in classroom by both genders is not statistically different.

Table 4.17: An analysis of students' understanding about teaching in class room as per gender

Item number	Statement	Gender	N	Mean $\bar{x}$
16	Mathematics teacher starts a lesson by reminding us of what was taught in the previous lesson	Male Female	190 181	4.411 4.414
17	Mathematics teachers explains what is to be covered during the lesson	Male Female	190 181	4.026 4.138
18	Mathematics teachers usually demonstrates to help explain some ideas and concepts	Male Female	190 181	4.205 4.365
19	Mathematics teachers adequately guides us in the use of mathematics materials and Resources	Male Female	190 181	4.300 4.395
20	Mathematics teachers use the locally available materials to teach us mathematics	Male Female	190 181	3.868 4.133
21	Mathematics teachers give us experiment/ practical activities when teaching us mathematics.	Male Female	190 181	3.611 3.575
22	Mathematics teachers use our ideas and suggestions when teaching	Male Female	190 181	3.426 3.326
23	Mathematics teachers assist us in group work	Male Female	190 181	3.900 4.182
24	Mathematics teachers allow us to do work on the chalk board	Male Female	190 181	4.211 4.171
25	Mathematics teachers give a summary of what has been taught in the lesson	Male Female	190 181	4.032 4.149
26	Mathematics teachers assist students with difficulties in understanding	Male Female	190 181	4.205 4.304
27	mathematics teachers mark assignments	Male Female	190 181	4.026 4.188
28	Mathematics teachers involve students when answering our questions	Male Female	190 181	3.926 3.983
29	Mathematics teachers encourage us to perform well	Male Female	190 181	4.668 4.702
30	Mathematics teacher like and enjoy teaching the subject	Male Female	190 181	4.489 4.602

Table 4.18: Further analysis of student understanding about teaching in classroom as per gender

	Statement	N	Mean of males $\bar{x}_1$	Mean of females $\bar{x}_2$
16	Mathematics teacher starts a lesson by reminding us of what was taught in the previous lesson	371	4.411	4.414
17	Mathematics teachers explains what is to be covered during the lesson	371	4.026	4.138
18	Mathematics teachers usually demonstrates to help explain some ideas and concepts	371	4.205	4.365
19	Mathematics teachers adequately guides us in the use of mathematics materials and Resources	371	4.300	4.395
20	Mathematics teachers use the locally available materials to teach us mathematics	371	3.868	4.133
21	Mathematics teachers give us experiment/ practical activities when teaching us mathematics.	371	3.611	3.375
22	Mathematics teachers use our ideas and suggestions when teaching	371	3.426	3.326
23	Mathematics teachers assist us in group work	371	3.900	4.182
24	Mathematics teachers allow us to do work on the chalk board	371	4.211	4.171
25	Mathematics teachers give a summary of what has been taught in the lesson	371	4.032	4.149
26	Mathematics teachers assist students with difficulties in understanding	371	4.205	4.304
27	mathematics teachers mark assignments	371	4.026	4.188
28	Mathematics teachers involve students when answering our questions	371	3.926	3.983
29	Mathematics teachers encourage us to perform well	371	4.668	4.702
30	Mathematics teacher like and enjoy teaching the subject	371	4.489	4.602
			$\bar{\bar{X}}_1 = 4.087$	$\bar{\bar{X}}_2 = 4.175$

Key:

$\bar{\bar{X}}_1$= Grand mean of Males $\bar{\bar{X}}_2$= Grand mean of Females

Table 4.19: Further analysis of students' understanding about teaching in classroom as per gender

	t-test for Equality of means		
	t	Df	Sig. (2-tailed
Equal variances Assumed	-0.836	28	0.410
Equal variances Not assumed	-0.836	27.982	0.410

Table 4.20 (p. 101) shows the analysis of the students' understanding about teaching in classrooms as per school category. This was done to find out whether the implementation of SMASSE was uniform in all the schools. Generally, all the three categories of schools rated their teachers highly as far as the implementation of SMASSE in classrooms is concerned.

In item number 20, the mean of boy's school is 3.030, that of girls' school is 4.182 and that of mixed schools is 4.182. This shows that girls' schools rated their teachers highly when compared to boys' schools and mixed schools. This seems to indicate that teachers in girls' schools are keen in implementing the new teaching approaches and methodologies as compared to those teaching either in boys' schools or mixed schools.

In item number 21, the mean for boys' schools is 3.671, that of girls' schools is 3.564 and that of mixed schools is 3.575. The three means are very close. This shows that in all the three categories of schools, mathematics teachers don't give a lot of experiments/ practical activities when teaching mathematics.

Table 4.21 (p.102) gives a summary for the means of the items as per the school category. The grand mean for boys' schools is 4.120, that of girls' schools is 4.187 and that of mixed school is 4.100. The rating of the implementation of SMASSE was the highest in the girls' schools.

The results in Table 4.21 were subjected to one way ANOVA so as to determine whether the differences in means for the three categories of schools were statistically significantly. The results are as shown in table 4.22(p. 101). One way ANOVA gave the p- value as 0.661. Since the p- value (0.661) > 0.05, it shows that the differences in means in the three categories of schools are not statistically significant. This seems to suggest that SMASSE INSET has improved the teacher's teaching approaches and methodologies in all the three categories of schools.

Table 4.20: An analysis of students' understanding about teaching in classroom as per school category

Item number		School category	N	Mean $\bar{x}$
16	Mathematics teacher starts a lesson by reminding us of what was taught in the previous lesson	Boy's School Girls School Mixed school	82 110 179	4.268 4.318 4.536
17	Mathematics teachers explains what is to be covered during the lesson	Boy's School Girls School Mixed school	82 110 179	4.000 4.200 4.045
18	Mathematics teachers usually demonstrates to help explain some ideas and concepts	Boy's School Girls School Mixed school	82 110 179	4.256 4.373 4.240
19	Mathematics teachers adequately guides us in the use of mathematics materials and Resources	Boy's School Girls School Mixed school	82 110 179	4.293 4.318 4.385
20	Mathematics teachers use the locally available materials to teach us mathematics	Boy's School Girls School Mixed school	82 110 179	3.939 4.182 3.911
21	Mathematics teachers give us experiment/ practical activities when teaching us mathematics.	Boy's School Girls School Mixed school	82 110 179	3.671 3.564 3.575
22	Mathematics teachers use our ideas and suggestions when teaching	Boy's School Girls School Mixed school	82 110 179	3.768 3.482 3.134
23	Mathematics teachers assist us in group work	Boy's School Girls School Mixed school	82 110 179	3.707 4.218 4.078
24	Mathematics teachers allow us to do work on the chalk board	Boy's School Girls School Mixed school	82 110 179	4.463 4.227 4.045
25	Mathematics teachers give a summary of what has been taught in the lesson	Boy's School Girls School Mixed school	82 110 179	3.927 4.082 4.168
26	Mathematics teachers assist students with difficulties in understanding	Boy's School Girls School Mixed school	82 110 179	4.232 4.236 4.162
27	mathematics teachers mark assignments	Boy's School Girls School Mixed school	82 110 179	3.927 4.145 4.162
28	Mathematics teachers involve students when answering our questions	Boy's School Girls School Mixed school	82 110 179	4.134 4.073 3.799
29	Mathematics teachers encourage us to perform well	Boy's School Girls School Mixed school	82 110 179	4.707 4.736 4.654
30	Mathematics teacher like and enjoy teaching the subject	Boy's School Girls School Mixed school	82 110 179	4.512 4.655 4.492

Table 4.21: Further analysis of students' understanding about teaching in classroom as per school category.

	Statement	Mean of **Boys** school ($\bar{X}_1$)	Means of **girls** school ($\bar{X}_2$)	Mean of **mixed** school ($\bar{X}_3$)
16	Mathematics teacher starts a lesson by reminding us of what was taught in the previous lesson	4.268	4.318	4.536
17	Mathematics teachers explains what is to be covered during the lesson	4.000	4.200	4.045
18	Mathematics teachers usually demonstrates to help explain some ideas and concepts	4.256	4.373	4.240
19	Mathematics teachers adequately guides us in the use of mathematics materials and resources	4.293	4.318	4.385
20	Mathematics teachers use the locally available materials to teach us mathematics	3.939	4.182	3.911
21	Mathematics teachers give us experiment/ practical activities when teaching us mathematics.	3.671	3.564	3.575
22	Mathematics teachers use our ideas and suggestions when teaching	3.768	3.482	3.134
23	Mathematics teachers assist us in group work	3.707	4.218	4.078
24	Mathematics teachers allow us to do work on the chalk board	4.463	4.227	4.045
25	Mathematics teachers give a summary of what has been taught in the lesson	3.927	4.082	4.168
26	Mathematics teachers assist students with difficulties in understanding	4.232	4.236	4.162
27	mathematics teachers mark assignments	3.927	4.145	4.162
28	Mathematics teachers involve students when answering our questions	4.134	4.073	3.799
29	Mathematics teachers encourage us to perform well	4.707	4.736	4.654
30	Mathematics teacher like and enjoy teaching the subject	4.512	4.655	4.492
Key: $\bar{\bar{X}}_1$= Grand mean of boy schools $\bar{\bar{X}}_2$= Grand mean of girls schools $\bar{\bar{X}}_3$= Grand mean of Mixed Schools		$\bar{\bar{X}}_1$=4.120	$\bar{\bar{X}}_2$=4.187	$\bar{\bar{X}}_3$=4.100

Table 4.22: One way ANOVA of students' understanding about teaching in classroom as per school category

	Sum Squares	df	Mean squares	F	Sig.
Between groups	0.121	2	.060	.418	.661
Within groups	6.057	42	.144		
total	6.178	44			

In all the categories of schools, the idea of teachers giving students practical activities in mathematics was rated very lowly. When a teacher perceives mathematics as an academic and he or she teaches only by a calculation of sums on the chalkboard, the students do not find fun in mathematics. Unless mathematics is made fun, students will not find it interesting. Interest motivates and energizes the student to develop and sustain the required level of concentration, a factor that is highly required in problem solving in mathematics.

In the classroom teaching, the learner should be the focus of attention and activities should be planned for the learner through the development of the ASEI lessons. In these lessons a bridge should be created to enable learners to relate and integrate practical activities with theoretical knowledge. In this approach, teaching is for the student and the emphasis is on teaching for understanding by actively engaging the learners in the construction of their own knowledge.

The relationship between gender of students and their response on teaching in classroom was subjected to chi- square tests.

The analysis reveals that the slight difference in students' responses for most of the responses were statistically not significant for the test items except only item 19 and 20. This implies that, generally girls and boys rated their teachers in a similar way. The details are in Table 4.23(p. 105). Chi- square test of relationship was also subjected to students' understanding on teaching in the classroom and school category. The details are shown in Table 4.24(pg 106).In general; the slight differences in students' responses as per the school category were statistically not significant. Only item 22 showed significant differences in students' responses. This suggests that all the students in different school categories generally rated their teachers in a similar way.

From the research findings that have been presented, it can be concluded that there is a significant relationship between the SMASSE INSET and teacher's teaching approaches and methodology. A teacher who has undergone SMASSE INSET is better equipped with skills and techniques on how to approach a topic from the perspective of the learners. The null hypothesis, HO_3 was therefore not accepted. The alternative hypotheses, HA_3: There is a significant difference between SMASSE INSET and teacher's teaching approach and methodology was accepted.

Table 4.23: Analysis of Chi- square tests of relationship between gender of students and their responses on teaching in classroom

	Statement	χ^2- value	Df	Sig.	Remarks	S or NS
16	Mathematics teacher starts a lesson by reminding us of what was taught in the previous lesson	6.051	4	0.195	P>0.05	NS
17	Mathematics teachers explains what is to be covered during the lesson	4.571	4	0.334	P>0.05	NS
18	Mathematics teachers usually demonstrates to help explain some ideas and concepts	9.356	4	0.053	P>0.05	NS
19	Mathematics teachers adequately guides us in the use of mathematics materials and Resources	12.244	4	0.016	P<0.05	S
20	Mathematics teachers use the locally available materials to teach us mathematics	9.602	4	0.048	P<0.05	S
21	Mathematics teachers give us experiment/ practical activities when teaching us mathematics.	1.858	4	0.762	P>0.05	NS
22	Mathematics teachers use our ideas and suggestions when teaching	4.196	4	0.380	P>0.05	NS
23	Mathematics teachers assist us in group work	6.741	4	0.150	P>0.05	NS
24	Mathematics teachers allow us to do work on the chalk board	3.137	4	0.535	P>0.05	NS
25	Mathematics teachers give a summary of what has been taught in the lesson	7.989	4	0.092	P>0.05	NS
26	Mathematics teachers assist students with difficulties in understanding	4.706	4	0.319	P>0.05	NS
27	mathematics teachers mark assignments	5.958	4	0.202	P>0.05	NS
28	Mathematics teachers involve students when answering our questions	0.615	4	0.961	P>0.05	NS
29	Mathematics teachers encourage us to perform well	6.144	4	0.189	P>0.05	NS
30	Mathematics teacher like and enjoy teaching the subject	4.425	4	0.352	P>0.05	NS

Key:

Df- degree of freedom
χ^2 -Chi- Square
S- Significant
NS- Not significant

Table 4.24: Analysis of chi- square tests of relationship between school category and students response on teaching in classroom

	Statement	χ^2- value	Df	Sig.	Remarks	S or NS
16	Mathematics teacher starts a lesson by reminding us of what was taught in the previous lesson	11.483	8	0.176	P>0.05	NS
17	Mathematics teachers explains what is to be covered during the lesson	6.112	8	0.635	P>0.05	NS
18	Mathematics teachers usually demonstrates to help explain some ideas and concepts	7.890	8	0.444	P>0.05	NS
19	Mathematics teachers adequately guides us in the use of mathematics materials and Resources	8.550	8	0.382	P>0.05	NS
20	Mathematics teachers use the locally available materials to teach us mathematics	7.821	8	0.451	P>0.05	NS
21	Mathematics teachers give us experiment/ practical activities when teaching us mathematics.	3.779	8	0.876	P>0.05	NS
22	Mathematics teachers use our ideas and suggestions when teaching	18.970	8	0.015	P<0.05	S
23	Mathematics teachers assist us in group work	12.636	8	0.125	P>0.05	NS
24	Mathematics teachers allow us to do work on the chalk board	10.720	8	0.218	P>0.05	NS
25	Mathematics teachers give a summary of what has been taught in the lesson	13.687	8	0.090	P>0.05	NS
26	Mathematics teachers assist students with difficulties in understanding	12.233	8	0.141	P>0.05	NS
27	mathematics teachers mark assignments	5.677	8	0.683	P>0.05	NS
28	Mathematics teachers involve students when answering our questions	9.690	8	0.287	P>0.05	NS
29	Mathematics teachers encourage us to perform well	4.369	8	0.822	P>0.05	NS
30	Mathematics teacher like and enjoy teaching the subject	9.347	8	0.314	P>0.05	NS

Key:

Df- degree of freedom

χ^2 - Chi- Square

S- Significant

NS- Not significant

4.5 Teachers' Experiences on SMASSE INSET

The aim of the study was to get the feedback from the mathematics teachers who had attended the SMASSE INSET. A total of 20 mathematics teachers were sampled for the study. A number of them were very co-operative and they were very much willing to fill the questionnaire. However, the few who were reluctant to fill the questionnaire accepted to have a direct face to face interview with the researcher.

Out of all the teachers who were involved in the study, 85% were males whereas only 15% were female teachers. This means that majority of the mathematics teachers in Bomet District are males. Fifty percent (50%) of the teachers were trained graduates, 40% were diploma teachers whereas 10% were S1 teachers. Thirty percent(30%) of the teachers had a teaching experience of over 12 years, 10% had a teaching experience of between 9-12 years, 35 % had a teaching experience of between 5-8 years and 25% had a teaching experience of between 1-4 years.

Half of the teachers (50%) had mainly taught all classes from form one to four, 20% had mainly taught forms one and two whereas 30% had mainly taught forms three and four.

Eighty five percent (85%) of the teachers interviewed attended all the four cycles of SMASSE INSET, 10% only attended one cycle whereas 5% attended three cycles.

From the questionnaire and interviews conducted the teachers pointed out that they were impressed by the following:

1. Actualization- planning and teaching as a group.
2. Practical approach of teaching mathematics.
3. Opportunity to share experience with colleagues.
4. Improvisation of teaching/ learning resources.

Among the things the teachers like least during the SMASSE INSET are:

1. Poor accommodation and lack of allowance
2. Preparation of SMASSE Lesson Plan.
3. Reporting the findings of group discussions
4. Taking sessions as a school system with strict rules
5. Time taken for SMASSE INSET was too long

The following are some of the things done by district trainers and District planning committee that made teachers either to like or dislike the teaching of mathematics:

1. Coming up with unrealistic practicals for teaching mathematics
2. Participation of trainers during the plenary sessions was very interesting.
3. New approach made the teaching of mathematics interesting
4. Lack of allowances and poor facilities for accommodation
5. Assumptions that the rest of the teachers are incompetent.

After undergoing SMASSE INSET teachers noted that they now put a lot of effort in the teaching of mathematics though there is minimal increase in performance. Some suggested that they now put a lot of effort in their teaching since the attitude of students has improved.

There is now full participation of the learning process by the students. 90% of the teachers pointed out that there is a difference between a teacher who has undergone SMASSE INSET and the one who has not.

SMASSE compliant teacher can come up with hands on activities which call for students' participation and involvement in the teaching/ learning process. Ten percent (10%) of the teachers noted that there is no difference between a teacher who has undergone SMASSE INSET and the one who has not because the teacher's attitude may not have been changed by the INSET.

The things that have most influenced the teaching of mathematics after undergoing SMASSE INSET are as follows:

1. Efficiency in planning for teaching
2. Improvisation of teaching/ learning resources
3. Involvement of learners in the teaching/ learning process
4. Practical teaching of mathematics

Fifty percent (50%) of the teachers interviewed pointed out that the SMASSE INSET cycles that they have attended are not enough to equip them with modern and more innovative mathematics teaching approaches and methodology.

Most of the teachers are not computer literate. 50% of the teachers said the SMASSE cycles attended are enough though they can still be revisited.

Fifty five percent (55%) of the mathematics teachers interviewed pointed out that the SMASSE INSET has enabled them to complete the mathematics in good time. This is because the student's participation enables the teacher to cover a wide area.

Forty five percent (45%) of the mathematics teacher noted that SMASSE INSET has not enabled them to cover the syllabus in good time. This is because full SMASSE approach has a lot of practical activities which consume time.

Thirty percent (30%) of the teachers noted that the ten days for each SMASSE INSET cycle were not sufficient to cover all the topics given adequately, more time should be given to actualization. However, 70% of the teachers said the ten days for each SMASSE INSET were sufficient.

Teachers suggested the following measures of improving and sustaining the SMASSE INSET:

1. Motivation of trainees financially by giving them allowances.
2. Newly employed teachers should be in-serviced from cycle 1.
3. Good accommodation should be provided for the trainees.
4. SMASSE INSET should be done outside the home district
5. SMASSE should be incorporated into the curriculum in teacher training colleges and institutions.

6. Improve recognition certificate by taking proficiency exams at the end of the SMASSE INSET.
7. Symposium for mathematics teachers should be held regularly.

Teachers suggested the following considerations to be put in place when planning for some of the mathematics in-service courses in future:

1. Involve teachers since they are the agents of change
2. Exchange of trainees from different places other than the ones from the home district
3. Areas of difficulty to students should be identified in advance
4. Create more INSET centres and equip them.
5. Teachers willing to attend the in-service should apply instead of being made to be mandatory for all the mathematics teachers to attend.

4.6 Summary

In this chapter the impact of SMASSE INSET on students' attitude towards mathematics, students' performance in mathematics and teachers teaching approaches and methodology were analyzed. It came out clearly that SMASSE INSET has improved the students' attitudes towards mathematics. SMASSE INSET has not resulted in the improved performance in mathematics. It was noted that the teacher's teaching approaches and methodology has improved as a result of SMASSE INSET.

The three hypotheses were tested to find out whether there was any significance difference between the independent variables, SMASSE INSET and the dependent variables, the students' attitudes towards mathematics, students' performance in mathematics and students' performance in mathematics and teachers teaching approach and methodology.

The next chapter will now discuss these findings, relate them to the SMASSE INSET, draw conclusions and make the necessary recommendations.

CHAPTER FIVE

5.0 SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter will revisit the research objectives and hypotheses outlined in chapter one, discuss each one of them and draw conclusion.

The main objective of this study was to investigate the impact of SMASSE INSET on students' attitude change and performance in mathematics in secondary schools in Bomet district. The independent variable for the study was SMASSE INSET whereas the dependent variables were students' attitudes towards mathematics and performance in mathematics. Data for this study was obtained through the use of students' questionnaire and teachers' questionnaire.

Summary of the main findings

5.2 SMASSE INSET and Students' attitude

The first research question was: **Does SMASSE INSET have any impact on students' attitudes towards mathematics?** The hypothesis that was tested in this regard was: HO_1: There is no significant difference between SMASSE INSET and students' attitudes towards mathematics. The analysis of the responses to the questionnaire test items shows that there is marked improvement of students' attitude after SMASSE INSET. Thus the hypothesis was not accepted.

The findings revealed that even though the general attitude of the students towards mathematics has improved, there are areas that need some further improvement.

Quite a number of the students in boys' boarding schools, girls' boarding schools and mixed schools do not have more confidence to deal with mathematics than in their ability to deal with other academic subjects. Majority of the students have not developed good mathematical problem solving since most of them expressed their inability to deal with new unfamiliar mathematical problems.

The findings also revealed that students in girls' boarding schools had a marked improvement in terms of the attitude towards mathematics as compared to students in boys' schools or mixed school. The school setting which reinforces fear of mathematics in girls should attempt to remove this fear. Teachers need to constantly point out that learning mathematics is not a function of sex and that girls are entering into the previously male dominated field like engineering architecture, medicine and others. Only then can we completely shatter the myth of mathematics as a male affair.

The results from this study suggests the need for teachers to develop positive relations with students ,to stress classroom activities which involve active teaching /learning process and to engage students meaningfully in mathematics ,so that a fruitful and satisfying result is assured.

5.3 SMASSE INSET and Performance In Mathematics

The second objective of the study was:

To determine whether SMASSE INSET has improved the performance in mathematics. This also involved the testing of the hypothesis: HO_2: there is no significant difference between SMASSE INSET and performance in mathematics. Using the one-way ANOVA or t- test, the study revealed that overally; there is no significant difference between SMASSE INSET and mathematics performance.

However when the performance of girls' schools was analyzed using one- way ANOVA or t- test, the study revealed that there is significant difference between SMASSE INSET and mathematics performance, at 0.05 significant levels. This implies that girls' schools never benefited from SMASSE INSET more than boys schools or mixed schools in terms of improved performance. As expected, the SMASSE INSET was supposed to result in an improved performance in mathematics. There seems to be a downward trend in girls' mathematics performance as a result of the introduction of the SMASSE INSET.

5.4 SMASSE INSET and Teacher's Teaching Approach and methodology

The third objective of the study was:

To determine whether SMASSE INSET has improved the teaching approaches and methodology. This involved the testing of the hypothesis; HO_3: There is no significant difference between SMASSE INSET and teachers' teaching approaches and methodology. The study revealed that there is general improvement in the teachers' teaching approach and methodology after undergoing the SMASSE INSET. Thus the hypothesis was rejected.

The study also revealed that even though there is general improvement in the teacher's teaching approaches and methodology, there are areas that need urgent corrective measures. Quite a number of the students pointed out that their mathematics teachers do not give them experiments or practical activities when teaching mathematics.

Teachers should embrace the ASEI/ PDSI approach to teaching mathematics. The teacher in the classroom should spend more time preparing his/ her lesson, taking into account students' mathematical background in terms of cognitive development and language level. As the teacher plans his/ her lesson, he / she must also consider the resource materials he/ she will use and the applicability of the teaching aids to be used. Teaching should be in steps, the lesson building up with students actively involved. Illustrations, examples and demonstrations should be given in relation to the experiences and the environment of the child. Mathematics teachers should endeavour to prepare many resource materials for learning. Teaching aids may not be useful unless they are properly integrated in a lesson. They are most useful if the learners make their own models using given instructions.

5.5 Conclusion

This study established that the students' attitude towards mathematics has greatly improved as a result of SMASSE INSET. The SMASSE INSET has provided students with opportunities to develop key competencies such as problem- solving, analysis, synthesis and application of relevant information.

The study found out that teacher's teaching approach and methodology have greatly improved as a result of SMASSE INSET. Teachers have now started developing more effective teaching and learning methodologies.

They have also developed effective teaching/ learning materials which have made the teaching of mathematics to be practically oriented.

Despite the positive attitudes developed by students and the new teaching approaches which have been adopted by the teachers, the performance in mathematics is still very low. It is hoped that with positive attitude which has been developed by the students, the performance of students in mathematics is expected to improve gradually.

To sustain and maintain the SMASSE project, there is need to incorporate it in the curriculum for teachers' training colleges and institutions since it is a very important innovation.

5.6 Recommendations

From the research findings and interviews conducted, the following are recommended:

(1) Since SMASSE INSET is a very important innovation, there is need to incorporate the whole of SMASSE programme into the curriculum at teachers training colleges and universities. Fresh graduands should be SMASSE compliant as they leave their training institutions. INSET should only be introduced as a way of sharpening and reinforcing the teacher's skills and competencies in teaching mathematics.

(2) The Teachers Service Commission should employ more mathematics teachers. Full SMASSE implementation is very demanding on the side of the teachers. Teachers do not give regular assignments in mathematics owing to the large number of students.

The idea of every teacher having a minimum of 27 lessons per week is not applicable to mathematics and sciences. These subjects demand a lot of adequate preparations and planning. When the teacher is overloaded, there are little preparations expected from such a teacher. Moreover, the idea of marking students' work on a daily basis is not possible.

(3) Examinations structure also need to be reviewed and if necessary changed. Students assess education in terms of success in examinations.

Teachers recognizing the importance of the external examination to the individual student are constrained to relate their teaching to an examination which can test only a narrow field of the students' interest and capacities and so inevitably neglect the qualities which are more important though less tangible. They are forced to attend to what can be examined; and to do that with success, they often have to "spoon-feed" their students rather than encourage habits of independent study .External examinations have a backwash effect. Backwash effect is defined as the effect of examinations upon the curriculum (Shiundu and Omulando, 1992). There is need for a combination of continuous assessment and the final examination for selection to higher levels.

.

(4) The one ingredient most likely to have an impact in student's learning is the quality of teaching. Curricular and pedagogical changes in mathematics depend on teachers becoming the agents of reform, rather than the targets.

This means that rather substantial resources need to be invested in the professional development of teachers. Teachers need to experience the new curricular themselves. Also model teaching in the seminars enhances implementation in teacher's classroom. Teachers need to see demonstration lessons with real students. Otherwise, they are and will remain skeptical, seeing it work enhances successful implementation. They have a right to be part of developing or adapting material for their classrooms. A sense of ownership and pride that goes with it is important.

(5) Teachers themselves should be given the primary responsibility for the improvement of their classroom practice. They should be made to own the in-service course instead of being coerced and threatened with interdiction in case they fail to attend the INSET. Teachers should not be assumed to be competent once they have completed their pre-service teachers training programmes. Participation in frequent school- based professional development groups should be considered as part of the teachers' job. These groups should not only provide a context in which teachers are mentored and trained but also provide for the development and testing of new teaching techniques and methodology.

(6) The teaching of mathematics is likely to be more efficient if the schools develop their own mathematics laboratories. Mathematics laboratories should be allocated for mathematics teaching and also for students' own investigative activities in mathematics concepts. In schools a classroom should be set aside as a mathematics laboratory by equipping it with mathematical tools such as geometrical instruments, models, projectors, calculators, computers etc. The change from students passively learning mathematics to students performing mathematical activities require the use of mathematics tools which need to be conveniently placed in a laboratory for easy access.

5.7 Summary

The study investigated the impact of SMASSE INSET on student's attitude towards mathematics. Generally student's attitude towards mathematics has improved. Most of them have shown interest in the subject. However teachers need to sustain and further improve the positive interest which has been developed by students.

The study found out that generally there is no significance difference between SMASSE INSET and student's performance in mathematics. The students' positive interest in the subject has not been reflected in the students' achievement in the subject.

It was also found that teachers have adapted the ASEI/ PDSI approach of teaching mathematics to some extent. Most mathematics teachers have developed a practical approach of teaching mathematics.

Teaching is no longer teacher centered but it has become student centred. Teachers need to change completely from the traditional method of teacher- centeredness and theoretical teaching of mathematics to student –centered method of teaching.

5.8 Suggestions for Further Research

This study could not exhaust all about the impact of SMASSE INSET on students attitude and performance in mathematics. More research is recommended to supplement data from this study. The following are areas that need further research:

1) Since the present study was limited to secondary schools in Bomet District, similar studies could be carried out in other districts. This present study might be a pointer in such direction.
2) This study could also be replicated using other academic subjects such as physics, chemistry and biology.
3) Research should be done to establish the relationship between mathematics preparation in primary schools on the subsequent study of mathematics in secondary and higher levels of education
4) Research should also be done on the effects of parent's/guardian's attitude towards mathematics on the performance of their children in mathematics.
5) Further research is needed to investigate whether all the major steps of any innovation were considered before the SMASSE INSET was implemented to cover the whole country.
6) Further research is also needed to investigate the effect of the teacher's gender on the performance of students in mathematics.

BIBLIOGRAPHY

Aiken, L. R. (1972). The effect of attitudes on performance in Mathematics. *Journal of Educational psychology*, 52 (1), 37-42.

Ajzen, I. (1991). Theory of planned behaviour. New Jersey: prentice Hall retrieved on 18th July 2007 from: http://en.wikipedia.org/wiki/theory of planned behaviour.

Ajzen, I. and Fishbein, M. (1980). Theory of reasoned action. New Jersey: Prentice Hall. Retrieved on 18th July 2007 from: http://www.people.umass.edu/aizen

Anderson, H. O .(1991). Developing favourable attitudes towards mathematics, Arithmetic teacher, 30, 46-52.

Armstrong, J. M. (1985). Attitudes towards Mathematics: Personal and environmental influence. *Journal of Research in mathematics Teaching*, 14, 121- 126

Birgen, P. (2007, May- June, issue 12) (Ed). Education Insight. SMASSE- WECSA getting roots in Africa, 40-45.

Bishop, A. J. (1988). Mathematics Education and culture. London: Kluwer Academic Publishers.

Bishop, G. (1986) .Innovations in Education. London: Macmillan press ltd.

Bolaji, C. (1996). A study of factors Influencing students' attitude towards mathematics in the Junior Secondary schools. *Kano journal of Education*, 3, 24-25

Borasi, R. (1990). The Invisible hand operating on mathematics instruction: students' conceptions and expectations. In T.J. Cooney (ed.) , Teaching and Learning Mathematics in the 1990s (NCTM Year book), pp 174-182. Reston: NCTM.

Borg, R. W. and Gall, M. D. (1989). Educational research: An Introduction to Theory and Practice. London: Alley and Bacon.

Choat, E. (1974). Mathematics teaching: 69, 11. In Dickson et al children Learning Mathematics: A teachers Guide to recent Research. Oxford: the Alden press Ltd.

Cockroft, W. H. (1982). Mathematics counts London: HMSO.

Copper, A. (1988). Changing Attitudes towards Mathematics among adolescents, Nature, 248:160-167

Cross, G. (1999) (Ed). A Vision for Science Education: Responding to the work of peter Fensham. New York: Routledge Falma.

Di martino, P.and Zam, R. (2003) "What does positive attitude really mean"? In Pate man, N. Dougherty, B. & Zilliox, J. (Eds). proceedings of the 2003 Joint meeting of PME and PMENA Vol 4, Honolulu, P. 451-458.

Dickson, L. (1984). Children learning mathematics. A teachers Guide to Recent research. Oxford: The Alden press Ltd.

Douglas, A. E. (2003) (Ed). Handbook of Research on Mathematics teaching and Learning: A project of the National Council of Teachers of Mathematics New York: NCTM.

Eshiwani, G. S (1986). Factors Influencing performance and Learning of Mathematics Among Secondary Schools in Kenya. Nairobi: Bureau of Educational Research.

Fadali, M. S., Bryant, N. V., & Robinson, M. (2004), "IS Attitude Towards Mathematics a major obstacles to engineering Education?". Retrieved on 17th July from http://fie.engrng.pitt.edu/fie2004/papers/1090.pdf

Fennema, E. (1990). Mathematics and gender: influences on teachers and students. New York: teachers college, Columbia University.

Fennema, E. and Sherman, J. (1987). Students perception of the Classroom learning environment in mathematics. *Journal of Research in mathematics teaching*, 15, 216-227.

Fullarton,S.(1993).Confidence in Mathematics:The effect of Gender. Greelong: Deakin University Press.

Furinghetti, F. and Pehkonen, E. (2002). Rethinking Characterizations of beliefs, In Leder, G., Pehkonen, E. and Toerner G. (eds). Beliefs: a hidden variable in mathematics education? Netherlands: Kluwer Academic Publishers.

Goetz, J.P. & Le compete, M. (1984). Ethnography and qualitative design in Educational research. San Diego: Academic press.

Grinstein, L. S and Lipsey, S. I. (2001). Encyclopedia of Mathematics Education New York: Routledge Falmer.

Haggarty, L (2002) (Ed). Teaching Mathematics in Secondary Schools. New York: Routledge Falmer.

Hannula, M. (2002). Attitude Towards mathematics: Emotions, Expectations and values. Netherlands: Kluwer Academic publishers.

Hart, K., Brown, M., Kuchemann, D., Kerslake and Mccartney,M. (1989). Children understanding of mathematics: 11-16. London: Attenaeum press Ltd

Howson, G., Keitel, C. & Kilpatrick, J. (1981). Curriculum development in Mathematics. Cambrdige: Cambridge University press.

Inyega, J. & Thomson, N. (2002). Change in attitudes towards Teaching strategies in Secondary Schools teachers in Kenya following In- Service professional Development. Retrieved on 18th July 2007 from: http://jinyega.myweb.uga.edu/indefile/SAETS.pdf

James,J. and James,H. (1992). Mathematics Dictionary (5th edition). New York: Chapman and Hall.

Jaworski, B., Wood, T. and Dawson, S. (1999) (Eds). Mathematics teacher Education: critical International Perspectives. London: Biddles Ltd, Guilford and King's Lynn.

Kerlinger, F. N. (1973). Foundation of Behavioural Research. New York: Surject publications.

Kombo, D. K. and Tromp. D. L. A. (2006). Proposal and Thesis writing: An introduction Nairobi: Pauline publications Africa.

Kothari, C. R. (2006). Research Methodology: Methods and Techniques. New Delhi: New Age International (P) Limited Publishers.

Koul, L. (1984). Methodology of Educational Research (2nd Ed). New Delhi: Vikas

Krejcies, R. & Morgan, D. (1970). Determining sample size for research activities, Educational and psychological measurement.

Kumar, R. (1999) Research methodology: A step- By- step guide for beginners. New Delhi: SAGE Publications.

Macnab, D. S. and Cummine, J. A. (1986). Teaching mathematics 11-16: A difficulty-centred Approach. Oxford: Basil Blackwell ltd.

Maritim, E. K. (2000). Performance in Mathematics and Sciences and Its Implication in the Development of the District: Kericho District Secondary Schools Heads' Association Annual conference held at Kipsigis Girls' High School, pp 8-11.

Maritim, E. K. (2001). Strengthening Academic Performance: A keynote Address delivered to Kericho, Bureti and Bomet Districts Secondary schools Heads Association General conference held at Mid-west, Kericho, PP3-5.

Miller, J. D. (1999). National Science foundation Virginia: NSF.

Mugenda, O. M. and Mugenda, A. G. (2003). Research Methods: Quantitative and Qualitative Approaches. Nairobi: ACTS press.

Mulusa, T. (1990). Evaluation Research for beginners: A Practical Study Guide. Bonn: German foundation for International Developments

Mutunga, P and Brekell, J (1992). Mathematics education. Nairobi: ERAP.

Nachmias, C. F. and Nachmias, D. (1992). Research methods in the social science (4th Ed). London: Edward Arnold.

Njuguna, B. M. (1999). The Findings from Baseline Studies by SMASSE project Bulletin, Unpublished.

Okech, J. G .(1986). Analysis of attitudes Towards mathematics of standard six pupils and their teachers. Kenyatta University: Bureau of Educational Research.

Orodho, A. J (2003). Essential of Educational and Social Science Research Methods .Nairobi: Malosa publishers.

Orodho, A. J. and Kombo D. K. (2002). Research methods. Nairobi: Kenyatta University, Institute of Open learning.

Orton, A. and Frobisher, L. (1996). Introduction to Education: Insights into teaching Mathematics. New York: Book craft Ltds, Mid Somer Norton.

Orton, A. (1992). Learning mathematics- Issues, Theory and Classroom practice. London: Cassell.

Philips, R. B. (1973). Teacher attitude as related to student Attitude and achievement in elementary School mathematics.

Reed, W. (1968). A study of Factors influencing attitudes towards mathematics of high school students. *Journal of Research in Mathematics Education*, 16, 217-222

Rotich, P. K. (2007). *Student's capacity to use Mathematical Terminology and its influence on mathematics performance*: A case of primary Schools in Bomet district. Eldoret: Moi University, M. Phil Thesis, Unpublished.

Schoenfield, A. (1985). Mathematical problem solving. Orlando, FL: Academic press.

Seliger and Shohamy (1989). Second Language Research Methods. Cambridge: Cambridge university press.

SMASSE Project (1998). Strengthening mathematics and Science in Secondary Education project. Ministry of Education, Science and technology, republic of Kenya. Retrieved on 17th July 2007 from http://www.smasse.org.

Stevenson, H. W. and Stigler, J. W. (1992). The learning Gap: why our Schools are Failing and What we can learn from Japanese and Chinese Education. New York: Simon and Schuster publishers.

Stigler, J. W. and Hiebert, J. (1999). The Teaching Gap: Best ideas from the World's teachers for improving education in the Classroom. New York: The Free press

The Kenya National Examination Council (2006). 2005 KCSE Examination Report. Nairobi: The Kenya National Examinations Council.

The Kenya National Examinations Council (2007). 2006 KCSE Examinations Report. Nairobi: The Kenya National Examinations council.

The Kenya National Examinations Council (2008). Essential KCSE Examination Statistics given during the release of 2007 KCSE Examination results on Thursday 28th February 2008. Nairobi: The Kenya National Examination Council.

Too, J. K. (1996). *A survey of the Availability and Use of Media Resources in Mathematics instruction*: The case of secondary schools in Nandi district. Eldoret: Moi University, M. Phil Thesis, Unpublished.

Tuchman, M. S. (1987). Scientific Methods and Social Research (revised edition). New York: sterling.

Waihenya, K. and Siringi, S. (2001, October 08). Study time: A new Report attributes the poor performance in National Examinations to inadequate preparation and failure to read questions. Daily nation. Retrieved on 17th July 2007 from http://www.nationaudio.com/News/DailyNation/today.

Wambui, N. N. and Wahome, A.N. (2006).SMASSE Project: Tsukuba Journal of Educational study in Mathematics. Retrieved on 18th July 2007 from: http://130.158.186.230/journal/vol125/nui.pdf

Wambui, N. N. (2002). Study on Mathematical Achievement using the climbing learning method in Kenyan Secondary school. Nairobi: SMASSE project. Retrieved on 18th July 2007 from: http://math.it/grim/21-project/21-malasya-wambui214-217-05.pdf

Wandiba, S., Maranga, J. S. & Chege, A. (1986) (eds). Factors influencing performance and Learning of Mathematics among Secondary schools in Kenya. Kenyatta University: Bureau of Educational Research.

Webster, S. (1985). Educational Research: Competence for Analysis and Application, 6th Edition. New Jersey: Macmillan.

Wilson, J. M. (1973). Mathematics Attitudes Among prospective primary School Teachers as predicted by general mathematics skills. Northern Illinois University, unpublished Doctoral dissertation.

APPENDIX I: STUDENT'S QUESTIONNAIRE (SQ)

School _____

'Class _____

Gender: Male

Female ☐

School category

Boys ' Boarding school ☐

Girls ' Boarding school ☐

Mixed school ☐

Dear student

This is a questionnaire whose aim is to get information about the teaching of mathematics in secondary schools. As a student who is studying mathematics, the information you will provide will be very useful in finding ways of improving the teaching of this subject. This information will strictly be kept confidential..

You are required to respond by ticking (√) the numerical value on the score for each item which best describes your feeling about the attitudes towards mathematics, teaching in the classroom and participation in class. There are no right or wrong answers.

Note:

Do not tick more than one numerical value for each item in the scale.

SECTION A

STUDENT'S ANALYSIS ON ATTITUDE TOWARDS MATHEMATICS

Key 5 Strongly Agree (SA)
4 Agree (A)
3 Undecided (U)
2 Disagree (D)
1 Strongly Disagree (SD)

		SA	**A**	**U**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
1	Mathematics is very interesting to me and I enjoy my mathematics course					
2	My mind goes blank and I am unable to think clearly when doing mathematics					
3	If I am confronted with a new mathematical situation, I can cope with it because I have a good background in mathematics					
4	I can draw upon a wide variety of mathematical techniques to solve a particular problem					
5	I do not feel that I have a good working knowledge of the mathematics course I have taken so far					
6	I learn mathematics by understanding the underlying logical principles, not by memorizing the rules					
7	If I cannot solve a mathematics problem, at least I know a general method of attacking it					
8	Mathematics problems are a challenge, solving problems provides satisfactions similar to those of winning a battle					
9	I have more confidence in my ability to deal with mathematics than in my ability to deal with other academic subjects					

		SA	A	U	D	SD
		5	4	3	2	1
10	Mathematics classes provide the opportunity to learn values that are useful in other parts of daily living					
11	Mathematics is a very difficult subject to study in school					
12	People who have studied mathematics get good jobs					
13	Mathematics require thinking, not just memorizing terminologies, formulae and concepts					
14	Mathematics is one of the easiest subject					
15	Mathematics develop critical thinking in solving problems					

SECTION B- UNDERSTANDING ABOUT TEACHING IN CLASSROOM

Key 5 Strongly Agree (SA)

4 Agree (A)

3 Undecided (U)

2 Disagree (D)

1 Strongly Disagree (SD)

	How often do the following teaching and learning activities take place in the classroom?	**SA**	**A**	**U**	**D**	**SD**
		5	**4**	**3**	**2**	**1**
16	Mathematics teacher starts a lesson by reminding us of what was taught in the previous lesson					
17	Mathematics teachers explains what is to be covered during the lesson					
18	Mathematics teachers usually demonstrates to help explain some ideas and concepts					
19	Mathematics teachers adequately guides us in the use of mathematics materials and resources					
20	Mathematics teachers use the locally available materials to teach us mathematics					
21	Mathematics teachers give us experiment/ practical activities when teaching us mathematics.					
22	Mathematics teachers use our ideas and suggestions when teaching					
23	Mathematics teachers assist us in group work					
24	Mathematics teachers allow us to do work on the chalk board					
25	Mathematics teachers give a summary of what has been taught in the lesson					
26	Mathematics teachers assist students with difficulties in understanding					
27	mathematics teachers mark assignments					
28	Mathematics teachers involve students when answering our questions					
29	Mathematics teachers encourage us to perform well					
30	Mathematics teacher like and enjoy teaching the subject					

APPENDIX II: SECONDARY SCHOOL TEACHER'S QUESTIONNAIRE (SSTQ)

SECTION A: General information

Respond by putting a tick (√) in all that apply

1 Gender male [ ]

Female [ ]

2 Qualification

(a) S 1 [ ]

(b) Dip. Ed [ ]

(c) Untrained Graduate [ ]

(d) Trained graduate [ ]

(e) M. ed [ ]

(f) M.S.C [ ]

(g) Other (specify----------

3 Teaching experience

(a) Less than one year [ ]

(b) Between 1-4 years [ ]

(c) Between 5-8 years [ ]

(d) Between 9-12 years [ ]

(e) Over 12 years [ ]

4 (i) which class(es) do you teach or have taught mathematics mainly?

(a) Form 1 [ ]

(b) Form 2 [ ]

(c) Form 3 [ ]

(d) Form 4 [ ]

(ii) For how long have you taught those class (es) in you present school?

		<1 yr	1-3 yrs	4-6 yrs	>6 yrs
(a)	Form 1	[ ]	[ ]	[ ]	]]
(b)	Form 2	[ ]	[ ]	[ ]	[ ]
(c)	Form 3	[ ]	[ ]	[ ]	[ ]
(d)	Form 4	[ ]	[ ]	[ ]	[ ]

SECTION B: SMASSE INSET

5 State the SMASSE INSET cycles you have attended since august 2004

(1)_____

(2)_____

(3)_____

(4)_____

6 Think about the SMASSE INSET cycles you have attended, what things did you like best?_____

_____

7 What things did you like least in SMASSE INSET cycles you have attended?

_____

_____

8 What did the District trainers and District planning committee do that made you like or dislike the teaching of mathematics_____

_____

_____

9 After undergoing SMASSE INSET , how much effort do you now put in your teaching of mathematics and does the amount of effort you put into your work make a difference in mathematics performance?_____

10 Is there a difference between a teacher who has undergone SMASSE INSET and the one who has not? If so, what difference is there?_____

_____

11 What things have most influenced your teaching of Mathematics after undergoing SMASSE INSET?_____

12 In your opinion, do you think the SMASSE INSET cycles you have attended are enough to equip you with the modern and more innovative mathematics teaching approaches and methodology?_____

_____

13 Briefly discuss whether or not SMASSE INSET has enabled you to complete the Mathematics syllabus in good time_____

_____

14 Do you think the ten days for each SMASSE INSET cycle were sufficient to cover all the topics given adequately? If not, how much time do you think should have been allocated?_____

_____

15 Briefly discuss how the SMASSE INSET can be improved and sustained.

_____

16 State some of the considerations that should be put in place when planning for some of the mathematics in-service courses in future_____

_____

_____

APPENDIX III: HOD MATHEMATICS QUESTIONNAIRE.

SCHOOL:_____

KCSE MATHEMATICS RESULTS ANALYSIS

	ENTRY	A	A-	B+	B	B-	C+	C	C-	D+	D	D-	E	MS	MG
2002															
2003															
2004															
2005															
2006															

APPENDIX IV: LETTER TO THE SCHOOL PRINCIPAL

RICHAR K LANGAT
MOI UNIVERSITY
P.O. BOX 3900
ELDORET
DATE

THE PRINCIPAL

_____

_____

_____

Dear sir/ Madam,

RE: REQUEST TO CARRY OUT RESEARCH IN YOUR SCHOOL

I am a student in Moi University pursuing a masters Degree course in Mathematics Education. As part of my course, I am required to carry out a research on "**Impact of SMASSE INSET on students' attitude and performance in mathematics in secondary schools".**

The purpose of this letter is to request you to allow me collect the required information from teachers and students in your school. If allowed, I promise to abide by your rules. Attached are copies of my research abstract, questionnaires and a letter from the university.

Thanking you in advance

Yours faithfully

RICHARD K. LANGAT

APPENDIX V: LETTER OF INTRODUCTION

Tel: (053) 43001-8 (053) 43555 Fax: (053) 43555

MOI UNIVERSITY

P.O. Box 3900 Eldoret KENYA

SCHOOL OF EDUCATION

REF: MU/SE/PGS/54 **DATE: 8th October, 2007**

The Permanent Secretary
Ministry of Education
Science and Technology
P.O. Box 30040-00100
NAIROBI

Dear Sir/Madam,

RE: RESEARCH PERMIT IN RESPECT OF RICHARD K. LANGAT EDU/PGCM/13/06

The above named is a 2nd year Master of Philosophy (M.Phil) student at Moi University, School of Education, Department of Curriculum, Instruction and Educational Media.

It is a requirement of his M.Phil studies that he conducts research and produces a thesis. His research is entitled:

"Impact of SMASSE Inset on Students' Attitude and Performance in Mathematics in Secondary Schools in Bomet District."

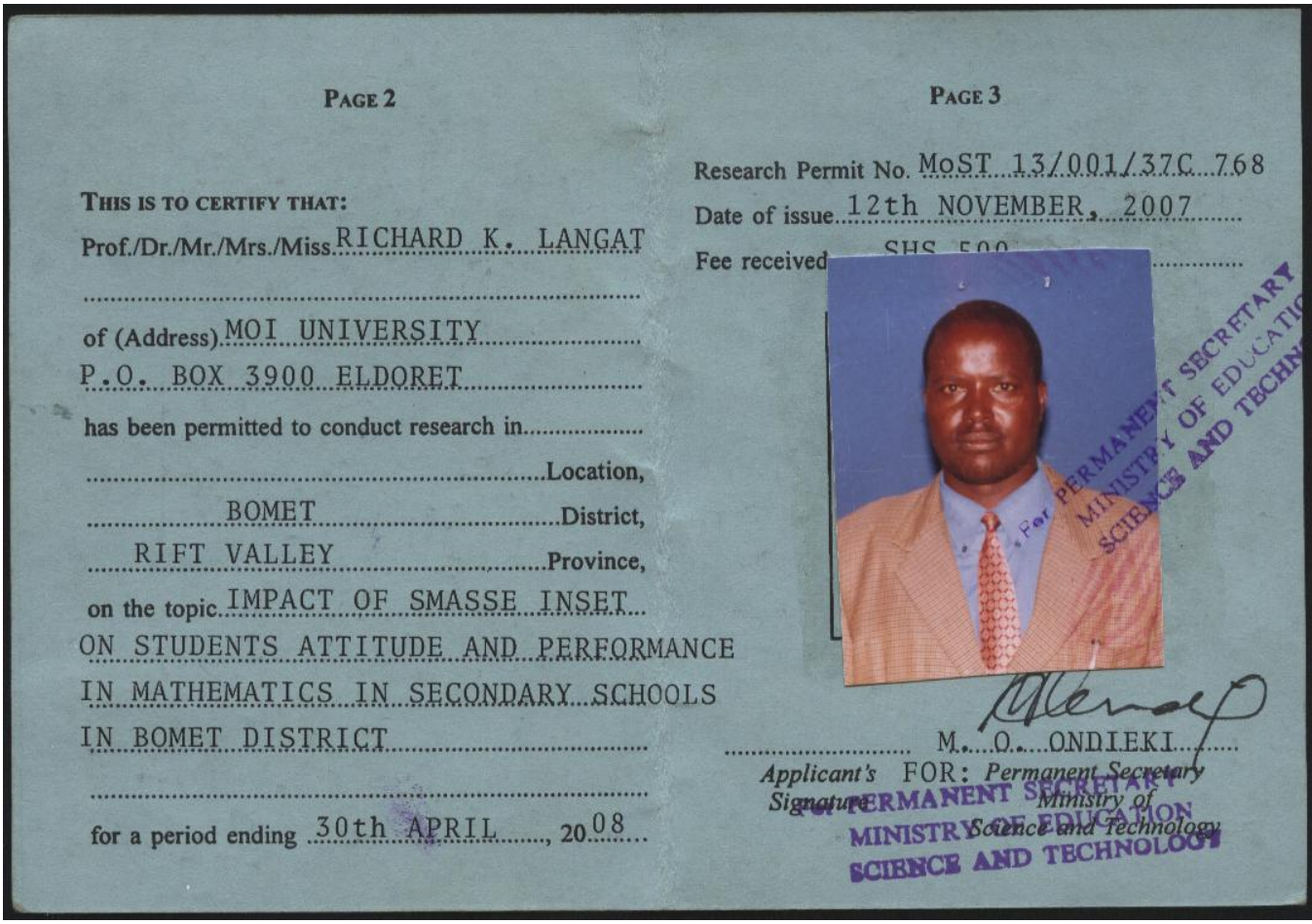
Any assistance given to him to facilitate the successful conduct of his research, will, be highly appreciated.

Yours faithfully,

DR. I. N. KIMENGI

DEAN, SCHOOL OF EDUCATION

APPENDIX VI: RESEARCH PERMIT FROM MINISTRY OF EDUCATION



PAGE 2

THIS IS TO CERTIFY THAT:

Prof./Dr./Mr./Mrs./Miss. RICHARD K. LANGAT

of (Address) MOI UNIVERSITY
P.O. BOX 3900 ELDORET

has been permitted to conduct research in

.....Location,

BOMET .....District,

RIFT VALLEY .....Province,

on the topic IMPACT OF SMASSE INSET ON STUDENTS ATTITUDE AND PERFORMANCE IN MATHEMATICS IN SECONDARY SCHOOLS IN BOMET DISTRICT

for a period ending 30th APRIL, 2008

PAGE 3

Research Permit No. MoST 13/001/37C 768

Date of issue 12th NOVEMBER, 2007

Fee received SHS 500

M. O. ONDIEKI

Applicant's Signature

FOR: Permanent Secretary
Ministry of
Science and Technology

APPENDIX VII: RESEARCH AUTHORIZATION FROM THE MINISTRY OF EDUCATION

MINISTRY OF SCIENCE & TECHNOLOGY

Telegrams: "SCIENCE TEC" Nairobi
Telephone: 02-3 1 858 1
E-Mail:ps@scienceandtechnology.go.ke

JOGOO HOUSE "B"
HARAMBEE AVENUE,
P.O. Box 9583-00200
NAIROBI

When Replying please quote
Rcf. NO.MoST 13/001/37C 768/2

12™ **November,** 2007

Richard K. Langat

Moi University

P. O. Box 3900

ELDORET

Dear Sir,

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on: ***"Impact of SMASSE Inset on student's attitude and performance in mathematics in Secondary Schools in Bomet District",*** *I* am pleased to inform you that you have been authorized to conduct research in Bomet District for a period ending 30th March, 2008.

You are advised to report to the District Commissioner and the District Education Officer Bomet District before embarking on your research project. On completion of your research, you are expected to deposit two copies of your research report t

Yours faithfully

M. O. ONDIEKI:
FOR PERMANENT SECRETARY

CC: The District Commissioner Bomet District

The District Education Officer Bomet District

APPENDIX VIII: RESEARCH AUTHORIZATION FROM THE DISTRICT COMMISSIONER BOMET DISTRICT

OFFICE OF THE PRESIDENT PROVINCIAL

ADMINISTRATION AND INTERNAL SECURITY

Telegrams: "DISTRICTS". Bomet
COMMISSIONER
Telephone: (052) 22004/22077 Fax 052-22490
When replying please quote

DISTRICT

P.O BOX 71
BOMET - 20400

Ref: ED.12/1 VOL.I/75

8th FEBRUARY, 2008

ALL DISTRICT OFFICERS
BOMET DISTRICT

RE: RESEARCH AUTHORIZATION

Mr. Richard K. Langat has been authorized to carry out research on "Impact of SMASSE Inset on Student's attitude and performance in mathematics in secondary schools in Bomet District."

Please accord him all the necessary support and assistance.

C. MUTAI (MS)
FOR: DISTRICT COMMISSIONER
BOMET

Cc

The Permanent Secretary Ministry of
Science and Technology P.O. Box 9583-
00200 NAIROBI

APPENDIX IX: RESEARCH AUTHORIZATION FROM THE DISTRICT

EDUCATION OFFICER

MINISTRY OF EDUCATION

Telegrams: "Elimu"
Bomet

Telephone: Bomet
22014/22265 When
replying please quote
Ref.BMT/TSC/

and date

DISTRICT EDUCATION OFFICER
BOMET DISTRICT **P.O. BOX 3**
BOMET.

8th February 2008

Richard K. Langat
Moi University,
P.O. Box 3900, ELDORET.

RESEARCH AUTHORISATION.

In reference to the Permanent Secretary's letter Ref: No. MOST 13/001/37c 768/2 dated 12th Nov. 2007, on the above subject, this office grants you permission to conduct research in the stated subject area.

May you also deposit a copy of your findings to this office to enable us assess the impact of SMASSE in the district

God bless you.

GABRIEL OGANO
FOR: DISTRICT EDUCAION OFFICER
BOMET.