

The impact of SMASSE Project on the  
Teaching Methodology and Learning in secondary  
schools in Kangundo/Matungulu district

by

Boniface Mutisya Peter

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## Declaration

This research project is my original work and has not been presented for a Degree in any other University



Sign .....

Boniface Mutisya Peter

L40/61762/2009

This research project has been submitted for examination with our approval as university supervisor/s

Sign.....

Joyce Atieno

University of Nairobi

Department of Education

## **Dedication**

I dedicate this work to my family my wife as well as my daughter. They gave me love, support and encouragement that boosted my determination to complete this degree programme.

## **Acknowledgement**

I would like to express my sincere appreciation to my supervisor Joyce Atieno for her patience scholarly and constructive suggestion during this period. I thank my lecturers who supported me in my academic work. I also appreciate my family for the understanding they gave me throughout my research work. I won't forget to thank God who above all has made this possible.

## **Abstract**

The government of Kenya recognizes the important role science and mathematics should play in the realization of vision 2030; to become a globally competitive and prosperous country by 2030. This has been reflected in the amount of resources both human and otherwise that are channeled towards enhancing the teaching and learning of science and mathematics at all levels of the education system. At secondary school level, there have been a number of intervention strategies that the government has put in place to ensure effectiveness in the teaching/learning of these subjects. In addition to strategies such as: providing schools with qualified mathematics and science teachers and improving their remuneration and terms of service; providing schools with science equipment and even constructing laboratories, the government has also institutionalized In-service Education and Training (INSET) of serving science and mathematics teachers under Strengthening of Mathematics and Science in Secondary Education (SMASSE) project and quite a substantial amount of the Ministry of Education's budget goes towards this course (MoE, 2005). SMASSE is a Technical Cooperation initiative between the Governments of Kenya and Japan signed in 1998 for purposes of implementation of the project.

This study discusses SMASSE; the initiative/agreement in terms of its development and gains so far made in upgrading mathematics and science teachers' skills for improved/enhanced classroom delivery of lessons in Matungulu/ Kangundo Districts. Also included in the discussion are some of the mechanisms that have been put in place for the smooth implementation, administration and sustainability of the SMASSE project. One of the mechanisms is the sensitization workshops for education managers such as principals of schools, Quality Assurance and Standards Officers (QASO) and District Education Officers (DEO). Another mechanism is monitoring and evaluation which has revealed some of the successes of the project. The study concludes by examining the future of SMASSE which clearly lies partly in continued enhancement of the capacity for educators in Matungulu /Kangundo Districts.

The purpose of this study was to find out the effect of SMASSE training of teachers on performance of students in Maths and Science. The study was carried out in Kangundo/Matungulu District Secondary Schools. Survey research design was adopted. To obtain the study sample, proportionate stratified random sampling was used.

The independent variables were classification of schools and attendance of SMASSE training. Dependent variables on the other hand were KCSE Maths and Science mean scores, attitude of students towards Maths and Science, attitude of teachers towards teaching Maths and Science and attitude of teachers towards the organization of SMASSE training. Data was collected using questionnaires, interviews and document analysis. Respondents were; Maths and Science teachers, Head teachers and students. Data was analyzed using both descriptive and inferential statistics.

The study found that there was a slight improvement in KCSE Maths and Science performance and a positive attitude of both students and teachers towards Maths and Science. However the attitude of students was weak. The study recommended SMASSE training of teachers who did not attend the full training and promotion of favorable attitudes of students towards Maths and Science.

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# LIST OF ACRONYMS AND ABBREVIATIONS

<b>ADEA</b>	Association for Development of Education in Africa
<b>ASEI</b>	Activity, Student, Experiment and Improvisation
<b>AU</b>	African Union
<b>BEGIN</b>	Basic Education for Growth Initiative
<b>CEMASTEА</b>	Centre for Mathematics, Science and Technology Education in Africa
<b>DAC</b>	Development Assistance Committee
<b>DEO</b>	District Education Officer (Office)
<b>DPC</b>	District Planning Committee
<b>DQASO</b>	District Quality Assurance and Standard Officer
<b>DTC</b>	District Training Centre
<b>EFA</b>	Education for All
<b>FEMSA</b>	Female Education in Mathematics and Science in Africa
<b>GOJ</b>	Government of Japan
<b>GOK</b>	Government of Kenya
<b>ICE</b>	International Conference on Education
<b>INSET</b>	In-service Education and Training
<b>JCC</b>	Joint Coordination Committee
<b>JICA</b>	Japan International Cooperation Agency
<b>KCSE</b>	Kenya Certificate of Secondary Examination
<b>KIE</b>	Kenya Institute of Education
<b>KJSE</b>	Kenya Junior Secondary Examination
<b>KNEC</b>	Kenya National Examination Council
<b>KSSHA</b>	Kenya Secondary Schools Heads' Association

<b>KSTC</b>	Kenya Science Teachers' College
<b>KU</b>	Kenyatta University
<b>M. Ed</b>	Masters in Education
<b>MDG</b>	Millennium Development Goals
<b>M&amp;E</b>	Monitoring and Evaluation
<b>MOE</b>	Ministry of Education
<b>MOEST</b>	Ministry of Education, Science and Technology
<b>NEPAD</b>	New Partnership for Africa Development
<b>NWC</b>	National Working Committee
<b>NCEOP</b>	National Committee on Education Objectives and Policies
<b>PDE</b>	Provincial Director of Education
<b>PDM</b>	Project Design Matrix
<b>PDSI</b>	Plan, Do, See and Improve
<b>PPE</b>	Post Primary Education
<b>PTTC</b>	Primary Teachers Training College
<b>QASO</b>	Quality Assurance and Standards Officer
<b>RECSAM</b>	Regional Centre for Education in Science and Mathematics
<b>SACMEQ</b>	Southern African Consortium for Monitoring Education Quality
<b>SEAMEO</b>	South East Asian Ministers of Education Organization
<b>SMASSE</b>	Strengthening of Mathematics and Science in Secondary Education
<b>SMASE</b>	Strengthening Mathematics and Science Education
<b>SPIAS SMASSE</b>	Project Impact Assessment Survey
<b>SSA</b>	Sub-Saharan Africa
<b>SWAP</b>	Sector Wide Approach
<b>TCE</b>	Third Country Expert
<b>TCTP</b>	Third Country Training Programme
<b>TICAD</b>	Tokyo International Conference for African Development

# CHAPTER ONE

## INTRODUCTION

### 1.1 Background of the study

The current trend of extending basic education to include lower secondary education is being taken very seriously by many Sub Saharan African countries. This is basically in effort to increase access to post primary education (PPE) following the UPE and EFA/MDGs initiatives that have seen many children attend primary education and are likely to complete it. ***Njuguna B.B (1999) Findings from baseline studies by SMASSE project bulleting.***

In the process of extending the basic education the need to maintain and improve quality of education offered is as important as access to post-primary education and training. In this regard, the quality of teachers and their professional development need no emphasis. This study mainly discusses a two-level cascade model of in-service education and training (INSET) programme that was successfully piloted in Kenya between 1998 and 2003 and subsequently expanded throughout the country and in other African countries due its impact and demand. ***CEMASTE, (2009)***

The programme aimed at upgrading the capability of Kenyan youth in mathematics and science education through INSET for mathematics and science teachers. The paper also highlights challenges Kenya faced and her effort to address shortage of trained teachers and measures taken towards maintaining quality of education with rapid expansion of both primary and secondary education. ***Noburu Saito, Boo Yun Kim (1998)***

It further indicates policy environment that contributed to the registered success, the implementation, lessons and challenges faced.

The objective of the study is to present a practical and promising case of an INSET system that can be adapted and applied for improving and maintaining quality of education as countries extend their basic education systems. ***Sammuel Kibe, JICA (1997)***

In Kenya, recommendation to extend primary system from 7-years to 9 years was made by NCEOP. However, the Presidential Working Party on Second University recommended the 8-4-4 system which was accepted and implemented with effect from 1985 on account of cost for the 9th year. The expansion of post-primary education has however been constrained by the level of poverty and cost-sharing policy which led to decline of enrolment and participation at both primary and secondary levels besides lowering quality. Currently the GOK plans to offer tuition free secondary education with effect from 2008. **Joseph Carilus Ateng *Journal of Jasme research in Mathematics Education.***

### **Quality of Education**

The decline in education quality, participation and retention rates have been attributed to high cost of education and rising level of poverty as many households are not able to effectively pay school levies. **Samuel Kibe JICA (1997)** Quality of education negatively affects enrolment, participation, retention, and quality of graduates from education system and subsequently the country's development. **CEMASTEA, ( 2008) Hand book on management of district SMASSE programmes.** Hence the demand and need to reverse the trend through teachers' INSET The adequacy and quality of education inputs and students' learning achievement (as outputs) are generally used as a measure of education quality.

The need for quality education is in line with the GOK policy on Vision 2030 which aims at making Kenya middle level economy. The emphasis on quality education therefore is aimed at nurturing and developing students' knowledge and skills in mathematics and sciences towards this end. Teachers of these subjects are therefore targeted so that they deliver lessons with the suitable approaches

and methodologies that would translate into upgrading young Kenyans capability in mathematics and sciences. **CEMASTEA (2009)**

## **SMASSE project**

Human resource development has been a top priority for the development of Kenya through education. Therefore, there has been a need for comprehensive training policy that would produce adequate manpower for development. Studies on quality of education in Kenya indicated poor quality and performance especially in mathematics and science compared with that of social science subjects. Due to resource constraints and need to improve quality of mathematics and science education, the GOK/MOE requested assistance from the development partners and the Government of Japan (GOJ) responded positively. **CEMASTEА (2010) Preliminary report on extend of practice of ASEI-PDSI**

## **SMASSE as a Student Centered Approach**

Student-centered learning is a pedagogical paradigm shift that is currently attracting immense attention. The definition of student-centered learning appears to differ among authors as some equate it with active learning, while others take a more comprehensive interpretation including: active learning, choice in learning, and the shift of power in the in the teacher-student. **CEMASTEА (2008)**

Centre for Mathematics, Science and Technology Education in Africa (CEMASTEА), Nairobi define student- centered approach to learning, teachers move from the center position to the side, from dispensers of knowledge they become advisors and facilitators of learning. Student-centered learning does not necessarily imply a particular methodology of teaching just like constructivism and inquiry learning, from which it borrows or relates heavily (**O'Neill & McMahan, 2005**).

Nevertheless, certain methodologies may be better suited than others for student-centered classrooms.

A commitment to clear and a shared definition for student centered learning is important to provide a foundation on which to improve classroom instruction and practices,



for a clear definition and agreement is necessary for us to know whether efforts are directed in the right directions. The disagreement on the meaning of student-centered learning has its attendant problems. These include the inability to compare results of studies (**Lea et al, 2003**) and difficulty in measuring or isolating the different dimensions of this strategy in teaching and learning. Nonetheless, the definition by **Cannon and Newble (2000)** was adopted as the working

definition for this research. They define student-centered learning as: ways of thinking about teaching and learning that emphasize student responsibility and activity in learning rather than *content* or what the *teachers* are doing. Essentially student-centered learning has student responsibility and activity at its heart, in contrast to a strong emphasis on teacher control and coverage of academic content found in much conventional, didactic teaching (**pp. 16- 17**) The literature on student-centered learning abounds with the features which the various authors and researchers propose as distinguishing marks of student-centered learning from teacher centered learning (**Cannon & Newble, 2000; Geelan, 2000; Lea, Stephenson, & Troy, 2003; O'Neill & McMahon, 2005; Rutto, 2005; Serbessa, 2005**).

These characteristics are crystallized as follows:-

- i. Active rather than passive learning (the student doing more than the teacher). Involvement and participation are necessary for learning.
- ii. Emphasis on deep learning and understanding of concepts
- iii. The teacher valuing and supporting (indirect) verbal and non-verbal interactions.
- iv. The teacher utilizing students' prior knowledge and experiences.
- v. Organizing learning around learning communities (for example groups, peers)
- vi. The teacher becomes a facilitator and resource person.

There is no shortage of literature that intimates that Japanese classrooms carry many of the elements that constitute student-centered learning (**Schmidt et al., 1996; Stevenson & Stigler, 1992; Stigler & Hiebert, 1999**). This is what gave this researcher the impetus to study biology lessons in Japanese schools.

## SMASSE Project in Kangundo /Matungulu Districts

Just like in other areas of Kenya the performance of Mathematics and Science subjects in Kangundo/ Matungulu Districts is dismal. The performance of these subjects is not encouraging. The table below from the Ministry of Education Kangundo Districts shows the performance of some of these subjects.( **MOE) Kangundo District.**

**Table 1.1 KCSE Examination Scores as Percentages,2001 - 2008**

<b>YEAR</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2008</b>
ENGLISH							
MALE	28.5	24.2	25.4	32.4	32.8	28.0	27.8
FEMALE	28.4	24.0	24.9	32.5	32.8	28.3	27.8
MATHS							
MALE	13.6	15.5	19.3	24.4	17.0	12.9	15.3
FEMALE	9.0	10.3	13.2	9.3	11.3	9.0	10.3
PHYSICS							
MALE	34.6	25.3	19.9	26.1	30.9	29.1	35.7
FEMALE	29.4	21.1	15.7	20.0	24.9	25.1	31.1
CHEM							
MALE	32.4	28.5	28.6	33.6	32.4	33.5	32.1
FEMALE	30.0	25.9	25.9	30.5	28.9	29.6	28.5

*Source: DEO's Office Kangundo District*

From the above performance the researcher wanted to know whether there has been any impact on the performance of the K.C.S.E performance in science and mathematics in Kangundo District.

Over the years teachers in maths and sciences have been attending INSET Cycles in Kangundo / Matungulu Districts. The table below presents the finding on the attendance of Mathematics and SCIENCE teachers in INSET Basic cycles.

The findings are presented according to teachers, principals and deputy principals.

**(CEMASTE, 2010)**

**Table 1.2: Distribution of attendance of SMASE INSET basic cycle**

**Basic Cycles**

Attendance	None	One	Two	Three	Four	Total
N	53	41	34	29	75	232
%	22.8%	17.7%	14.7%	12.5%	32.3%	100%

**Source: CEMASTE A 2009 – Monitoring and evaluation reports of districts INSET**

Only 32. 3% of mathematics and science teachers had attended all four basic cycles of SMASSE INSET, while 22.8 had not attended any of the 4 basic cycles of SMASSE INSET. These findings imply that a substantial number of mathematics and science teachers had not covered the whole content of four basic cycles of SMASSE INSET. Therefore, there is need for continued SMASSE INSET s in the Districts to train all the teachers.

## **1.2 Statement of the Problem**

Following the failure of students in Science and Mathematics the government in conjunction with the Japan government introduced training of science teachings. This was done through in-service education training INSET. From the year 2003 to 2008 the SMASSE project was under the sponsorship of JICA under this project, teachers were trained on how to use the available resources in their school to improve performance of science and mathematics. The trainings were done over the holidays. The training was done at District level. Each training session last over the holidays lasted for 3 weeks or three (3) weeks depending on the duration of the holiday. In 2008 the SMASSE project under sponsorship of JICA came to an end. SMASSE in Secondary became a programme under the Ministry of Education.

Between 2003 and 2008 four cycles of the SMASSE project were done. In each cycle which lasted about a year, a certificate of participation was awarded.

SMASSE project under the sponsorship of JICA came to an end in 2008, SMASSE in Secondary became a programme under the Ministry of Education. However, at the end of the project period it was found that the practices of activity students experiment and improvisation (ASEI) plan do see and improve (PDSI) in the classroom were not well exercised.

The situational findings (**Cemastea, 2009**) Indicate week practice of ASEI – PDSI in the class room. The ( MOE) and JICA agreed to continue supporting the secondary programme focusing on strengthening the practice of ASEI –PDSI at class room level. This is through understanding that the teachers have already gained meaningful teaching skills through the ASEI/PDSI and what is remaining now is to enhance these skills in the classroom and this can be done very effectively through lesson study. (**CEMASTEIA, 2009**)

To improve performance of Science and Mathematics in Secondary schools, there is a need for teachers to be trained in ICT Integration in Teaching and Learning of Mathematics and Science. The ICT options were based on sessional paper No. 1 of 2005 and KESSP and outlined among others, priorities on improving quality teaching and learning, improving educational policy and coordination and considering costs and benefits of education interventions. These are eight options which included quality teaching and learning through ICT with a focus on development: ICTs in Teacher Training Colleges, computer in secondary schools, ICT for in-service teacher training and video – for in-service Teacher Training *among others*.

**( Sessional paper No. 1 of 2005 and KESSP)**

On Computers for Secondary Schools the paper recognized the challenge of poor performance in Mathematics and Science and outlined potential benefits of ICT Integration to enhance grater critical thinking skills, scientific inquiry, and analytical creative and collaborative power of computers. While recognizing the importance of ICT skills and computer studies, the paper observed the insufficiency of those skills to redice the full potential of ICT in education creativity and collaboration and thus clearly for integration of ICTs in all subjects.

**( Sessional paper No. 1 of 2005 and KESSP)**

### **1.3 Purpose of the Study**

The purpose of the study is to obtain data and information that would give information on the impact of SMASSE Project on methods of teaching and learning in Secondary Schools in Kangundo / Matungulu Districts.

The study would seek to gather information on whether the SMASSE Project has led to improvement of performance and whether teaching methodology learned during INSET Cycles is practiced. Its purpose is to inform future INSET activities, guide policy regarding INSET and form the basis for further research and evaluation on the practice of ASEI-PDSI at SECONDARY School level in Kenya.

A situational study would also help CEMASTEА to establish areas of capacity development for District trainers. It would also establish whether there is a system for effective supervision of teaching methodology in classroom.

Based on the findings of the study, recommendations would be made that are to guide practice regarding District INSET and supervision of ASEI – PDSI in the classroom. The finding would also inform CEMASTEА in terms of areas of capacity development for District Trainers and School Administrators regarding teaching methodology in class room.

#### **1.4 Objectives of the Study**

The study will seek to achieve the following objectives.

- i) Establish whether teachers in Matungulu / Kangundo Districts have been attending SMASSE INSET Cycles and if so, to what extent.
- ii) Determine the extent to which **ASEI –PDSI** was being practiced by Mathematics and Science Teachers at Secondary School levels in Kangundo / Matungulu District.
- iii) Establish the attitude of students towards science and mathematics subjects in Kangundo / Matungulu Districts.
- iv) Determine the impact of SMASSE Project on the performance of Science and Mathematics in Secondary Schools in Kangundo / Matungulu District.

## **1.5 Research Questions**

- i) How is the attendance of INSET cycles by science teachers?
- ii) To what extent has the ASEI-PDSI been practiced by Mathematics and Science Teachers in Kangundo Districts?
- iii) How is the attitude of students in Kangundo / Matungulu Districts towards the performance of Science and Mathematics subjects?
- iv) What is the impact of SMASSE Project on the performance of Science and Mathematics in Kangundo / Matungulu Districts?
- v) What are the challenges facing SMASSE in the improvement of Maths / Science in Kangundo / Matungulu District?

## **1.6 Significance**

This study was to address the impact of SMASSE project on teaching methodology and teaching in Secondary Schools in Kangundo / Matungulu District.

The findings of the study was to contribute to the creation of knowledge that will be used to policy makers in SMASSE.

The study would also help the school administrators and educational policy makers to acknowledge the existing challenges of SMASSE project on TEACHING Methodology and Learning means of tackling teaching them in schools.

The result of the study was to help the MOE and curriculum developers to know some of the difficult science topics students encounter during the teaching process and curriculum implementation at school level thus become the basis of curriculum innovation and improvement in science subjects.

## **1.7 Delimitations of the Study**

The study was conducted in Kangundo / Matungulu districts. The district was chosen because it is one of the worst performed districts in Kenya and has an history of poor results especially in Science and Mathematics.

The study will focus in SMASSE Project in Secondary Schools within the District since the Project is conducted only in Secondary Schools more over it is where students start experiencing problems in Maths and Sciences.

The Maths/Science Teachers in the District will also be used in the study since they have the experience in the students performance in maths and science.

## **1.8 Limitation**

The study will be limited to Kangundo / Matungulu Districts in Machakos county. This is because of the cost of doing the research on a wider scope. The researcher had limited resources and therefore chose the districts because of their accessibility and good infrastructure connecting the schools where the research was done. The terrain of the Districts could also allow easy movements using motorbikes.

## **1.9 Assumption of the study**

When the study is done it will be assumed that the data collected from the research though different from other counties or districts may be similar. It is therefore assumed that the study will give a data that will establish the extend of INSET Cycles by Mathematics and Science teachers in Matungulu District. Other assumptions are:-

- i) Teachers continue to practice ASEI/PDSI.
- ii) Other programs do not adversely affect teachers' participation.
- iii) Assistance of MOEST will continue.

- iv) The counterparts at National INSET Centre and key trainers in the Districts will continue to work for the project.

## **1. 10 Definition of significant terms**

**SMASSE Project:** SMASSE is an acronym for Strengthening of Mathematics and Science in Secondary Education. SMASSE Project is a joined venture between the Kenya government through MoEST, and Government of Japan through JICA initially on pilot basis. SMASSE Project is mainly involved in In-Service Training (INSET) of Serving Teachers in Mathematics and Science in Secondary Schools in Kenya.

**Methodology:** Most teachers are content/syllabus driven; thinking that covering the syllabus is the same as effective teaching. Lecture becomes the method of choice even in science subjects because it allows coverage of ground in terms of content, although very little, if anything is achieved in terms of learning. Methodology is the skill a teacher uses so as to achieve the best results with students.

**Mastery of content:** In our classrooms we have the following categories of teachers;

1) Teachers who have good content mastery. The following is portrayed in their teaching.

- i) take time to plan,
- ii) Think about the delivery process with their students in mind
- iii) Are sequential in their teaching and
- iv) Most often student focused /centered.

2) Teachers who 'lack' the time and their teaching portrays that they ;

- i) Do not take time to plan
- ii) Do not think about the delivery process
- iii) Are not sequential in their teaching
- iv) Are out of touch with the syllabus
- v) Aren't student focused/centered and in many cases confuse students



3) The third category is of those who lack content mastery. They ;

- i) Cannot explain concepts satisfactorily
- ii) Often misleading students unknowingly

SMASSE has all these factors in mind while preparing for INSETS.

During INSET teachers are equipped with the necessary skills to develop teaching/learning (training) materials, use limited resources efficiently and effectively and utilize materials in their environment, Work

**Learning** :Learning is a change of behavior. If a teacher has an improvement which is positive in his area of specialization, then learning has taken place. If there is no improvement on the performance of the student there is no learning. A change in performance which is positive is therefore learning.

## **CHAPTER TWO**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

Chapter two covers literature review on the impact of SMASSE Project on the teaching methodology and learning in Secondary Schools. It looks into the practice with the SMASSE skills in improving the performance of science and Mathematics in Kangundo / Matungulu District and how other regions have benefited from the project. It is divided into the following sub-sections:- The impact of SMASSE INSET Cycles on teaching and learning, use of ASEIPDSI in teaching Maths and Science subjects, challenges facing SMASSE Integration in Secondary Schools, Improvisation as a way of teaching Maths and Science, enhancing SMASSE Project to improve performance of Maths and Science in Secondary Schools, summary of Literature Review, Theoretical framework and Conceptual framework.

#### **2.2 IMPACT OF SMASSE INSET CYCLES ON TEACHING AND LEARNING IN SECONDARY SCHOOLS**

SESEMAT Project was launched in August, 2005 on a pilot phase to enhance the quality of teaching and learning of Science and Mathematics through In-service Education Training (INSET) for secondary Science and Mathematics teachers. This is according to a handbook on management of District SMASSE programmes, **CEMASTE A, (2008)**. After one year of SESEMAT inception 38 non-pilot districts applied to the MoES for the national extension of SESEMAT activities. According to **CEMASTE A, (2009)** the MoES had no objection and the proposal was officially approved by the Government of Uganda and supported by Government of Japan. The joint evaluation on the pilot SESEMAT activities that was conducted by officials from the MoES and JICA in February 2007 confirmed positive impacts on the attitudinal change of teachers, improved pedagogy and administrative/parental support. Just as it happened in Uganda, INSETS cycles can have positive impacts on teachers and students towards the performance of science and mathematics in Kangundo / Matungulu Districts.

**SESEMAT** project captured a strong attention to most of secondary schools and districts in Uganda for her unique methods of teaching and learning of Science and Mathematics. **CEMASTE A, (2008)**

The successful implementation of the pilot project contributed to formulation of the expansion pilot phase that was implemented in August 2007. In February 2008 (six months before the expiration of the pilot project) **JICA** dispatched a team of Japanese Final Evaluators to access and evaluate the relevance, effectiveness, impact and sustainability of **SESEMAT** Project. In their joint evaluation report all aspects were rated high. In its struggle to improve access to secondary education through Universal Post Primary Education and Training (UPPET), the Government recognized the need for quality enhancement at secondary level. Since Science and Mathematics are serious challenges in the quality of education according to **O’neill Mc Trichon, (2005)** there was need to empower teachers in this area in using available resources to facilitate learners’ learning process to their fullest potential.

This prompted the SESEMAT Project already in existence to extend its services to cater for the demands and gaps in the teaching and learning of Science and Mathematics. In Kangundo / Matungulu Districts, teachers needs to be empowered through INSETS to improve teaching and learning of Mathematics and Science subjects.

Above all the SESEMAT project aligned well with the **Education Sector Strategic Plan (ESSP) 2004-2005** that articulates the necessity of establishment of continuous in-service training to enhance the quality of education (**Sub- objective 2.2 and Strategies b**). The tangible progress of the SESEMAT programme attracted more attention from stakeholders in non pilot districts. This is why Kangundo/ Matungulu Districts is no exception among the Districts that attracted the attention of this pilot scheme.

The expansion pilot programme that was implemented in August 2007 increased access to SESEMAT activities for Science and Mathematics teachers. The expansion pilot phase designed to run for three years reached out more 2051 Science and Mathematics teachers in addition to the 457 in the pilot districts and 20 PTC tutors. **CEMASTE A, ( 2009).**

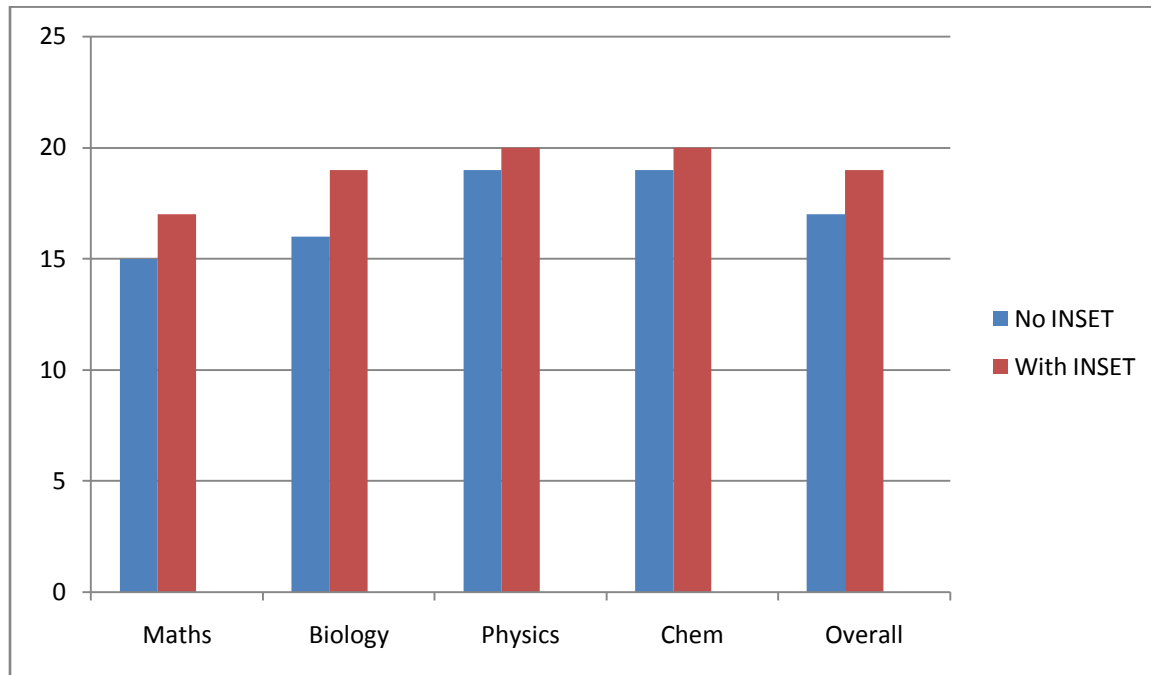
The choice of these districts for the expansion was based on evidence for ability to sustain SESEMAT activities.

Capable districts applied for consideration following a sensitization workshop to secondary school Chairpersons of Head Teachers' Association about SESEMAT activities. All districts that applied were considered and nine regional centers for the pilot expansion programme were established.

Kangundo / Matungulu Districts Teachers have therefore been undergoing this training to improve Maths and Science in this field. The results obtained from the pilot districts may not be the same as Kangundo / Matungulu districts. The aim of the researcher is therefore to obtain data to compare whether the results will be the same or otherwise.

**Ryo Sasaki et al (2008)** analyzed the gathered data by subjecting it to Independent t-tests analysis to establish if there was statistically a difference between Student taught by SMASSE trained teachers and those taught by SMASSE Un-trained teachers. It was also subjected to Analysis of Variance to establish if there was significant difference in students' achievement by frequency of INSET attendance. Factor Analysis was carried out to reduce the diversity of response variables, and to establish latent variables that were thereafter used in Structural Equation Modeling (SEM). The purpose of SEM analysis was to understand causal relations among Principals' encouragement of teachers' professional development; Teachers' attitude towards teaching; Teachers practice of ASEI-PDSI; Students' learning process; Students' participation; Students' attitude; School Characteristics; Family Background; and Students' Test-scores. This presentation notes two fundamental findings of the analysis as illustrated below.

**Figure 2.1** Students achievement score with teachers attendance of INSET Cycles



**Source:** Ryo Sasaki et el (2008)

**Figure 2.1**

From Figure 2.1 it is clear that achievements for students taught by teachers who had attended INSET was higher in all subjects than that of students taught by SMASSE non trained teachers.

Despite the positive move on the cycles the performance of science and mathematics in Kangundo / Matungulu Districts is still dismal. This therefore raises the concern that needs to be researched to establish whether the attendance of INSET Cycles has lead to an improvement of performance of science and mathematics subjects.

### **2.3 THE USE OF ASEI-PDSI IN TEACHING MATHS AND SCIENCE SUBJECTS.**

**SMASSE** Team came up with the Activity, Student, Experiment, and Improvisation (ASEI) movement to upgrade the various aspects of teaching and learning. There are four basic principles inherent in this, which guide SMASSE INSET activities aimed at a shift as follows:-

Pre –ASEI (Before INSET) A shift from to Knowledge/Content – based approach Few, teacher demonstrations Theoretical or Lecture method (Chalk and talk/talk and talk) Teacher – centered teaching ASEI-Condition (After INSET) Activity-focused Teaching/Learning Student-focused / Centred Learning Experiment / Research based approach Small scale and improvisation PDSI Approach: To achieve the ASEI condition, SMASSE came up with the Plan, Do, See and Improve (PDSI) approach to teaching and learning. **CEMASTE, ( 2008 )**

## **Plan**

Apart from schemes of work and lesson plans, the teacher carefully plans and tries out the Teaching / Learning activities, materials and examples before the lesson.

Emphasis is on how instructional activities will enable learners to:

- i) Understand individual concepts and connections among them
- ii) Get the rationale/value for the lesson
- iii) Retain the learning and apply it in real life situations
- iv) Get rid of learning difficulties and misconceptions
- v) Have more interest in the lessons

## **Do**

The teacher carries out the planned lesson / activity as planned Teachers are encouraged to;

- i) Be innovative in lesson presentation.
- ii) Present lessons in varied interesting ways to arouse learners' interest  
e.g. through role play, story telling
- iii) Ensure active learner participation
- iv) Be a facilitate the teaching/learning
- v) deal with students' questions and misconceptions
- vi) Reinforce learning at each step

In Kangundo / Matungulu Districts during INSETS, Teachers carry out peer teaching on the ASEI lessons and later actualize in schools.

## **See ( Lesson study )**

The teacher evaluates the teaching and learning process during and after lesson, using various techniques and feed back from students. Teachers also allow their colleagues to observe their lessons and offer feed back.

- i) Enables teachers to;
- ii) see the good practices in the lesson and strengthen them
- iii) see mistakes made in earlier lesson
- iv) Avoid earlier mistakes in future lessons
- v) In the process teachers become more open to evaluation by;
- vi) fellow teachers
- vii) school administrators
- viii) Quality and standards assurance officers
- ix) Students

## **Improve**

Reflect on the performance, evaluation report and effectiveness in achieving the lesson objectives.

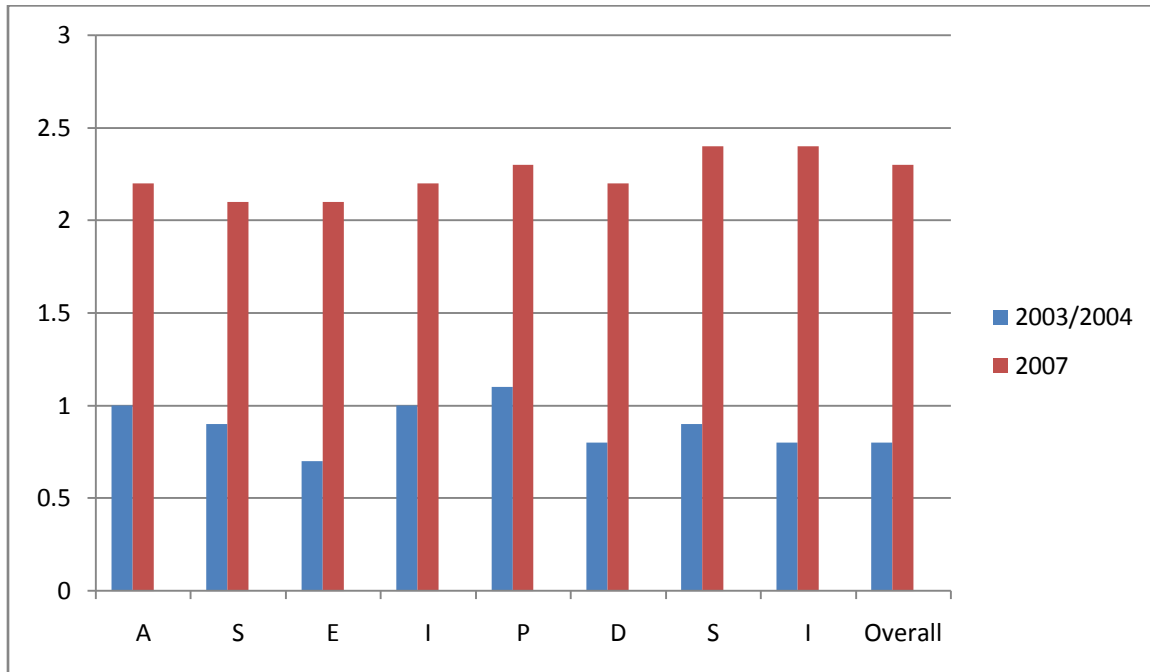
These Enables the teacher to;

- i) see the good practices in the lesson and strengthen them
- ii) see mistakes made in earlier lesson
- iii) Avoid earlier mistakes in future lessons

In Kangundo / Matungulu Districts the teacher makes use of such information in planning the next lesson to enhance performance and student learning.

ASEI – PDSI checklist is an instrument used by an observer to evaluate extent of use of ASEI-PDSI aspects in the lesson. The evaluation is on a 5point (0-4) with 0 indicating the aspect was not observed in the lesson, and 4 indicating that the aspect was applied to a great extent. The methodology was a trace study in which lessons for particular teachers were observed in the 2003/04 before they undertook training and in 2007 just after completion of the 4<sup>th</sup> module of training.

**Figure 2.2** below illustrates the findings of the study.



**Source:** SMASSE Project Monitoring and Evaluation reports ( 2007)

From the above results teachers who have been attending INSET Cycles have been practicing ASEI-PDSI approach in teaching. Despite these results the practice of the ASEI-PDSI in Kangundo/ Matungulu Districts needs to be established and the researcher wanted to establish whether the practice of the same has an impact on the performance of Maths and Science subjects. Therefore this research will attempt to close this gap.

## **2.4 Attitude change**

SMASSE determines the impact of INSET activities on participant’s attitude towards various issues on the teaching and learning through the administration of pre-INSET questionnaire just

before INSET begins and post-INSET questionnaire at the end of the training **Waititu ( 2009)**. Waititu used comparison of the items of the questionnaires for mathematics and sciences to investigate the attitude of teachers towards SMASSE. The categories in the original questionnaires were blind (A-G) but the intended indicators were included in the research. The questionnaires for the other subjects were similarly constructed with minor adjustments.



Interpretation of mean scores ( $M$ ) in the Pre and Post-INSET evaluation ranged from “definite change of attitude required” ( $0.0 \leq M < 2.0$ ), “positive but needs confirmation” ( $2.0 \leq M < 3.5$ ) and “can be sustained” ( $3.5 \leq M \leq 4.0$ ) (SMASSE Project, 2003). The results for 2001 and 2002 represent pilot phase of the project, while 2004-2007 represent each cycle of INSET for the national phase. The results indicate a tendency towards positive attitude change may be sustained. In all instances participants had more positive attitude by the end of INSET than before, indicating that INSET activities indeed influenced them for the better, as shown in Table 2.1. Table 2.1 Summary of overall Mean Scores on teachers pre- and post INSET attitude

**Table 2.1 Summary of overall Mean Scores on teachers pre- and post INSET attitude**

Subject	2001		2002		2004		2005		2006		2007		Overall Mean	
	Pre	post	Pre	post	Pre	post	Pre	Post	Pre	Post	Pre	Post	pre	post
Biology	3.1	3.5	3.2	3.6	2.7	3.4	2.8	3.3	3.0	3.4	3.1	3.5	2.99	3.45
Chem	2.9	3.3	3.0	3.3	2.7	3.5	2.9	3.3	3.0	3.5	3.2	3.5	2.95	3.4
Maths	2.9	3.5	3.1	3.5	2.8	3.5	2.9	3.2	3.0	3.5	3.1	3.5	2.97	3.45
Physics	2.8	3.4	3.1	3.6	2.8	3.4	2.9	3.4	3.0	3.5	3.2	3.5	2.97	3.47
Overall	2.9	3.4	3.1	3.5	2.7	3.4	2.9	3.3	3.0	3.5	3.2	3.5	2.97	3.43

**Source:** Waititu (2009)

According to Waititu it can be shown that the attitude of teachers towards SMASSE before training and after training changes to be positive in all science subjects. If a teacher has a positive attitude towards his subject of specialization its most likely that the students will also have a positive attitude.

Regardless of these findings the research was based on national findings butt not in a specific area like Kangundo and Matungulu districts. The researcher therefore will do a research to fill this knowledge gap.

## 2.5 Effect of SMASSE on performance of students

### 2.5.1 Achievement in SMASSE and Non-SMASSE Districts

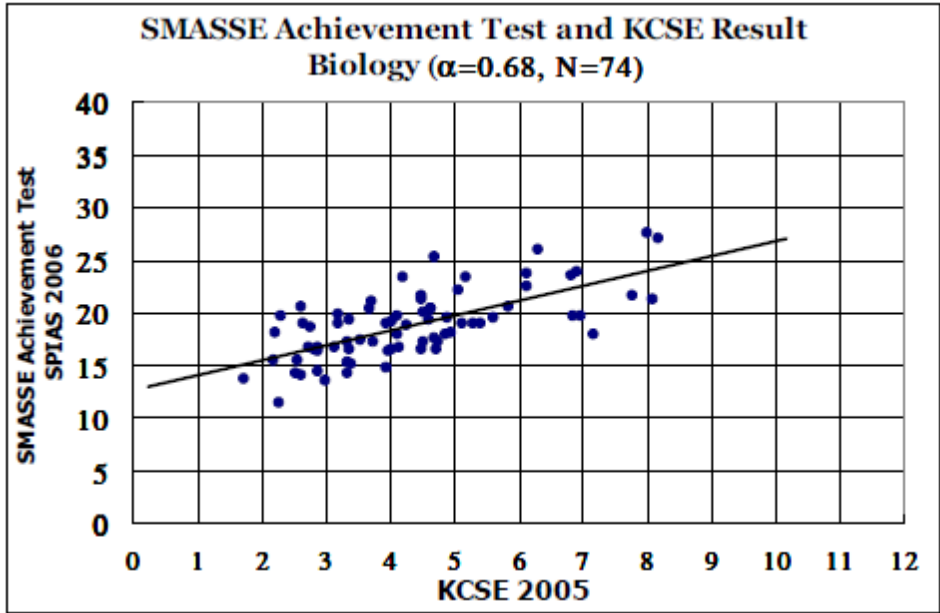
According to **CEMASTE A (2008)**, students' achievement, which is an important reflection of the quality of teaching and learning, is monitored through the SPIAS. The correlation between students' performance in the Kenya Certificate of Secondary Education (KCSE) examination and the achievement tests for each subject is very high, with values tending to 1, Figure 2. From a survey carried out in 2002, the achievement scores of students taught by SMASSE trained teachers were higher than those of students whose teachers had not undergone SMASSE training, Table 1.4 And on the basis of national examinations differences in favour of students taught by SMASSE trained teachers ranged from 0.64 to 1.66 units on a 12-point scale.

Table 2.2 KCSE score of samples schools used as an indication for the school educational standard in SMASSE and non-SMASSE (total score being 12).

<b>Subject</b>	<b>SMASSE</b>	<b>Non-SMASSE</b>
Biology	7.61	5.67
Chemistry	4.63	3.92
Mathematics	3.84	3.32
Physics	5.29	4.69
Overall	5.34	4.40

**Source: ADEA – 2008 Biennale on Education in Africa**

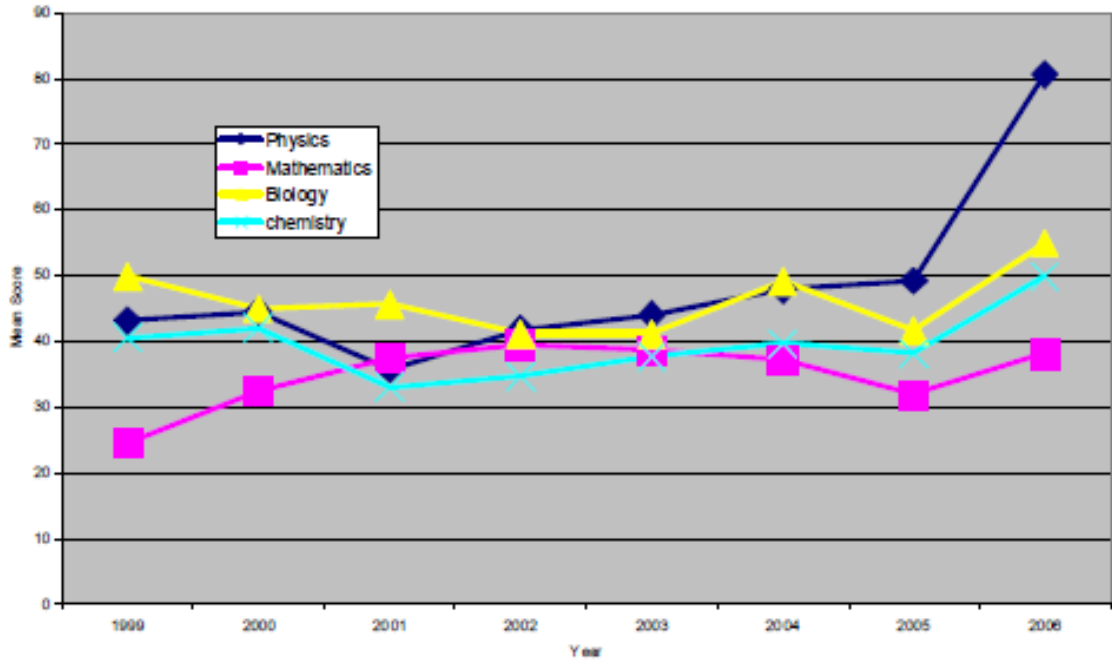
**Figure 2.3: SMASSE Achievement Test and KCSE Results**



Source: SMASSE Evaluation report (2007)

Correlation between SPIAS and KCSE Examination results

**Figure 2.4: Trends in KCSE Mean Scores in Mathematics and Sciences**



To assess the overall impact of the programme towards the achievement of the overall goal, SMASSE Project Impact Assessment Survey (SPIAS) is used. In Kenya, the SMASSE Project's impact assessment has already been done for Phase I (pilot) at mid-term and final evaluation and phase II (national and regional). **Biennale on Education in Africa (Maputo, Mozambique, May, 5-9 2008)**

There has been general improvement of KCSE grades from 1999 – 2006 as shown in the table 2.3 below.

### SMASSE Achievement Test and KCSE Result

Table 2.3: Impact of SMASSE on Performance in KCSE Exams

Subject	Yr	Entry	No. scoring A-B	% scoring	Mean score	KCSE Entry	% doing Subject	% improvement
Physics	1999	36049	6342	17.59	43.04	173,792	20.74	9.21
	2006	72890	19,932	23.23	80.64	243,317	29.96	
Maths	1999	173,792	6527	3.76	24.46	173,792	100%	35.97
	2006	243,317	21,702	8.92	38.02	243,317	100%	
Bio	1999	93,871	21,045	22.42	49.81	173,792	54.01	40.99
	2006	219090	35,681	16.29	54.93	243,317	90.04	
Chem	1999	98,813	12,812	12.97	40.49	173,792	56.86	40.99
	2006	238,102	28,638	12.03	49.86	243,317	97.86	
Mean score (%) fluctuations recorded 1999-2006						Comment: Although examination moderation for each year's marking is different from that of the previous year, this data from the KNEC shows improvement of examination performance in the 4 subjects at KCSE since 1999.		
Subject	Lowest & year		Highest & year					
1. Physics	35.71(2001)		49.18(2005)					
2. Maths	24.48(1999)		39.45(2002)					
3. Biology	41.08(2002&2003)		54.93(2006)					
4. Chemistry	32.99(2001)		49.86(200)					

**Source:** Kenya National Examination Council (KNEC)

From the above results it can be seen that since the inception of SMASSE Project there has been a gradual improvement on the performance of science and mathematics nationally. However the researcher wants to investigate whether the same results will be obtained in Kangundo / Matungulu Districts. The researcher will do that using questionnaires and interview guides for both teachers and students.

## 2.6 CHALLENGES FACING SMASSE PROJECT ( BARRIERS)

Several studies have divided barriers into two categories. Extrinsic and Intrinsic. In one study **Ertmer, (1999)** referred to extrinsic as first order and cited access, time, support, resources and training as extrinsic. He also cited intrinsic as second order e.g attitude, believes, practices, and resistance.

However, **Hendren (200, as cited in Al-Alwani, 2005)** defined extrinsic barriers as pertaining to organizations rather than individuals and intrinsic as pertaining to teachers administration and individuals. Character of administrators in education and those in KANGUNDO / Matungulu Districts can affect the SMASSE Project. If proper support is given then the project would be successful.

**Becta (2004)** grouped barriers according to whether barriers are related to an individual ( teacher level barriers) these barriers can include lack of time, resistance to change or institutional ( school level barriers). Lack of effective training in solving problems and lack of access to resources can be referred to as school level barriers. There are also other barriers that are personal; characteristics of teachers and they differ from one teacher to another. these are teacher level barriers.

Similary **Balanskat et. Al 2006)** divided them into micro-level barriers. Including those related to teachers attitudes and approach towards SMASSE Project. There are also Macro-level barriers which include those related to institutional context. This also include barriers which are related to the wider educational framework. This means that a teacher could make an effort to improve performance but face challenges from the set curriculum or from the education administration or challenges that are caused by his personality.

**Dawes (2001)** defines barrier as lack of confidence. It is contextual factor which can act as a barrier.

In **Bectas survey of practitioners (2004)** the issue of lack of confidence was the area that attracted most responses from those who took part.

Begg (200) asserts that teachers fear of failure caused lack of confidence. Fear to fail can therefore cause lack of confidence among teachers in Matungulu / Kangundo Districts.

## **2.7 ENHANCING SMASSE PROJECT TO IMPROVE PERFORMANCE OF SCIENCE AND MATHEMATICS IN KANGUNDO / MATUNGULU DISTRICTS.**

SMASSE Project has had a positive impact on skills, knowledge and attitudes in the teaching and learning of mathematics and science. There has been significant improvement in performance in these subjects, in the districts where SMASSE has been in operation during the project period.

The graph below shows some of those results in Kenya;

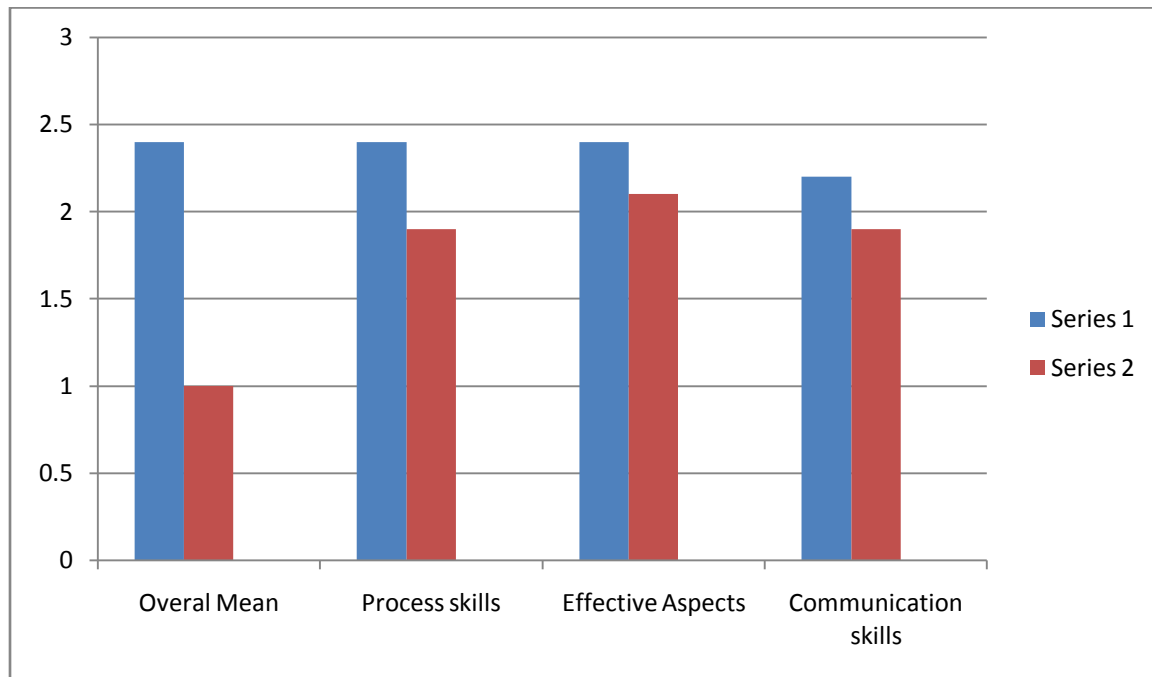
This is according to **CEMASTE, ( 2009) monitoring and evaluation District reports.**

Just like in other Districts in Kenya SMASSE Project can improve communication skills, process skills in students and teachers if applied well in Kangundo / Matungulu Districts.

Other than focusing on Kenya, SMASSE focuses on the African region through SMASSE-Western, Eastern, Central and Southern Africa (WECSA) as a regional association of mathematics and science educators. It was started in 2001 for the purpose of strengthening the quality of teaching and learning of mathematics and science in member countries. Member countries have adopted SMASSE's ASEI movement and PDSI approach as a way of improving classroom practice. As a follow-up, SMASSE Kenya personnel conducted Monitoring and Evaluation of application and impact of the principles of ASEI movement and PDSI approach, in the classroom in Malawi, Zambia, Rwanda and Zimbabwe They also administered lesson Quality of Participation questionnaire to the students in the classes they observed lessons to assess the quality of learning by SMASSE trained and non-SMASSE trained teachers. The results were as follows:-

Quality of Learning in Malawi, Zambia, Rwanda and Zimbabwe  
Extent of student Participation in Lesson (N=41) -May 2005

FIGURE 2.5: OVERALL MEAN PROCESS SKILLS AFFECTIVE ASPECT COMMUNICATION SKILL



**SMASSE Project Impact Assessment Survey Results 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 toward the subjects and their participation in class during learning. The following were observations on the teachers and the learners after being exposed to the INSET

### **Net impact on Teachers;**

- i) Plan better and more consistently
- ii) Attend students' needs more
- iii) Teachers are more open to team work
- iv) More confident to carry out practical activities and experiments previously thought to be difficult or dangerous
- v) Try out new methods
- vi) Face the challenge arising from lack of resources better
- vii) Face the challenge of large classes better

### **Net impact on Students;**

- i) Are actively involved
- ii) Show great interest and responsiveness
- iii) Attend lessons more punctually and regularly
- iv) Do their assignments more neatly and promptly
- v) Carry discussions beyond class time
- vi) Ask questions in and out of class
- vii) Students' interest and curiosity is aroused and sustained as they relate mathematics to their real life experiences
- viii) Encourages teamwork but allow individual participation for the students.
- ix) Provide students with opportunities to develop key competencies such as problem-solving, analysis, synthesis and application of relevant information
- x) Demystify math because by relating it to students' real life experiences
- xi) Their attitude gradually becomes positive**

Enhancement of the SMASSE project can therefore lead to better planning for teachers and make teachers face the challenges arising from lack of resources better. Enhancement of the project will also make students to be actively involved in class and also show interest in their work and this will lead to a better performance. Despite the enhancement of the SMASSE Project, Kangundo / Matungulu districts continues to post dismal results in the KCSE Exams.



The researcher therefore attempts to fill this knowledge gap by using questionnaires for both teachers and students.

## **2.8 SUMMARY OF LITERATURE REVIEW**

It has been found that SMASSE project in other Districts has improved performance. Attendance of INSET Cycles also leads to a better performance in the KCSE Exams. This is demonstrated in the literature review through data collected by **Waititu (2009)**. The practice of ASEI-PDSI methods of teaching makes students to have more interest and curiosity is aroused and this will make students to be interested in the science subjects. Through the data in the literature review teachers who practice this methods have been posting good results in the KCSE Results. In general SMASSE Project has improve performance in all the districts where the project has been initiated **Biennale on Education in Africa (Maputo, Mozambique, May, 5-9 2008)**. Although other institutions have progressed because of incorporating other teaching methods, there are no studies indicating the presence or absence of application of SMASSE skills in teaching Maths and Science subjects. Success therefore can be or cannot be associated with SMASSE skills. **Gitonga, ( 2009)**

## **2.9 CRITICAL REVIEW OF LITERATURE**

The overall literature suggests that teacher-related variables are most important to the impact of SMASSE on performance. The present study is structured to probe the most important school related determinants of liking or not liking maths and science 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 believe 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 and science 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.

## **2.10 THEORETICAL FRAMEWORK**

### **Climbing learning approach**

Other than ASEI and PDSI approach SMASSE has borrowed other important practices in the classroom like the **Climbing Learning Approach** Climbing Learning approach was developed by **Professor Noboru Saito of Naruto University of Education, Japan**, Mathematics department. This method utilizes a *concept map*, *table of the reason for arrow lines* and *the research card* during the lesson instruction.

Students are supposed to fill in the space of the concept-map the explanation of the learning elements, the formula, the examples and self made problems and answers. In the process the teacher makes the students understand the content and meaning of each learning element tightly. Thereby having the student extend the existing knowledge and reconstruct it. The other teaching learning tools in this method is the *Table of the reason for arrow lines*, where the students write the reason for arrows in the concept map. This activity is to enhance the students' understanding of interrelation of learning elements The 3rd tool is *the research card* where the students write any questionable issues. These are *how*, *why* and *what* issues.

The climbing approach theory is relevant to the impact of SMASSE Project on learning. The use of the concept map is similar to the ASEI-PDSI methods of teaching. The concept map uses the technique of planning and ensures active learning. This encourages innovation on the side of the learner and also the teacher.

The table of reason using the climbing approach tests the cognitive abilities of the learner. The arrow lines presents a lesson in interesting ways to arouse the learners interest for example, role play. Climbing approach is therefore similar to Do, See, Improve techniques of teaching as applied in ASEI-PDSI. The climbing approach will enable the teacher to see the good practices in a lesson and strengthen them, see mistakes made by the students and avoid further mistakes.

## **2.11 CONCEPTUAL FRAMEWORK**

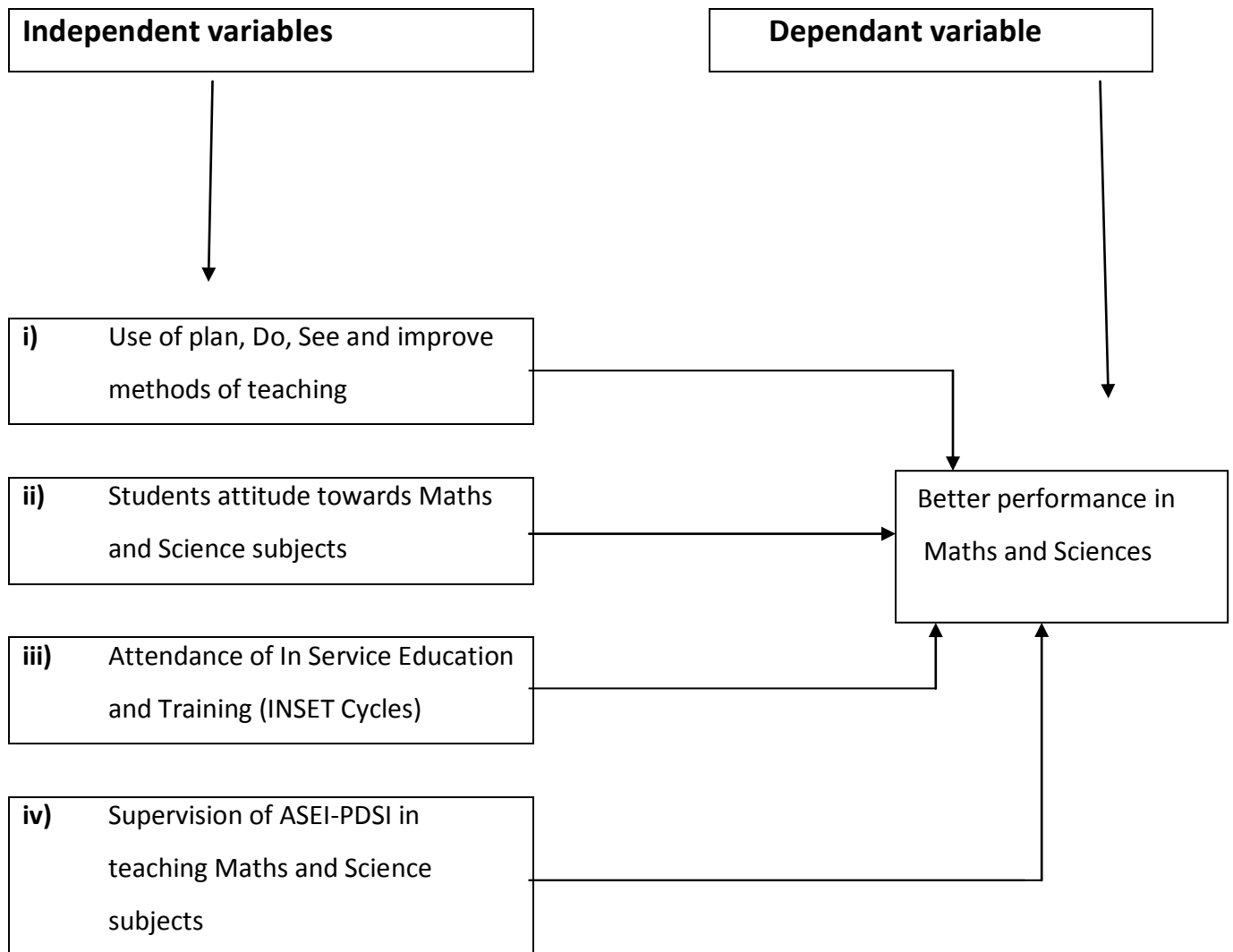
There are two categories of variables

- i) Independent variables
- ii) Dependant variables

An independent variable is a variable that a researcher can manipulate in order to determine its effect or influence on another variable. This is according to **Mugenda and Mugenda (2003)** Dependant variable attempts to indicate the total influence arising from the effects of the independent variable. For this study the independent variables are the use of ASEI-PDSI methods of teaching, a students attitude towards maths and science subjects, the attendance of INSET Cycles by science teachers, supervision of ASEI-PDSI.

From the literature review attendance of INSET Cycles has lead to better performance for students in their exams. The practice of the ASEI-PDSI methods of teaching have shown students to have interests in science subjects therefore leading to better performance. Attitude of students towards the science and maths subjects will affect their performance. Supervision of ASEI-PDSI ensures their practice in class therefore improving the performance of maths and science subjects.

**Figure 2.6: conceptual framework of the study.**



## CHAPTER THREE

### RESEARCH METHODOLOGY

#### 3.1 Introduction

The procedures and strategies that were used in the study are described in this chapter. The research design, target population, sample and sampling procedures, instrumental validity, reliability of the research, data collection procedures, analysis and presentation of data were highlighted. Each of these are discussed below.

#### 3.2 Research Design

The research design adopted was survey. A study design is the plan of action that helps to answer research question and helps to realize the objectives of the study. In a survey, a cross-section sample of a population at a point in time permits the gathering of information from respondents relatively quickly and in expensively. ( *Ary, Jacobs, Razarieh and Sorensen, 2006* )

This was necessary on the study in consideration of varied and spread locality of the institutions in the research. According to *tuckman 1994* a survey research is done by utilizing comparison groups. In this study groups like science teachers in schools, head of departments, quality assurance officers and students will take part in the study.

#### 3.3 Target Population

The study targeted principals, deputy principals, HODs, teachers of Mathematics and Science subjects and Students of 10 Secondary Schools from Kangundo / Matungulu District, Machakos County. It was undertaken in July and August 2012. It involved 8 public secondary schools and 2 private schools. The table below shows the number of the schools designation and number of respondents.

**Table 3.1 distribution of School and designation**

<b>SCHOOL</b>	<b>DESIGNATION / PRIVATE / PUBLIC</b>
1. Sengani Girls	Public Girls Boarding School
2. Kangundo Boys	Public Boys Boarding School
3. Tala Girls	Public Girls Boarding School
4. Tala Boys	Public Boys Boarding School
5. Misyani Girls	Public GIRLS Boarding School
6. Syanthi Secondary School	Private Mixed day school
7. Kathithyamaa Secondary School	Private Mixed day school
8. Matetani	Private Mixed day school
9. Holy Spirit	Private Mixed day school
10.AIC Ndovoini	Private Mixed day school

**Table 3.2** below also represents the list of respondents.

<b>TITLE</b>	<b>NUMBER</b>
Deputy Principal	9
Head of department	9
Teachers	58
Form Three Students	340

### **3.4 Sampling Design and Procedure**

Proportionate Stratified random sampling design was used. According to Mugenda and Mugenda (1999), in stratified random sampling subjects are selected in such a way that the existing sub groups in the population are more or less reproduced in the sample. It is advantageous in that it ensures inclusion in the sample of sub groups which otherwise would be omitted entirely by other sampling methods because of their small numbers. Kothari (1985) also recommends the sampling design used as appropriate according to the laws of statistical regularity. Thus if on average the sample chosen is a random one, it will have the same composition and characteristics as the universe. This would enable the research to make generalization of the findings of the study. There were three main strata namely; SMASSE centers, Actualization centers and Participant schools.

To obtain the study sample according to Gay cited in Mugenda and Mugenda (1999), for correlational research 30 cases or more are required; for descriptive studies 10% of the accessible population is enough and for experimental studies, at least 30 cases are required per group. The rule of thumb is to obtain as big sample as possible. However, according to Brown (1998), the sample size depends on the situation and on the statistic that is involved. Hence rules of thumb that are proposed e.g. the sample should be 28 or 30 per variable are imprecise.



For this study 10 schools were sampled to represent 27 schools in Kanggundo/ Matungulu District then. Respondents were head teachers, chemistry teachers, form three students and District Quality Assurance and Standards Officers (DQUASOs). In total 9 head teachers one from each school, 58 Science teachers specifically teaching form three class and 340 form three students responded to the questionnaire

. Form 3 class was purposively chosen based on the following reasons;

- 1) They had learned chemistry for the past two years
- 2) They had selected the subject
- 3) They were the incoming candidates

### **3.5 Data Collection Instruments**

Data was collected using the following instruments

#### **Questionnaires**

Structured questionnaires were used. They were developed to address the specific objectives of the study. Questionnaires were found appropriate in enabling the researcher gather a large amount of data from many subjects economically. There were three categories of questionnaires;

## **Students' Questionnaire**

This was closed ended with the aim of getting information about the attitude of learners towards chemistry. There were ten statements in the questionnaire. Each statement was rated on a 5-point Likert type of scale ranging from “**Strongly Disagree**” with a score of **1** to “**Strongly Agree**” with score of **5**. The students were required to tick in the box corresponding to their option. A sample of this questionnaire is attached as appendix E.

## **Chemistry Teachers' Questionnaire**

This was closed ended with 14 statements. The statements were rated on a 5-point Likert scale similar to the students' questionnaire. The questionnaire was to obtain information on attitude of teachers towards teaching chemistry and their attitude towards organization of the training.

## **Head teachers' Questionnaire**

This was a 10 statement closed ended questionnaire. A 5-point Likert scale was also used. The purpose of this questionnaire was to obtain information on the attitude of students towards chemistry after teachers undergoing SMASSE training. All the questionnaires were administered by the researcher in person.

## **Interview**

Face to face interview was done for the District Quality Assurance and standard officers (DQUASO) to confirm the information obtained through questionnaires and get information on the future plans of the project in the district.

## **Document Analysis**

Document analysis is the systematic examination of instructional documents such as syllabi, assignments, lecture notes, and course evaluation results in order to identify instructional needs and challenges and describe an instructional activity. Quantitative data was collected from KCSE result booklets and school records.

### **3.6 Data Collection Procedure**

The researcher conducted a comprehensive reconnaissance of the study area to assess its viability for study. Through ample facilitation by school of Education studies of University of Nairobi, the researcher was able to secure a legal authority from the Ministry Education Head quarters, Jogoo house, Nairobi.

In collecting data, the researcher visited the sampled schools to administer the questionnaire and carry out the interviews. Where necessary, clarification was made on the items of the questionnaire. The researcher administered the questionnaire to the respondents, waited for them to complete and then collected them. Respondents who were not able to complete were given a day or two to complete. Face to face interviews were conducted with the DQUASOs.

Respondents were assured of confidentiality of their response, which was meant for study purposes only. Data collected was presented in form of frequency tables and graphs for easier understanding and interpretation.

### **3.7 Validity of the Instruments**

Validity refers to the degree to which an instrument measures what it is supposed to measure. According to Kothari (1985), validity can be determined by using a panel of persons who shall judge how well the measuring instrument meets the standards.

For this study validity was tested by discussing the instruments with the supervisors and other specialists in department of Educational University of Nairobi.

### **3.8 Reliability of the Instruments**

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. To test for reliability, a pilot study was carried out in Sengani girls High School Matungulu District. Form three students responded to the student questionnaire.

Split half method of assessing reliability was used. Split half technique, according to Kothari (1985), requires only one testing session hence eliminating the chance error due to differing conditions. A Spearman's correlation coefficient of value 0.994 was obtained which indicated that there was a high reliable data. Mugenda and Mugenda (1999) indicated that in research study a reliability coefficient can be computed to indicate how reliable data is. A coefficient of 0.80 or more would imply that there was a high reliable data.

### **3.9 Data Analysis**

Data was analyzed using the SPSS computer package. Descriptive statistics of means and standard deviation were used .The hypotheses were tested using the T-test and One- Way ANOVA inferential statistics.

## CHAPTER FOUR

### Data analysis, presentation and interpretation

#### 4.1 Introduction

This chapter purposed on the questionnaire return rate, demographic information of respondents, presentation, interpretation and discussion of findings. The presentation of findings was done based on research question.

The chapter is presented under the following sub-sections.

- i) Questionnaire return rate
- ii) Demographic information of respondents
- iii) Extent of attendance of inset cycles by mathematics and science teachers in Matungulu/ Kangundo districts.
- iv) Extent to which ASEI-PDSI is practiced in Kangundo/Matungulu districts
- v) Attitude of students towards Maths/Science subjects
- vi) Impact of SMASSE Project on performance of Maths and Science subjects in Kangundo/ Matungulu districts.

#### 4.2 Questionnaire return rate

The questionnaire return rate is the proportion of the sample that participated as intended in all the procedures.

**Table 4.1: below shows the questionnaire response rate.**

RESPONDENTS	AVAILABLE	EXPECTED	%
Principals	7	9	77%
D/ Principals	8	9	88%
HODS	9	9	100%
Teachers	54	58	93%
Students	323	340	97%
<b>Total</b>			<b>91%</b>

The data shows that the response rate was good since 91% is above the recommended 80%. This response was considered appropriate for the study. Seven students did not respond and this was attributed to absence from school due to school fees problem. Two principals did not respond to the questionnaires and this was due to the busy schedules that are common among the school managers. The success of the response rate was attributed to the fact that the researcher personally administered the questionnaires and followed up those respondents who were busy hence they filled the questionnaires at their will. The researcher had also a very good relationship with the HODs of the schools used in the research. Therefore the good response rate of the teachers who work under the HODs.

### 4.3 Demographic information of respondents

Individuals gender, age, highest level of education, professional qualification and teaching experience play a great role in determining how a teacher integrates various methodologies in teaching mathematics and science in secondary schools. The study sought to establish individual's demographic aspects.

**Table 4.2: below shows these findings**

VARIABLE		NUMBER	PERCENTAGE
Gender	Male	54	69%
	Female	24	31%
Education Level	Degree	44	57%
	Diploma	30	39%
	Masters	11	14%
Teaching experience	Less than 5 years	12	16%
	5-10 years	11	14%
	11-15 years	13	17%
	16-20 years	27	35%
	21-24 years	10	13%
	26-30 years	5	6%

From the table most of the science teachers in Kangundo / Matungulu districts are male teachers. That is 69% of the respondents. Most of the science teachers and mathematics have education up to university level attaining degrees in the education sector. This was 57% of the respondents. Most of the science / mathematics teacher in Kangundo / Matungulu Districts have a teaching experience of 16- 20 years which gave 35% of the respondents.

**4.4 Extent of Attendance of INSET Cycles by Mathematics and Science teachers in Matungulu/ Kangundo Districts.** Sign.....

This sub-section presents the finding on the attendance of mathematics and science teachers in INSET basic cycles. The findings are presented according to the teachers, principals and deputy principals.

**Attendance of the INSET basic cycles**

*Table 4.3: Distribution of attendance of SMASSE INSET basic cycle*

**Basic Cycles**

Attendance	None	One	Two	Three	Four	Total
N	13	10	8	8	19	58
%	21.7%	17.4%	13.0 %	13.0 %	34.7 %	100%

Only 34.7 % of mathematics and science teachers had attended all four basic cycles of SMASSE INSET, while 21.7 % had not attended any of the 4 basic cycles of **SMASSE INSET**.

These findings imply that a substantial number of mathematics and science teachers had not covered the whole content of four basic cycles of **SMASSE INSET**. Therefore, there is need for continued **SMASSE INSET's** in Kangundo/Matungulu Districts to train all the teachers.



#### 4.4.1 Attendance of INSET cycles by teaching experience

**Table 4.4: Distribution of attendance of SMASSE INSET Cycles based on teaching experience**

Teaching Experience	Number	% of Total	None	At least one cycle	Four cycles
< 5 years	22	37.9%	43%	57%	6%
5-10 years	13	22.4%	17%	82%	26%
11-15 years	11	18.9%	3%	98%	53%
16-20 years	6	10.3%	6%	94%	76%
21-24 years	6	10.3%	19%	81%	42%
Total	58	100%	23%	77%	32%

It was observed that 76% of teachers with the teaching experience between 16-20 years had attended the four cycles, while only 43% of the teachers with the teaching experience had not attended any SMASSE INSET. The result implied that many newly recruited teachers, may be mainly B.O.G employees, do not attend INSETS.

#### 4.4.2 Attendance of the INSET as reported by Principals and Deputy Principals

**Table 4.5 :** Distribution of attendance of SMASE INSET basic cycles according to principals and deputy principals

Table 4.5: Attendance of INSET by teachers

	N	Regular	Partial	None	Non- Committal
Principals	9	75%	9%	15.6%	0.4%
Deputy principals	9	75.6%	-	9.8%	14.6%

According to 75% of school principals who participated in the study teachers regularly attended the INSET, While 9% and 15.6 % reported partial attendance and non- attendance respectively. Of the deputy principals who participated in the study, 75.6 % of them indicated that mathematics and science teachers in their schools attended the INSET, while 9.8 % reported that teachers in their schools had not attended any cycle of the INSET.

As to how attendance was ensured, principals cited circulars from District Education Office that invited teachers to attend the INSET. Some principals reportedly wrote official letters to individual mathematics and science teachers releasing them to attend INSET. Other principals attended opening and closing ceremonies of District INSET or checked attendance register at the INSET Centers to ensure that teachers from their schools attended INSET. Yet other principals whose teaching subjects were mathematics and science attended INSET as trainees. Still other principals required their teachers to give reports on the INSET once they went back to their schools. The principals attributed non-attendance or partial attendance of the INSET to a number of factors namely:-

- i) Some teachers were newly employed
- ii) Some teachers were employed on temporal basis
- iii) Pursuance of further studies by some teachers and
- iv) Negative attitude towards the INSET by some teachers

According to the deputy principals the mechanisms put in place to ensure INSET in Kangundo / Matungulu districts attendance by the teachers included: Facilitating teachers in terms of official release from duty, using trainers from the school to monitor the teachers and demanding for reports after INSET among others.

#### **4.5 THE EXTENT OF PRACTICE OF ASEI-PDSI IN THE TEACHING AND LEARNING BY MATHEMATICS AND SCIENCE TEACHERS ACCORDING TO TEACHERS**

This section presents findings on teachers’ self- perception of their practice of ASEI-PDSI, Preparation of ASEI lesson plans, extend of student involvement in the lesson, extent of improvisation, extent of engaging colleague teachers in lesson observation, challenges experienced by teachers in the implementation of ASEI-PDSI practice and remedies to challenges as suggested by teachers.

##### **4.5.1 SELF-PERCEPTION OF THEIR PRACTICE OF ASEI-PDSI**

The mathematics and science teachers’ self perception of their practice of ASEI-PDSI was using a questionnaire. The questionnaire was to determine whether with ASEI and PDSI the teacher was able to deal with the learner’s problems more adequately.

**Table 4.6: Practice of ASEI-PDSI**

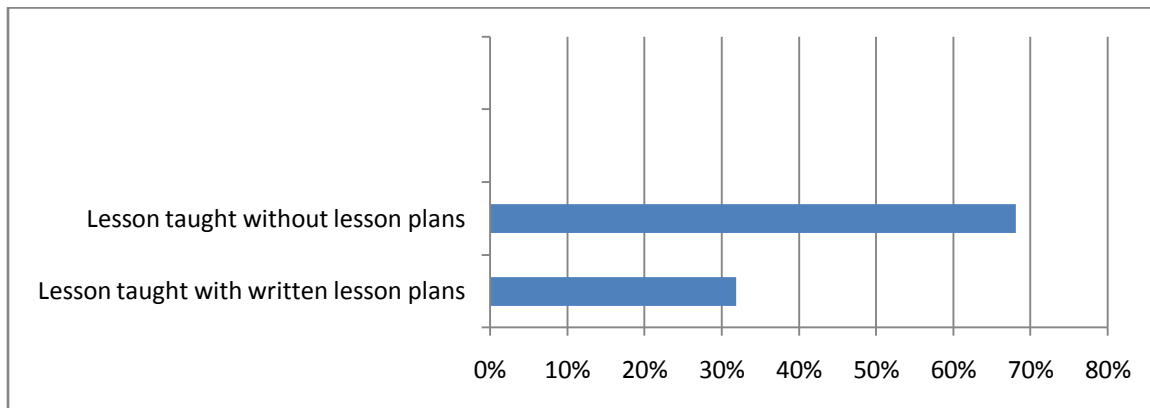
	<b>SA</b>	<b>A</b>	<b>UD</b>	<b>D</b>	<b>SD</b>
No.of Trs	19	27	6	5	1
Percentage	33.4	45.8	10.4	8	2.4

From the table 45.8% of the teachers interview agree that the practice of ASEI-PDSI has led them to deal with learners problem more adequately. Only 2.4% strongly disagree on the practice of ASEI-PDSI in the improvement off learners performance.

## 4.5.2 PREPARATION OF LESSON PLANS

This section presents findings on the availability of written lesson plans based on teachers' experience and qualification: the extent of teacher preparedness for the lesson and for practical activities to be carried out during the lesson.

**Figure 4.1: Preparation of lesson plans**



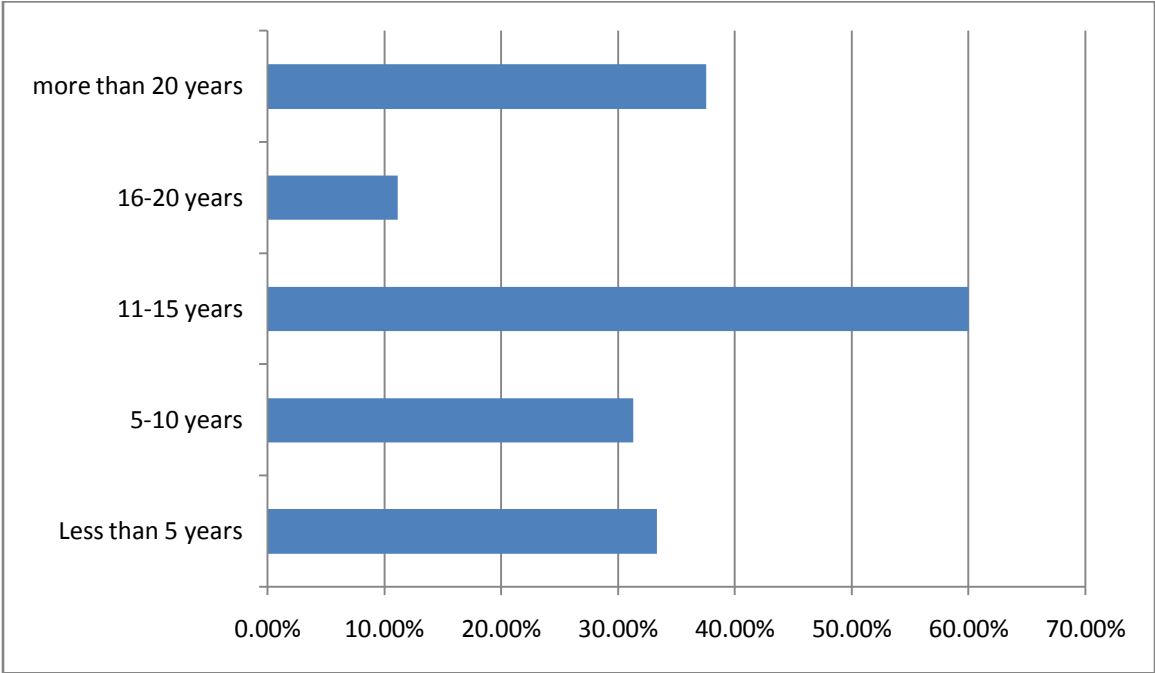
**Figure4.1:** Shows Lesson taught with or without written lesson plans

Of the lessons observed, 31.9% had written lesson plans while 68.1% did not have written lesson plans. The availability of lesson plans was checked against other variables such as teachers experience, number of basic cycles of INSET attended, teacher's qualification and subject. The findings are presented as follows:-

## 4.5.3 written lesson plan and teachers' experience

Figure 2 below shows distribution of lessons (N=22) observed based on availability of lesson plans and teacher's experience

**Figure 4.2: Availability of lesson plans according to teachers experience**

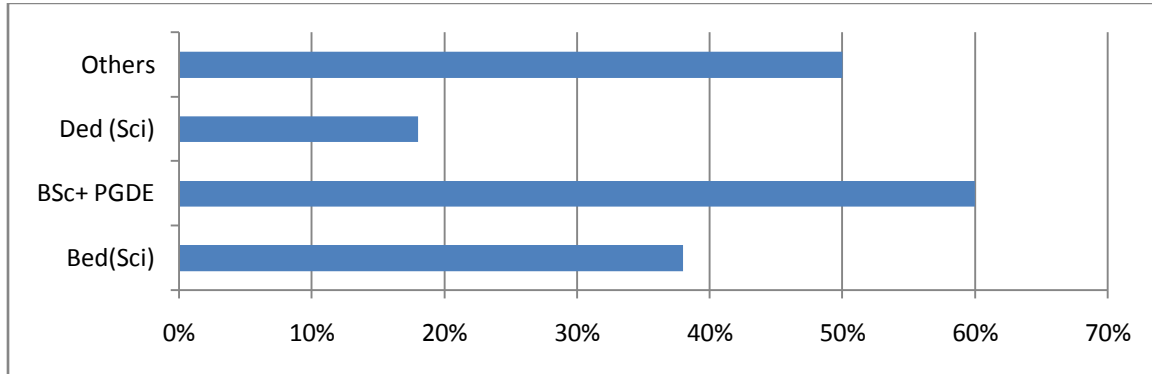


**Figure 2:** Distribution of lesson observed with written lesson plans based on experience  
Teachers in the 11 to 15 years of teaching experience had the highest percentage of written lesson plans at 60%, while teachers in the 16 to 20 years of teaching experience had the lowest percentage of written lesson plans at 11.1%

#### 4.5.4 written lesson plan and teachers' qualifications

Figure 4.3 shows the distribution of lessons ( N = 23) observed based on availability of lesson plans teachers' qualifications.

**Figure 4.3: Availability of lesson plans according to teachers qualification**



From the results, it can be seen that 60% of the teachers who had PGDE qualification had written lesson plans. Only 28% diploma teachers had lesson plans. The low percentage of diploma teachers is because they contribute only a small percentage of teaching force in secondary schools nationally.

#### 4.5.5 supervision of aseI-pdsI by hods, principals and deputy principals through the students

To supervise the extent of the practice of the ASEI-PDSI by the teachers, HODs Deputy principals used the students to gauge the practice in the classroom.

There were various aspects of students' involvement in the lesson that were rated. They included: active participation by all students, interactions among the students, generation of ideas by students, respect of students' ideas and involvement of students in carrying out the activities.

**Table 4.7: Distribution of the extent involvement of students in the lessons observed**

Extent of student involvement	Active participation	Interactions	Generation of ideas	Respect of stud. ideas	Involved in activities
Not applicable	-	-	-	-	4.2
Not at all	9.7	48.6	20.8	11.1	13.9
To a small extent	34.7	20.8	37.5	29.2	29.2
To a satisfactory extent	25	18.1	26.4	33.3	18.1
To a large extent	26.4	9.7	11.1	23.6	25
To a very large extent	4.2	2.8	4.2	2.8	9.8

From the Table 4.7 above, active participation by all the students at satisfactory and above had 55.6 %, Interactions among the students was 30.6 %, generation of ideas by students was 41.7 %, respect of students' ideas was 59.7% and involvement of students in carrying out the activities was 52.8%.

#### 4.5.6 Experiment

Table 8 below shows the distribution of lessons observed through the students based on whether they had experiments or not.

**Table 4.8:** Distribution of lessons observed based on whether they had experiments or not.

ACTIVITIES	SUBJECTS					%
	Maths	Bio	Chem.	Phy	Total	
Experiments	2	4	9	11	26	36.2
Not experiments	10	10	7	5	32	44.4
Not applicable	8	2	2	2	14	19.4
Total	20	16	18	18	72	100

Of the activities that were observed in lessons, 63.8 % were not experiments while only 36.2% of them were experiments. Physics had the highest number of experiments while mathematics had the least.

#### 4.5.7 Improvisation

Table 10 below shows the distribution of lessons observed through students based on whether they had experiments or not.

**Table 4.9:** The extent of improvisation, adequacy of improvisation and contribution of improvisation in achieving lesson objectives

Extent of improvisation	Attention to improvisation	Adequacy of improvised material	Contribution in achieving objectives
Not applicable	15.3	27.8	29.2
Not at all	51.4	44.4	38.9
To a small extent	15.3	16.7	12.5
To a satisfactory extent	11.1	2.8	8.3
To a large extent	6.9	6.9	5.6
To a very large extent	0	1.4	5.6
<b>Total</b>	100	100	100

In 51.4% of the lessons observed, there was no improvisation while in 18% of them; improvisation was done to satisfactory and above extents. Adequacy of improvisation to satisfactory and above extents was only 11.1% and contribution of the improvised materials in achieving the objective of the lesson was only 19.5%.

According to Wambui Nui and Nyacomba Wahome the practice of ASEIPDSI techniques has led to improvement in the performance.



Through these approaches, SMASSE Project has had a positive impact on skills, knowledge and attitudes in the teaching and learning of mathematics and science. There has been significant improvement in performance in these subjects, in the districts where SMASSE has been in operation during the project period.

#### **4.6 Effect of smasse on performance of maths and science subjects in kangundo / matungulu districts**

From the questionnaires collected from the teachers, the table below shows teachers views on whether the SMASSE Project has led to improvement in Maths and Science subjects.

**Table 5.0: Views on SMASSE**

	NUMBER	PERCENTAGE
Improvement	20	34%
No improvement	13	23%
Difficult to judge	25	43%

From the results it might be difficult to judge whether the SMASSE Project has led to an improvement in the performance of Maths and Science subjects. This is because the improvement in the performance is a combination of many factors. It is important to note that however 34% of the teachers felt that SMASSE Project has led to an improvement in Maths and Science subjects over the recent years.

##### **4.6.1 Performance in KCSE Maths and Science before and after SMASSE Training**

KCSE Science mean scores for the years 2002, 2003, 2005 and 2006 were collected from 10 schools. The years 2002, 2003 were referred to as before while 2005, 2006 as after SMASSE. One school's scores were omitted because it was a young school and lacked the before SMASSE scores. Scores for 9 schools were therefore compared as in Table 4.4.

**Table 5.1 Mean of KCSE mean scores**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
KCSE2002	9	2.02	8.92	4.0361	1.9070
KCSE2003	9	2.17	9.45	4.2362	1.9214
KCSE2005	9	2.22	9.45	4.3786	1.9369
KCSE2006	9	2.04	9.34	4.1200	1.7780

There was slight improvement after the introduction of SMASSE training as reflected in the mean of KCSE 2005. However there was a drop the following year 2006. The trend in the scores was in agreement with the organizational learning curve. Newstrom and Davis (1993) described the curve as a moment that experiences a small drop in the line of effectiveness after change occurs. The explanation is that employees need time to understand and adapt in order to accept change. During this period, there are many problems to be worked out. Procedures are upset and communication patterns disrupted. Problems arise and time must be taken to resolve them In fact things are likely to get worse before they get better.

Average scores for before SMASSE and after SMASSE were calculated to provide two set of scores shown in Appendix G. To find out if there was an improvement or a drop after SMASSE the mean of the mean score were calculated as shown in Table 4.5.

**Table 5.2 Mean of scores before and after SMASSE**

	<b>N</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Mean</b>	<b>Std. Deviation</b>
Before SMASSE	9	2.14	9.19	4.1361	1.8331
After SMASSE	9	2.14	9.39	4.2494	1.8271

There was an overall improvement of 0.1133. The change seems to indicate that SMASSE training had an impact albeit on a small scale. This change though small is encouraging and perhaps if all the teachers had gone through the training the change could have been much greater than indicated. The observed change in performance could be attributed to the slight positive attitude of students shown in the study findings. It could also be due the fact that many teachers had not attended some cycles of SMASSE training. Furthermore, during SMASSE training of teachers, it was only possible for a teacher to be trained in one of the teaching subjects. Some teachers who taught chemistry were trained in the other teaching subject. Unless the teachers shared and discussed, such teachers would still continue with their old way of teaching chemistry.

An interview with DQUASOs revealed that they were aware and relevant plans were under way. There were plans in the district of carrying out a mop up. This would involve training of teachers who did not attend certain cycles of SMASSE training for some reasons. However, Musvosvi (1998) acknowledges the fact that education changes slowly and benefits from it come after a long time.

When the mean scores before and after SMASSE were analyzed there was a strong correlation of 0.914 as shown in table 5.3

### **Paired Samples Correlations**

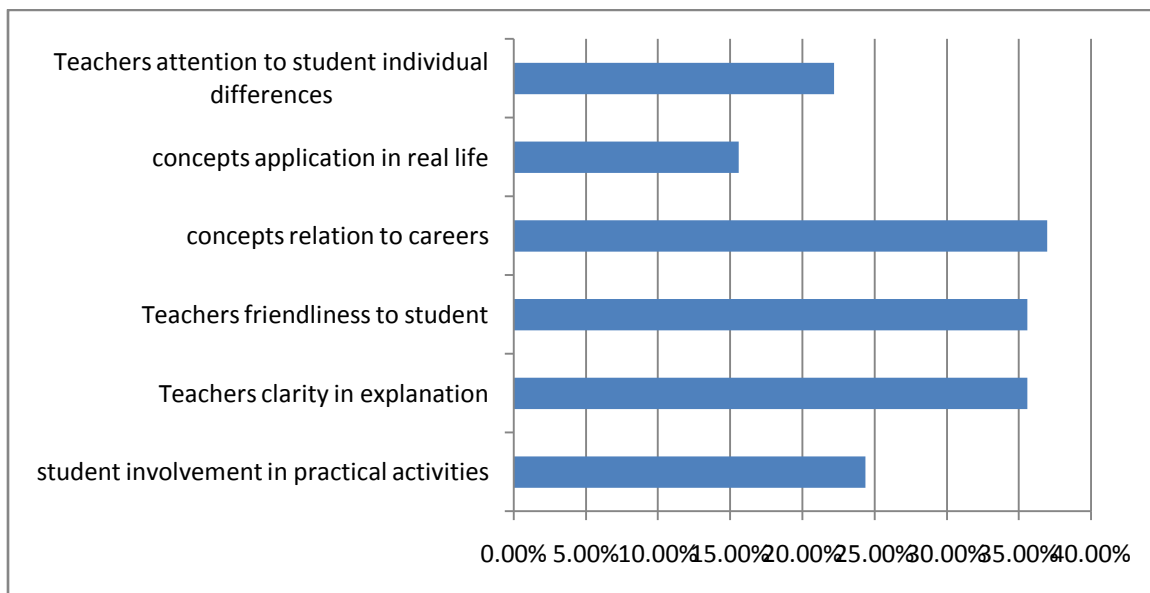
	<b>N</b>	<b>CORRELATION</b>
<b>Pair Before and after SMASSE</b>	<b>9</b>	<b>0.914</b>

Such a correlation was in order given that the comparison was on the same subject. The students are also likely to have been taught by the same teachers since the years being compared are at close range. One would have expected the correlation to be small but then relevant changes ought to be gradual. It was possibly for these reasons that there was the observed correlation.

#### 4.7 Attitude of Students towards Science and Mathematics in Kangundo /Matungulu Districts.

Note Some students indicated that they enjoyed learning mathematics and science because they thought that these subjects were in line with their future career and application in life. For such students, the main motivation was their career opportunities inherent in math and science subjects. To ensure that the mathematics and science were posing a challenge to them, students in some schools had self-organized group discussion where they discussed and used the chalkboard to present their work to others and where difficulties are encountered they consulted teachers. Figure 4.4 below shows the summary of factors that make students to enjoy math and science.

**Figure 4.4:Attitude of students towards science and maths**



Newstrom and Davis (2002) defined attitude as, feelings and beliefs that largely determine how one perceives their environment, commit themselves to intended actions and ultimately behave. A study by Njuguna (1998) revealed that students who had a favourable attitude towards science subjects were likely to have better achievement scores. He therefore recommended that there be promotion of favourable attitudes towards science subjects.

The figure reflected a positive attitude, which was not strong. This could have been because some teachers had not attended Cycle 1 of SMASSE training, which was concerned with attainment of a positive attitude change. It was also likely that some teachers had not grasped the aspects learned during the training or had not yet implemented them. According to Kurt Lewin cited in Dubrin (2006) a successful change requires unfreezing the status quo, changing to a new state and freezing the new change to make it permanent. For change to be accepted, employees must first deal with and resolve their feelings about letting go the old. Daft (2004) said that the implementation of change is the most difficult process and until people use the new idea, no change has actually taken place. Koontz and Weihrich (1988) said that for change to be effective it has to be congruent with a person's self-concept and values. That change if incongruent with the attitudes and behaviours of others in the organization, chances are that the person will revert back to the old behaviour.

The fact that students in secondary schools are taught by teachers who have undergone almost a similar training and the policy of TSC of employing only trained teachers makes all the students to be at par. The sampled schools were also within the same district hence there was a likelihood of having many aspects of teaching/ learning in common. For instance, they were likely to be meeting during get together like symposiums and science congress hence sharing their experiences. The students are also likely to be coming from the same locality especially for day schools. Such similarities are likely to make students have similar attitudes. According to Tsuma (1998), attitudes are wrapped with individual's feelings, needs and self concept and it is widely recognized that culture plays an important role in shaping our attitudes and developing interests.

## 4.8 Challenges of Smasse Project in Kangundo/Matungulu districts

Despite the successes registered, the project has faced several challenges. From the questionnaires collected from the teachers, these are some of the challenges faced by SMASSE Project:-

- i) some teachers have not appreciated the role of INSET in their individual continuous professional development,
- ii) Few field officers and principals have not been supportive enough
- iii) Lack of effective incentives beyond getting students to do well in their studies
- v) Conflict of interests. SMASSE being only for mathematics and science teachers and being conducted during the holiday when other teachers are free to attend their personal interests.
- vi) Coordination of INSET and other programmes that have future financial or promotional gains- e.g. post-graduate programmes and KCSE examiners' training conducted during the school holidays.
- vii) Non-collection and/or non-remittance of SMASSE funds to DPC due to poverty level that diminishes DEB capability in raising and remitting funds to DPC for effective conducting and managing INSET.
- viii) Strengthening INSET management capacity at the district level besides coordination of educational activities for enhance attendance of INSET
- ix) High staff turnover and transfer of trainers to non-curriculum implementing posts.
- x) Interferences in recruitment process of INSET trainers- failure to use specified criteria.
- xi) Language barrier
- xii) Different educational levels among participants
- xiii) Limited opportunities for further training for trainers.
- xiv) Harmonization and collaboration of QASO and SMASSE M&E activities/duties.

## **CHAPTER FIVE**

### **SUMMARY, CONCLUSION AND RECOMMENDATIONS.**

#### **5.1 Introduction**

This chapter is divided into the following subsections: Summary of the findings, Conclusions, Recommendations and Suggestions for further research.

#### **5.2 Summary of the Findings**

There was a slight overall improvement in the performance of science and maths after SMASSE with a mean scores of 0.1133. This could be attributed to the slight positive attitude of students shown in the study findings. It could also be due the fact that many teachers had not attended some cycles of the SMASSE training. Similarly, during SMASSE training of teachers, it was only possible for a teacher to be trained in one of the teaching subjects. Some teachers who taught for example chemistry were trained in the other teaching subject. Unless the teachers shared and discussed, such a teacher would still continue with their old way of teaching chemistry.

There was no significant difference in KCSE science performance of students before and after SMASSE training of teachers. Although that was revealed by the  $t$  – test, the change was encouraging. Perhaps if the research had captured a larger sample the change would have been significant. There was a positive correlation between the two sets of scores. It was probably for the small change in the result of the two sets of time that there was observed a very strong correlation. The correlation was in order because a good change ought to be gradual. An abrupt change is likely to lead to resistance.

Students had a slight positive attitude towards science. This could have been because some teachers had not attended Cycle 1 of SMASSE training, which was concerned with attainment of a positive attitude change.

It was also likely that some teachers had not grasped the aspects learned during the training or had not yet implemented it. According to Kurt Lewin cited in Dubrin (2006) a successful change requires unfreezing the status quo, changing to a new state and freezing the new change to make it permanent. For change to be accepted, employees must first deal with and resolve their feelings about letting go the old.

Further analysis of students' attitude indicated that there was no significant relationship between attitudes of students towards science and classification of school. Their attitudes did not vary with either students coming from SMASSE centers, actualization centers or participant schools. The fact that students in secondary schools are taught by teachers who have undergone almost a similar training and the policy of TSC of employing only trained teachers makes all the students to be at par. The sampled schools were also within the same district hence there was a likelihood of having many aspects of teaching/ learning in common. For instance, they were likely to be meeting during get together like symposiums and science congress hence sharing their experiences. The students were also likely to be coming from the same locality especially for day schools. Such similarities are likely to make students have similar attitudes.

Chemistry teachers had a positive attitude towards teaching science . Teachers who attended only one cycle agreed to the statements relating to SMASSE training having made them deal with students' problems better. Similar response was recorded by teachers who attended three and those who attended all the four cycles. However the teachers who attended two cycles gave response, which was not systematic. The researcher expected them to be more positive than those who attended only one cycle. Surprisingly they were undecided on almost all the statements. It was the expectation of the researcher that when teachers go through the whole training there would be gradual change and finally make them to appreciate the role of SMASSE training as depicted by those who attended all the cycles.



According to Newstrom and Davis (2002), a study on quality and teacher training and student achievement indicated that trained teachers do make a difference and in particular teacher qualification, experience and amount of education and knowledge were positively related to student achievement.

There was no significant relationship between attendance of SMASSE training and attitude of science teachers towards teaching science and maths. The attitude of teachers towards teaching science did not vary depending on whether they had attended all the cycles or not. The teachers seemed to be aware of the implications of the attitude in the teaching/learning process hence were keen with their teaching subject.

The attitude of teachers was desirable. Newstrom and Davis (2002) asserted the importance of employee attitudes to organizations. Negative attitudes are both a symptom of underlying problems and a contributing cause of forthcoming difficulties in an organization. Favourable attitudes on the other hand are desired by management because they tend to be connected with some of the positive outcomes. It was therefore worth concluding that the issue of negative attitude of teachers towards teaching science kangundo and matungulu district was no longer a problem.

science teachers had a positive attitude towards some aspects of the organization of SMASSE Training. The teachers seemed not to be contented with the mode of choosing trainers and the way their welfare was handled. There was need for these aspects to be reviewed incase of other cycles of SMASSE training. Ignoring such aspects was likely to have some effects on the whole training which could be a set back given the effort and investment in the SMASSE project. According to Walkiin (1992) staff is not always ready to pledge their support to what they do not fully understand. Consequently, involving the relevant stakeholders when planning makes the process participatory.

Participatory approach leads to owning up of the project hence ensuring maximization of the output, which is the goal of any innovation.

There was no significant relationship between attendance of SMASSE and attitude of science teachers towards the organization of SMASSE Training. . Attitude of teachers did not vary in relation to the number of cycles of the training attended. This was because one did not require attending all the cycles to make observations and hence give a comment about it. It therefore did not matter whether one attended all the cycles or not because it was possible to observe as long as one had attended at least one of the cycles. Similarly it did not require one to have a specific teaching experience to make observations on various aspects of the training

### **5.3 Conclusion**

Analysis of performance of students in KCSE science before and after SMASSE training of teachers indicated a slight overall improvement. Although the change was small it seemed to indicate that SMASSE training had an impact albeit on small scale. From study findings there was no significant difference between KCSE science mean score before and after SMASSE training of teachers as revealed by the  $t$  – test. Despite that, the change was encouraging. Perhaps if the research had captured a larger sample the change would have been significant.

Analysis of student response to items in the questionnaire relating to their attitudes towards science indicated a weak positive attitude. Daft (2004) said that the implementation of change is the most difficult process and until people use the new idea, no change has actually taken place. According to Tsuma (1998), attitudes are wrapped with individual's feelings, needs and self concept and it was widely recognized that culture plays an important role in shaping our attitudes and developing interests.

Mean response of science teachers indicated that they had a positive attitude towards teaching science. According to Newstrom and Davis (2002), a study on quality and teacher training and student achievement indicated that trained teachers do make a difference and in particular teacher qualification, experience and amount of education and knowledge were positively related to student achievement.

The attitude of teachers towards teaching science did not vary depending on whether they had attended all the cycles or not. It was therefore worth concluding that the issue of negative attitude of teachers towards teaching science in kangundo and matungulu district was no longer a problem.

Another objective of the study was determining teachers' attitudes towards the organization of SMASSE training. It was also noted that there was no significant relationship between attendance of SMASSE and attitude of teachers towards organization of SMASSE training. However; they were positive to some aspects of the organization of the training and negative to others. After considering aspects dealt with during the study, the researcher reached a general conclusion that SMASSE training of teachers had a positive effect on performance of students in science.

## **5.4 Recommendations**

From research findings and conclusion made, the following recommendations were made

- (1)** More in-service trainings and SMASSE training to train teachers in the second teaching subject. The mop up mentioned by the DQUASOs was timely hence it should be implemented.
- (2)** The findings indicated a weak positive attitude change towards science by students. There should therefore be promotion of favourable attitudes towards science.

- (3) More effort needs to be directed towards making science and maths enjoyable by students.
- (4) Involvement of major stakeholders like Head teachers and representatives of targeted teachers during preparation of in-service trainings would promote participatory approach.
- (5) From study findings teachers were positive towards teaching the subject and toward the organization of the training. There was need to ensure that the situation is refrozen so that it takes hold.
- (5) The mode of choosing Trainers and matters concerning welfare need to be reviewed in case of future trainings.
- (6) Monitoring and evaluating will be necessary to track performance, give ongoing information on direction of change, pace of change and generation of appropriate results regarding SMASSE training of teachers.

### **5.5 Suggestions for Further Research.**

- (1) There is need to carry out a similar study in other subjects.
- (2) There is need to carry out a similar study with a broader sample.
- (3) There is need to repeat this study in three years time just incase it came too early to establish the effect of the training.

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## **Appendix A:**

Researcher's Letter of Introduction to Respondents.

Boniface Mutisya

P.O Box 1010

Kangundo

Dear Participant,

I am a Post Graduate Diploma in Education University of Nairobi. I am carrying out a study to investigate the impact of SMASSE Project on the teaching methodology and learning in Secondary schools in Kangundo / Matungulu Districts. When identified, the information will be used to make recommendation on future SMASSE training programmes and training of science teachers. The attached questionnaire seeks to achieve this objective. You are among the people that have been selected to participate in this survey. Your co-operation in completing the attached questionnaire will be highly appreciated. All the information will be kept confidential.

In advance, I thank you most sincerely for accepting to participate in this study.

Yours sincerely,

**BONIFACE MUTISYA.**

## Appendix B:

### QUESTIONNAIRE FOR HEAD TEACHERS.

This section intends to find out the impact of SMASSE training on teaching methodology and learning in secondary schools and the attitude of teachers towards the ASEI/PDSI.

#### SECTION A: PERSONAL DETAILS

(1) Please indicate your gender

Male

Female

(2) Qualifications

BED

BA/BSC

PGDE

M.PHIL

(3) In which groups do your teaching subjects belong?

Mathematics

Sciences

Applied Sciences

(4) Teaching Experience

Up to 5 years

6 to 10 years

11 to 20 years

Above 20 years

(5) In which category was your school?

Public Boy School

Public Girl School

Public Mixed School

Private School

## **SECTION B**

The statement appearing below relate to the attitude towards Maths and Science where

**SA** means **Strongly Agree**

**A** stands for **Agree,**

**U** means **Undecided,**

**D** means **Disagree**

**SD** means **Strongly Disagree**

The statements call for one response from among the five alternatives. Please tick inside the box corresponding to your response.

	SA	A	U	D	SD
1) I am aware and well informed of SMASSE project					
2) I was involved in the preparation for SMASSE project.					
3) I facilitated my chemistry teachers to attend the SMASSE training.					
4) I have noted the students developing interest in chemistry.					
5) My teachers were willing to attend SMASSE Training					
6) SMASSE training has contributed towards the improved performance of learners in Chemistry.					
7) The time for SMASSE Training during school holidays was appropriate for the school.					
8) SMASSE Training has been a great step towards improving performance in chemistry.					
9) I have witnessed creativity in students regarding chemistry since SMASSE training					
10) SMASSE training has encouraged team work among teachers					

## Appendix C

### QUESTIONNAIRE FOR HEAD OF DEPARTMENTS (HOD).

This section intends to find out the effect of SMASSE training on Performance of learners in maths/science, attitude of teachers towards teaching maths/science after SMASSE training and attitude of teachers towards the organization of the training, practice of ASEI-PDSI.

#### SECTION A: PERSONAL DETAILS

(1) Please indicate your gender

Male

Female

(2) Qualifications

BED

BA/BSC

PGDE



MSC

(3)Teaching Experience

Up to 5 years

6 to 10 years

11 to 20 years

Above 20 years

(4) Attendance of SMASSE Training

All the four cycles

Three cycles

Two cycles

One cycle

None

## **SECTION B**

5. The statement appearing below relate to the attitude towards maths/science where

**SA** means **Strongly Agree**

**A** stands for **Agree,**

**U** means **Undecided,**

**D** means **Disagree**

**SD** means **Strongly Disagree**

The statements call for **one** response from among the five alternatives. Please tick inside the box corresponding to your response.

	SA	A	U	D	SD
1) I am aware of SMASSE INSET and participated in the District					
2) The duration and time for Training in my District was appropriate.					
3) The Trainers/Facilitators had good previous record in their schools					
4) During SMASSE training I was accorded the respect I deserve as a teacher.					
5) The trainers' presentation of their papers was good.					
6) The choice of the trainers was on merit					
7) During SMASSE training, the teachers' welfare was catered for.					
8) Time allocated for the training was enough for me to internalize the concepts presented.					
9) With ASEI and PDSI I am able to deal with the learner's problems more adequately.					
10) I have been implementing SMASSE methodology of ASEI and PDSI.					
11) SMASSE has made me more competent in teaching chemistry.					
13) After SMASSE training I am able to handle my learners and their difficulties better.					
14) I advocate for more in-service trainings like SMASSE.					

6. To what extent do you practice the concept of ASEI-PDSI in the classroom (please tick where necessary)

To a large extent

To a small extent

To a satisfactory extent

Not at all

## Appendix D

### QUESTIONNAIRE FOR SCIENCE/MATHS TEACHERS.

This section intends to find out the effect of SMASSE training on Performance of learners in maths/science, attitude of teachers towards teaching maths/science after SMASSE training and attitude of teachers towards the organization of the training, practice of ASEI-PDSI.

#### SECTION A: PERSONAL DETAILS

(1) Please indicate your gender

Male

Female

(2) Qualifications

BED

BA/BSC

PGDE

MSC

(3)Teaching Experience

Up to 5 years

6 to 10 years

11 to 20 years

Above 20 years

(4) Attendance of SMASSE Training

All the four cycles

Three cycles

Two cycles

One cycle

None

## **SECTION B**

5. The statement appearing below relate to the attitude towards maths/science where

**SA** means **Strongly Agree**

**A** stands for **Agree,**

**U** means **Undecided,**

**D** means **Disagree**

**SD** means **Strongly Disagree**

The statements call for **one** response from among the five alternatives. Please tick inside the box corresponding to your response.

	SA	A	U	D	SD
1) I am aware of SMASSE INSET and participated in the District					
2) The duration and time for Training in my District was appropriate.					
3) The Trainers/Facilitators had good previous record in their schools					
4) During SMASSE training I was accorded the respect I deserve as a teacher.					
5) The trainers' presentation of their papers was good.					
6) The choice of the trainers was on merit					
7) During SMASSE training, the teachers' welfare was catered for.					
8) Time allocated for the training was enough for me to internalize the concepts presented.					
9) With ASEI and PDSI i am able to deal with the learner's problems more adequately.					
10) I have been implementing SMASSE methodology of ASEI and PDSI.					
11) SMASSE has made me more competent in teaching chemistry.					
13) After SMASSE training I am able to handle my learners and their difficulties better.					
14) I advocate for more in-service trainings like SMASSE.					



6. To what extent do you practice the concept of ASEI-PDSI in the classroom (please tick where necessary)

To a large extent

To a small extent

To a satisfactory extent

Not at all

## Appendix E:

### QUESTIONNAIRE FOR STUDENTS

This section intent to find out the attitude of learners towards Maths/science and their Performance in the subject.

#### SECTION A.: PERSONAL DETAILS FOR STUDENTS

(1)Please indicate the category of your school.

National

Provincial

District

Private school

(2)Please indicate you gender

Male

Female

(3) Please indicate your age bracket

Up to 15 years

16 to 20 years

Above 20 years

#### SECTION B

The statement appearing below relate to the attitude towards chemistry where

**SA** means **Strongly Agree**

**A** stands for **Agree,**

**U** means **Undecided,**

**D** means **Disagree**

**SD** means **Strongly Disagree**

The following statements call for **one** response from among the five alternatives. Please tick inside the box corresponding to your response.

	SA	A	U	D	SD
1) My relation with the chemistry teachers is good.					
2) My Chemistry teacher involves us during the lesson making it interesting.					
3) My chemistry teacher shows concern over my chemistry scores					
4) Chemistry discussions are interesting and we do extend beyond class time.					
5) Chemistry Assignments are less stressful.					
6) I intend to take a career related to chemistry in future.					
7) Chemistry is not difficult as others have been saying					
8) My scores in Chemistry are low as compared to other science subjects.					
9) I should have dropped chemistry.					
10) I do not understand any thing during chemistry lessons					

## **Appendix F:**

### **Interview schedule for District Quality Assurance and Standards Officer (DQUASO).**

- (1) What has been accomplished in Kangundo/Matungulu District as far as SMASSE training is concerned.
- (2) How can you rate the attendance of SMASSE in the District?
- (3) What can you say about the way teacher's welfare was handled?
  - a) Meals
  - b) Accommodation
  - c) Leisure time/entertainments
  
- (3) What can you say about the quality of the cycles in the training?  
.
- (4) Are your teachers in the districts satisfied with SMASSE?
- (5) What are future plans for improvement?
  
- (6). Do you think SMASSE has had any effect on chemistry as one of the science subjects?

**Appendix G:**

**Work plan/Time schedule**

The research plan is expected to cover periods below

Activity	May	June	July	August	September	October	November
Literature Search and Review	Shaded	Shaded	Shaded				
Proposal writing			Shaded	Shaded			
Design of instruments			Shaded	Shaded			
Piloting				Shaded	Shaded		
Field Work				Shaded	Shaded	Shaded	
Data analysis					Shaded	Shaded	
Report Writing						Shaded	
Dissemination						Shaded	
Final Report writing							Shaded

## Appendix H:

### Budget estimate

The estimate expected for the whole of this study is as follows

1. Writing and of research proposal

Typing	5,000
Photocopy	2,500
Binding	500
<b>Sub total</b>	<b>8,000</b>

2. Field Work

Piloting	6,000
Transport	7,000
	7,500
Duplicating Papers	1,500
Staples	700
<b>Sub total</b>	<b>22,700</b>

3. Typing and evaluation of

Computer	5,000
Photocopy	800
Binding	1,500
Stationary	1,500
<b>Sub total</b>	<b>8,800</b>

**Grand total**                      **39,500**