FACTORS INFLUENCING TEACHERS' PERCEPTION ON THE EFFECTIVENESS OF SMASSE PROJECT ON TEACHING OF MATHEMATICS IN SECONDARY SCHOOLS IN WESTLANDS DISTRICT, KENYA

BY

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DECLARATION

This research project report is my original work and has not been presented for a degree in any other university.

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DEDICATION

This work is in memory of my late father Alfred Asembo Odhier and late mother Hassanath Akinyi Orem whose love and inspiration strengthened me and made me progress this far academically.

To my dear loving husband Walter Ila and children Timmy Clyde Ila, Tarra Lulu Ila and Trynn Letitia Ila for their love, patience, support and understanding throughout the course of my studies.

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ABBREVIATIONS AND ACRONYMS

ASEI	Activity, Student centered, Experiments Improvising
DEBs	District Education Boards
DTOTs	District Trainers of Trainees
INSET	In-Service Education and Training
JICA	Japan International Cooperation Agency
KCSE	Kenya Certificate of Secondary Education
KESI	Kenya Educational Staff Institute
KESSHA	Kenya Secondary Schools Heads Association
KIE	Kenya Institute of Education
KISE	Kenya Institute of Special Education
KNEC	Kenya National Examinations Council
KSTC	Kenya Science Teachers College
MoE	Ministry of Education
MoEST	Ministry of Education Science and Technology
NCTM	National Council of Teachers of Mathematics
PDSI	Plan Do See Improve
MED	Masters of Education
B.Ed	Bachelors of Education
OECD	Organization for Economic Co-operative and Development
PGDE	Post Graduate Diploma in Education
SMASSE	Strengthening of Mathematics and Sciences in Secondary Education
UNESCO	United Nations Educational, Scientific and Cultural Organizations
WESCA	Western, Eastern, Southern Central and Africa
WSSD	World Summit on Sustainable Development

ABSTRACT

The main objective of this study was to investigate factors influencing teachers' perception on the effectiveness of SMASSE project on teaching of mathematics in secondary schools in Kenya. The study was carried out in Westlands District, Nairobi County and focused on the head teachers, heads of Mathematics department and teachers of Mathematics. The study sought to establish teachers' attitude towards the effective implementation of SMASSE project in the teaching of mathematics, determine the extent to which teachers' perception influences the effective implementation of SMASSE project in teaching mathematics, determine the adequacy of the teaching materials in the effective implementation of SMASSE project and to assess the role of the school administration in the effective implementation of the project towards the teaching of mathematics. The study employed a survey research design that targeted eight (8) public schools in Westlands District, eight (8) head teachers, eight (8) heads of mathematics department and thirty six (36) Mathematics teachers. The study employed purposive sampling where only the TSC employed teachers who had attended the SMASSE in-service training were interviewed. The data obtained was analyzed using SPSS and output presented in form of frequency distribution tables for interpretation. The study revealed that most teachers had a negative attitude towards SMASSE program which could be traced to the environment under which it was done and the benefits that they receive from the project. A significant percentage of the teachers (33.3%) of the teachers felt that SMASSE was not useful. This is despite the fact that over 60% of the respondents indicating that SMASSE had affected their teaching since it enhanced their professional development. Additionally over 80% of the respondents agreed that the themes and topics taught during SMASSE were relevant. However, over 50% of the HOD and 32% of the teachers indicated that the facilitators did not communicate their content clearly. The study further revealed that 69.3% of the teachers and 67.6% of the HODs agree that SMASSE activities delay the coverage of the syllabus since they were numerous and involving. With their current workloads it was not possible to undertake such activities. It is also interesting to note that 48% of the HODs and 40% of the Mathematics teachers felt that the time spent during the INSET was not managed properly. The teachers agreed that adequate materials were needed for successful implementation of the programme though funding was low, 68% of the teachers had indicated an increase in the materials though this was still inadequate. Administration is considered an important pillar for implementation. The teachers however felt that they were receiving little help from the administrators. Supervision was lacking as HODs only concentrated in checking Schemes of work and records of work at the expense of lesson plans. The study showed that 66.7% of the HODs rarely checked lesson plans while 60% of them never supervised lessons in class. The study recommended the following: there should be adequate materials to facilitate the implementation of the project; more teachers should be employed to ease the workload. Similarly, professional facilitators who can best manage the seminars and training should be employed. Additionally, the project should target schools with less teaching facilities. Consequently, there should be more financial support from the government and non-governmental organizations to facilitate implementation of the project. The SMASSE project can be best implemented if it is incorporated in the teachers training programs in universities and colleges.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Education has been recognized as a central element in development. Across nations, education is especially regarded as a major agent for economic, political, and social development; this importance has led to education taking an increasing share of national budgets across the world (Ayot, 1992). In the modern world today, greater emphasis is being placed on Industrial and Technological development. As a result students are being encouraged to take up science related subjects. One subject that cuts across all the sciences is mathematics. Today, mathematical methods are literally applied in every field of human endeavor and play a fundamental role in economic development of a country and the world as a whole (Aremu and Ayotola, 1998).

According to the National Development Policy, Kenya is aiming to be an industrialized country by 2020. However, performance of mathematics and science education on which the industrialization relies has been remarkably poor. The improvement of mathematics and science education was, therefore, considered a matter of urgency in Kenya. As an intervention Japan International Cooperation Agency (JICA) and the Government of Kenya started SMASSE Project in 1998 which covered nine (9) pilot districts of the seventy one (71) in Kenya. The Project aimed at strengthening Mathematics and the three science subjects Biology, Chemistry and Physics through In-Service Education Training (INSET) for teachers in these subjects.

According to Kenya Vision 2030, Kenya is working towards attaining the status of *"A globally competitive and prosperous country with a high quality of life by 2030"* through its broad vision of industrialization. This industrialization relies on good performance in mathematics and science education. The teaching of mathematics has undergone many changes in the last one

hundred (100) years. In many parts of the world projects have proliferated and new topics have been introduced under the name *modern mathematics* though most of the topics so described date from the last century. An attempt to deviate from the formal teaching of mathematics where the teacher explained a rule on the chalkboard gave some examples of the rule in operation, and then set the class many more examples and exercises to do for themselves. Teachers in this case believed that understanding would eventually come through sufficient practice (Omolo- Ongati, 2000). On the contrary, like in all other disciplines, the teaching of Mathematics has its own dynamics, problems and yet to be answered questions. The performance in Mathematics at all levels by both girls and boys are not significantly different. The problem lies with the instructor, the quality of recruit, the training process, ability to adapt to changes in curricula, opportunity for skills improvement, remuneration, working environment among others (Mureithi, 2000).

Mathematics and Science Education face numerous challenges in Kenya and the region as a whole. There has been persistent poor performance of students in Mathematics and Science in the National Examinations at the secondary level (Mureithi, 2000). In view of this, Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) project was initiated in 1998 to provide solutions to some of the problems that contribute to the poor performance.

Initially the project started in nine districts on a pilot basis namely Gucha, Kisii, Kakamega, Butere-Mumias, Lugari, Kajiado, Makueni, Maragwa and Muranga. In 2000 the project expanded to include Garisa, Kilifi, Taita- Taveta, Baringo, Kiambu and Meru South districts. The emergence of SMASSE on the scene and its accompanying impact saw the 2001 Kenya Secondary Schools Heads Association (KESSHA) National Conference appeal to the Ministry of Education to expand the project nationwide. It was not until 2003 that the Ministry requested for JICA's further assistance for countrywide coverage. In the course of implementing the Project,

SMASSE has interacted with other African countries and shared its experiences on the principles of Activity, Student centered, Experiments, Improvising (ASEI) and Plan Do See Improve (PDSI). This was done through technical exchange visits to and by other countries and through two regional conferences held in Kenya in 2001 and 2002. The conferences culminated in the formation of SMASSE- Western, Eastern, Southern, Central and Africa (WESCA) Association. This movement coincided with Japanese type two initiatives at the World Summit on Sustainable Development (WSSD) held in Johannesburg in 2002.The regional collaboration is moving towards Asia-Africa Cooperation through dispatch of counterpart personnel to and from the Philippines, where Japan conducted technical cooperation for mathematics and science education. With the successful attainment of the Phase I, the Government of Kenya (GOK) requested the Government of Japan to continue the technical cooperation for SMASSE Phase II Project which included SMASSE INSET to go national and to strengthen SMASSE-WECSA Network.

The way teachers view the impact of the project on their teaching will to a large extent determine the level and degree of its usage. Teachers form an impression which is favourable or otherwise, depending on specific traits that they attribute to the project. Teachers' perception is predicated upon what they feel the project can do in the teaching-learning process. It must be noted that perception can be influenced by the personality characteristics of the perceiver and the features of the thing or object being perceived. Unfortunately, in any perception study, one is not sure which has more control over the other (Simonsen and Dick, 1997)

1.2 Statement of the Problem

Teachers are supposed to be the most important actors in the implementation of the SMASSE project. Teachers can 'make or break' the effective implementation of SMASSE project which will eventually affect the students' performance. If the teachers have a positive perception towards the SMASSE project, it can be implied that they can at least effectively implement the SMASSE project. However, it becomes worrying when teachers have a negative perception. The SMASSE baseline studies of 1999 noted that negative and neutral attitude were the main contributors of poor performance in Mathematics and Sciences. Studies by Ndirangu (2006), Etale (2008) and Konchora (2008) looked at the impact of SMASSE project on the teaching and learning of Biology, Chemistry and Physics respectively. They however failed to address the perception of teachers on the effectiveness of SMASSE project on teaching mathematics in secondary schools hence creating a gap in knowledge. An analysis of the mean grades in Mathematics within Westlands district indicates that a majority of the schools registered D+ which is a low grade despite the implementation of the SMASSE project thus begging the question, how effective is the project in the teaching of mathematics?

One National Daily (The Standard, Wednesday, April 23rd 2011) reported that teachers were faulting the SMASSE training programme claiming it was a waste of time. At the centre of controversy were unclear management structures, lack of proper training curriculum, poor accommodation for teachers and awarding of certificates that do not merit anything. The Teachers Service Commission Secretary, Gabriel Lengoiboni, admitted that the commission does not recognize the certificates. He stated that they are an added advantage but do not guarantee salary increments or promotion. This study therefore sought to investigate the factors

influencing the teachers' perception on the effectiveness of SMASSE project on the teaching of mathematics as perceived by teachers in secondary schools in Westlands District.

1.3 The Purpose of the study

The study sought to examine the factors influencing teachers' Perception on the effectiveness of SMASSE project on teaching of Mathematics in secondary schools in Kenya

1.4 Objectives of the study

The study endeavored to fulfill the following objectives:-

1. To establish teachers' attitude towards the effective implementation of SMASSE project in the teaching of mathematics
2. To investigate the effect of INSET Training on the effective implementation of SMASSE project on the teaching of mathematics
3. To determine the adequacy of the teaching materials in the effective implementation of SMASSE project in the teaching of mathematics
4. To assess the role of the school administration in the effective implementation of the SMASSE project towards the teaching of mathematics

1.5 Research questions

The following research questions were explored:-

1. What is the teachers' attitude towards the effective implementation of the SMASSE project in their teaching of mathematics?

2. To what extent does the INSET Training influence the effective implementation of the SMASSE project in teaching mathematics?
3. Which teaching materials are available in the schools that facilitate effective implementation of SMASSE project on the teaching of mathematics?
4. What role does the school administration play in the effective implementation of the SMASSE project towards teaching of mathematics?

1.6 Significance of the study

Teachers are the agents of imparting knowledge to students and whom the SMASSE project targets through the In-service training. The analysis of their perception of the process is therefore imperative. The findings of this study may provide feedback to the Ministry of Education, Trainers and other stakeholders on the reasons behind the teachers' perceptions. It might also highlight both the positive and the negative effects of these perceptions on the teaching of the subject hence help the designers and implementers of the project to enhance efficacy. The findings of the study may also contribute to knowledge that might assist in solving some of the problems in the implementation of the SMASSE project.

1.7 Limitations to the study

This study had the following limitations:-

1. Confining the study to teachers in one district was likely to prevent the researcher from generalizing the findings of this study freely outside Westlands district.
2. The time lapse between the last INSET session and the moment of responding to the questionnaire items may be limiting due to memory lapses.

1.8 Delimitations of the study

This study sought to investigate factors influencing teachers' perception on the effectiveness of SMASSE project in teaching mathematics in secondary schools in Kenya though the study was conducted within Westlands District. This was to ascertain that indeed the project had been rolled out in all parts of the country, Westlands being but one of the many districts within the country. Though SMASSE project involves both the science and mathematics subjects, teachers of science subjects (chemistry, biology and physics) were not included. Only selected mathematics teachers, head teachers and heads of departments participated in the study. This is because they are the ones charged with the implementation of the project. The students however were not included since the study involved the teachers' perception which they may not be able to accurately measure.

1.9 Basic Assumptions of the study

The following assumptions were made:-

1. That the perceptions and attitude of the respondents were measured using questionnaires.
2. That the head teachers and heads of the mathematics department had also been taken through the INSET process.
3. That learning conditions in sampled schools for study were uniform throughout the period of study
4. That respondents gave honest and truthful responses to the instruments

1.10 Definitions of significant terms used in the study

Attitude- Refers to a relatively stable opinion towards a person, object or activity, containing a cognitive element (perceptions and beliefs) and an emotional element (positive or negative feelings) (Myers, 1996)

Effectiveness- Refers to the extent to which the set goals or objectives of a programme are accomplished.

In-service Training- Refers to any planned programme of learning opportunities afforded to staff members of schools, colleges, or other educational agencies for the purpose of improving performance of individual in already assigned positions (Harris, 1998)

Perception- is defined as an idea, a belief or an image one has as a result of how he/she sees or understands something. Perception is more subject to the influence of learning. It is a process of integrating, organizing and interpreting sensations. (Hockenbury, 1997)

Teacher- Refers to a trained person who creates conditions that will encourage and stimulate learning

1.11 Organization of the study

Subsequent chapters of the study were organized as follows: - Chapter Two presented a review of the literature and conceptual framework. The literature reviewed included; Concept of Perception and Teacher attitude, Teaching materials, SMASSE project, In-service education and training, evaluation of INSET programmes and resources of training, teaching of mathematics and teachers' perceptions

Chapter Three covered a description of research methodology used. This included: the research design, target population, sample and sampling procedure, data collection instruments, validity and reliability of research instruments, data collection and analysis techniques.

Chapter Four consists of the data analysis and discussion of the research findings.

Chapter Five contains a summary of findings, conclusions and recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This section looked at the literature review under the following thematic areas: Concept of perception, Teacher Attitude, Teaching Materials, SMASSE project, In-service education and training, evaluation of INSET programmes and resources of training, Challenges facing the effective implementation of the project, Teaching Mathematics and a conceptual framework given followed by a summary of the literature review.

2.2 The concept of perception

According to Goodley (1971) perception is defined as the process of awareness of objects or other data through the medium of senses. He notes that perception is not only a process of seeing but also of hearing, smelling and tasting. Wagemans (1941) gives a more comprehensive definition when he states that perception or rather to perceive is the acquisition of information about the environment through the senses, which are essential for adaptive behavior to occur. Much of what human beings learn comes through the senses. Without hearing, inner feelings and drive, seeing, tasting, smelling and feeling, human beings cannot learn anything.

Goodley (1971) further notes that perception relates to external stimuli, culture, beliefs, languages, past experiences, attitude and length of residence in a given location. People's individual differences and uniqueness are largely the result of cognitive processes. There are a number of cognitive processes; imagination, perception and thinking- but it is generally recognized that perception is a very important one that takes place between the situation and behavior which is relevant in this study.

According to Hockenbury (1997) perception has to do with the taking in and making sense of the vast array of sensory information that we experience. He further notes that perception refers to the processes that occur in the mind which converts sensations into a representation of the world that we make sense of. One important influence on perception is a person's attitude. Attitude is a learned tendency to respond in a certain way because of deeply held beliefs or feelings. It implies a feeling about something as well as knowledge of it. Attitudes can be acquired from reading materials on specific issues, coming into contact with a given situation or by observing how other people are doing things. Attitudes are held at three levels; one at the compliance level whereby one seems to form an attitude in order to avoid rejection or win approval. The second level is identification whereby one adopts an attitude as a result of an emotional attachment to a person or group while the third level is internalization. Here, one takes the new attitude into his/her own belief system. He/she believes it for his/ her own reason not just because of the others. The attitude becomes a part of them and this influences their perceptions

There is no sure method of describing and measuring perception, the description and measurement of opinion may in many instances be closely related to people's real feelings and attitudes. Techniques that have been used include ThurnStorn's technique, the Likert scale

method and semantic differential method also known as the Gultman method (Borg and Gall, 1989).

2.3 Teachers' Attitude

SMASSE Project (1998) found the main root cause of poor performance as negative attitude towards the teaching and learning of Science and Mathematics by students. SMASSE Project targeted teacher attitudes first because of the time they spent with the students. Teachers' negative attitudes can be impacted on the learners' attitudes towards mathematics and science. Attitude is a general feeling of favor or otherwise towards some stimulus (Di Martino, 2003). One of the factors that affect the output when carrying out a task is the attitude towards that task or towards the people with whom we carry out the task. A positive disposition will enable one to push on with the task despite advance situations. SMASSE Project (1998) shows that there was a general feeling among some teachers, students and key stakeholders that Mathematics and science subjects are difficult.

Allan (2002) defines attitude as the willing to accept verified facts, thus mathematics is based on attitude. Njuguna (2009) also asserts that children are natural investigators and they love to touch and feel things. Children find themselves observing, questioning, hypothesizing, predicting, interpreting and communicating. SMASSE innovation to change teachers' attitude through unfreezing of old methods of teaching students to new approach of ASEI-PDSI was laudable development in mathematics in its small way as it has given children opportunities to explore and satisfy their curiosity.

Teachers play key roles in education reforms as the agents of change that work directly with students. As Fullan (1996) explains, "We need to first focus on how teachers make sense of the

mandates and policies because there will be no educational reform until after teachers interpret the policies and make decisions based on their beliefs and attitude about the new demands"

Cross (1999) notes that attitudes determine what teachers teach and their willingness to teach. Negative attitude can powerfully inhibit intellect and curiosity and keep us from teaching and learning what is well within our power to understand. Beside the student, the teacher is a very important factor in the learning process. His preparation must be geared towards meeting the demand for effectiveness. The knowledge he acquires must go beyond the knowledge of the children he teaches and his attitudes must be positive so as to influence the learners so as to encourage them to learn more meaningfully.

All his actions must therefore have positive impact on the behaviour of the learners. While some feel that students need a strict, disciplined environment to learn, others feel that a greater degree of freedom should be given to develop student responsibility though the teacher assumes the position of leadership in their learning. To promote student responsibility, some teachers feel that a pleasant classroom atmosphere has to be created where students can take risks and be creative. This accounts for the varying interpersonal behaviours exhibited by teachers in their interaction with the students they teach.

However, teachers must demonstrate and reflect on their interpersonal dispositions and change their beliefs, attitude and behaviours if found not appropriate. Effective teaching especially of mathematics requires careful and reflective thought about what the teacher is doing and the effect of his or her action on students' social and academic development.

Thus there is need to check the views of teachers regarding the aspects of the SMASSE Program (ASEI-PDSI), its implementation and impact it has transferred to their attitude and its implementation.

Despite the inarguable influence of various contextual factors on science teaching and learning, there is still one key player that that has an immediate, overwhelming influence on the day-to-day details of curriculum implementation: the classroom teacher. While certainly constrained by classroom space, available equipment, the "assigned" curriculum, and administrative guidelines, the teacher is nonetheless relatively free to modify, adapt, improve, experiment, and motivate.

The way in which a given curriculum is interpreted, tinkered with, and (ultimately) implemented is not arbitrary, of course. Keys and Bryan (2001) firmly attribute such modifications/adaptations to the teacher's own thoughts and opinions, as embodied in their conclusion that "curriculum reforms, however well meaning, are shaped and the point that the notion of a "teacher-proof" curriculum is unrealistic; the way in which a given curriculum is enacted will necessarily vary based on teachers' individual beliefs, attitude and perceptions related to teaching, learning, and the instructional environment. Consequently, given the teacher's prominent role in curriculum implementation, classroom teachers are necessarily at the heart of educational reform (Bybee, 1993; Lumpe, Czerniak, & Haney, 1999). Administrators and other stakeholders concerned with engineering a sweeping, effective, sustainable reform must be concerned with the teachers' attitude a nd perceptions in the district(s) in which reform is being attempted.

SMASSE techniques is determined by three things; attitude towards a specific behavior, subjective norms and perceived behavioral control. These three attributes determine the teachers' readiness to use SMASSE methods in teaching mathematics and science. The

teachers' decision to use SMASSE approaches or not determines the learners' performance in mathematics and science.

2.4 Teaching materials

Learning and teaching is the concern of the trained teacher. But learning is a complex process. It can however be defined as a change in disposition; a relatively permanent change in behaviour overtime and this is brought about by experience. Learning can occur as a result of newly acquired skill, knowledge, perception, facts, principles, new information at hand etc. (Adeyanju (1997). Learning can be reinforced with learning aids of different variety because they stimulate, motivate as well as arrest learner's attention for a while during the instructional process.

Learning aids are instructional materials and devices through which teaching and learning are done in schools. Examples of learning aids include visual aids, audio-visual aids, real objects and many others. The visual aids are designed materials that may be locally made or commercially produced. They come in form of wall-charts illustrated pictures, pictorial materials and other two dimensional objects. There are also audio-visual aids. These are teaching machines like radio, television, and all sorts of projectors with sound attributes.

It is interesting to note that a large percentage of trained teachers and those undergoing professional training courses can teach with some of the learning aids. They do so consciously because they know that the use have positive effect on learning outcomes as their cognate experiences during teaching practice supervision reveals. In a research conducted by investigators in Winneba District, a survey sample of teachers with several years of teaching experience of between three (03) and twenty-five (25) years, claim that learning aids improve

methodology. They also claim that learning aids reduce their talk and chalk method. It is therefore imperative for teachers of mathematics to use teaching and learning materials for the effective implementation of the SMASSE project

2.5 SMASSE Project in Kenya

The SMASSE project's goal is enhancing the capability of young Kenyans in Mathematics and Sciences by providing In-service Education training for the serving teachers of Mathematics, Physics, Chemistry and Biology. The project objectives are; to enhance capability in Mathematics and sciences in terms of teaching methodology, knowledge level and management of experimental equipments, to enhance regular and frequent interaction among Mathematics and science teachers, to establish and utilize INSETs for Mathematics and science subjects and to improve trainee ability and skills in resource management, teaching approaches and strategies and consequently strengthen mathematics and sciences (SMASSE, Baseline Studies,1999)

The project was launched on the 27th day of February 1998 following a signing of records of discussion and minutes of agreement by the two parties (JICA, 1998). Offices had been set up at the ministry of education headquarters and the Kenya Science Teachers College (KSTC). This was followed by a baseline study on the causes of poor performance in Mathematics and science in Kenyan secondary schools in nine pilot districts.

In Kenya, there are other independent institutions within the Ministry of Education which do offer opportunities for staff development alongside their main task of establishment other than the SMASSE programme which is basically geared towards upgrading the capability of teachers of mathematics and science subjects. These institutions include the Kenya Institute of Education (KIE), Kenya Institute of Special Education (KISE), Kenya Educational Staff Institute (KESI)

and the Kenya National Examinations Council (KNEC). The SMASSE project falls under the Director of Quality Control and Assurance. In 2004 SMASSE started a training program for Western, Eastern, Central and Southern Africa (WESCA) regions known as SMASSE-WESCA Association. (SMASSE (a) 2004).

The SMASSE project has three main donors which include JICA, MoEST and District Education Boards (DEBs). JICA is by far the largest donor that ensures training of counterparts in Japan, provision of experts both on short and long term basis and provision of equipment and materials for National and District level INSETs. MoEST provides salaries, travel and subsistence allowances for national trainers as well as accommodation. It also provides buildings both at national and district levels. The District Education Boards gives allowances to trainers at district level through the levies provided by the parents.

The Baseline studies carried out by the SMASSE project team in 1998 made them realize that it is only a radical step in the form of a movement that would do especially for the classroom situation. It therefore came up with two approaches of changing the situation.

The first was the ASEI movement that advocated for; A-Activity based lessons which include practical, discussions and presentations that involve students' active participation, S- Student centered lessons which give priority to how the students learn, E-Experiments which students should perform to enhance understanding of concepts and principles in Mathematics and I-Improvising using locally available resources when conventional apparatus are not available and also for creating interest in the learners. (SMASSE Baseline studies, 1999)

The second was the PDSI approach which makes the ASEI lessons possible. It advocates for; Plan- Careful planning based on the learners' needs and problems, Do- Teach the lesson using well chosen and planned activities, See- Evaluate the lesson at all the stages of its development

and Improve- Feed back the evaluation results to improve lesson instructions and future planning and implementation

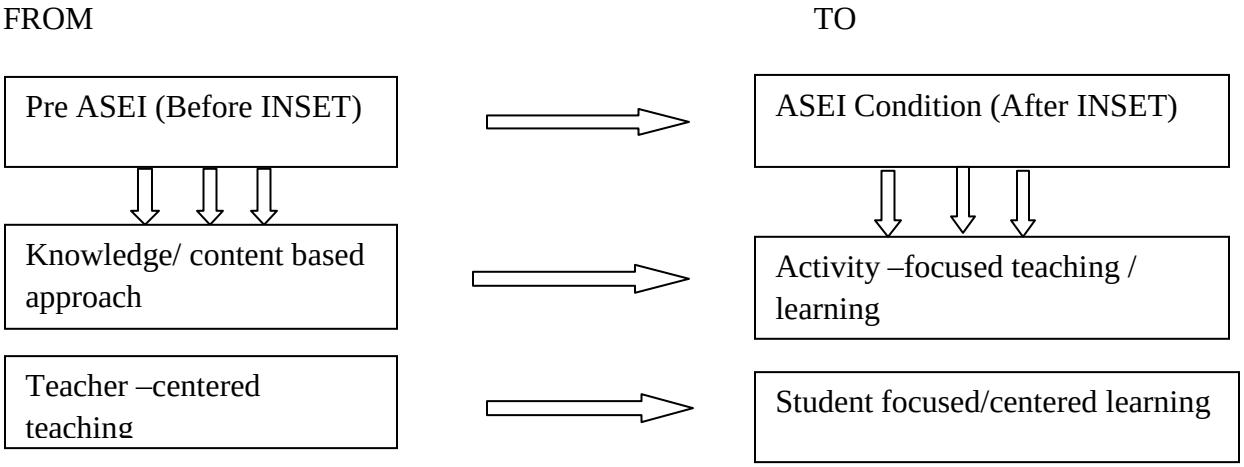
The SMASSE project has adopted the ASEI/PDSI approach so as to achieve the objective of the project. The approach is applied to all those involved in teaching and learning, school management, supervision and guidance. (Njuguna, 1999)

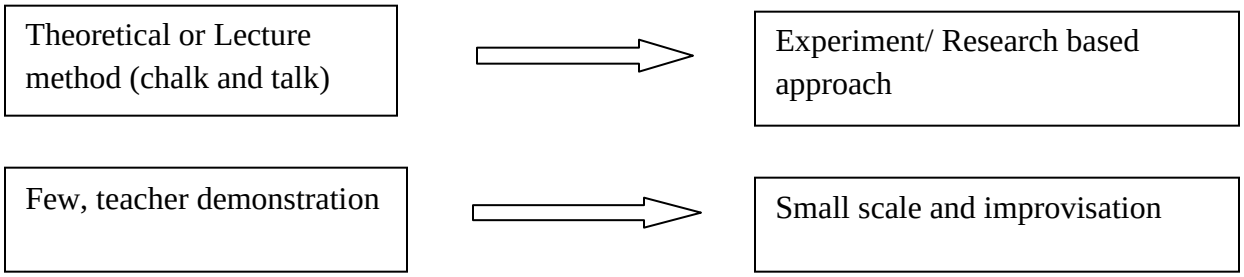
2.6 Positive Impacts of ASEI/ PDSI methods and approach

This approach has had a positive impact in the teaching and learning of Mathematics and Sciences. For many schools, the challenge combines incompetence in delivery processes and lack of student participation during classroom sessions. With attitude change, teachers can meaningfully utilize what schools have at the same time improvise what is not available. The study on the impacts of the training was conducted in Malawi, Zambia, Rwanda and Zimbabwe by the monitoring and evaluation task team of SMASSE-WESCA in collaboration with SACMEQ using the ASEI/PDSI evaluation tools to see the effectiveness and adaptability of the approach. (SMASSE-WESCA; 2006)

The results from the study indicated that there is a statistically significant difference at 5% level between ASEI trained and untrained teachers in their lesson delivery. There was also a statistically significant difference at 5% level in students participation between students who were taught by ASEI trained teachers and those by untrained teachers. Although there were some limitations of sampling such as internal evaluation and possible pre-existing difference of teaching between the ASEI trained teachers and the untrained teachers, the results could imply that the training has produced positive effects in the teaching and learning of Mathematics and Sciences (SMASSE-WESCA, 2006).

The Baseline studies carried out by the SMASSE project team in 1998 enabled them to come up with an INSET relevant to the needs of the trainees. In a number of cases the District trainers have conducted a session on baseline studies which echo the national INSET programme and content. The main issues identified by the needs assessment conducted in 1998 were; Attitude, Teaching methodologies, Content mastery, Interaction of teachers professionally, Development of teaching and learning materials and Administrative factors (SMASSE, Baseline Studies, 1999) The SMASSE project has developed the ASEI/PDSI approach as a working philosophy. The ASEI approach is based on four tenets that guide SMASSE activities thereby assisting teachers to shift classroom practices;





(SMASSE-WESCA 2004)

Figure 1 SMASSE's project ASEI Approach diagram

PDSI on the other hand emphasizes on planning before going to teach, doing the actual teaching, seeing where the planning is weak so as to improve on the future lessons.

The SMASSE project applies the cascade system of INSET that involves two levels of training – at the national and district levels. The national trainers train district trainers who in turn train teachers in their respective districts. In addition, the SMASSE project has four cycles in each level that is conducted within 10 days each. The curriculum of the INSET is based on the findings of the needs assessment which includes; subject content, pedagogy, attitude enhancement, 'hands-on' activities for process skills development, peer teaching and monitoring and evaluation. The SMASSE project was divided into four training cycles so as to reach both teachers and students in the shortest time possible. District trainers of trainees (DTOTs) were first in-serviced for the first cycle so that they could train the cluster trainees in their respective districts. This went on until the fourth cycle was over.

According to JICA, 2002, the first SMASSE in-service training on cycle one, for the DTOTs had been held in August 1999. The DTOTs later in April 2002, had trained the trainees in their district. The four cycles were; Cycle one-focusing on attitude, Cycle two-focusing on hands on

activities, Cycle three- focusing on ASEI lesson activities and Cycle four- focusing on impact transfer.

2.7 CYCLE I- Attitude

From the baseline studies it was noted that negative and neutral attitude were the main contributors to poor performance in Mathematics and Sciences. This cycle strives to lay emphasis on attaining positive attitude towards these subjects among the stake holders, teachers and learners. The sessions are used to enlighten the participants on issues that strongly influence how they perceive and conduct their duties as teachers and how learners perceive and react to their lessons.

Further, the four subjects have an input on the teaching methodologies. The topics covered during this cycle include; Attitude enhancement, Communication, Adolescent issues, Gender issues, Stress and stress management, Motivation, Work ethics and value judgement, Performance in mathematics and Sciences and Teaching approaches and methods.

This cycle is based more on theoretical pedagogical issues in Mathematics and Science education.

2.8 CYCLE II- "Hands–on" activities

Within this cycle, INSETs adopt a more practical oriented approach that provides hands-on experience. It offers the opportunity to put into practice the principles of ASEI movement and PDSI approach. The trainees work in groups in the specific subjects in order to focus on the problem areas of their subjects. The main emphasis of this cycle is proper lesson planning and practical approach in teaching mathematics and sciences, learner participation and the variation

of the stimuli by the teachers for effective learning through the ASEI movement and PDSI approach.

2.9 CYCLE III – Actualization

This cycle focuses on classroom implementation of ASEI/ PDSI principles. Activities of the INSET have been designed to transform the concept of ASEI from theory to practice, a process in SMASSE known as actualization of ASEI. The cycle involves implementing ASEI lessons and peer teaching sessions in addition to the actual classroom implementation in schools within the locality. Lessons are taught to different classes during the holidays.

The expected outcomes of this cycle are; to enhance participants ability to plan and implement ASEI lessons in schools and translate theoretical pedagogical issues into actual practice in the classroom, to enable the participants to develop skills in the area of improvisation and scaling down, to clearly bring out the importance of practical work in teaching and learning and to encourage the spirit of teamwork among the participants

2.10 CYCLE IV- Monitoring and Evaluation

This cycle involves monitoring and evaluation whose purpose is to improve the quality of the project activities. JICA evaluates the project on the basis of Effectiveness, Efficiency Sustainability, Relevance and Impact. It emphasizes on student growth transfer.

2.11 Challenges facing SMASSE project

Students' attitude was generally neutral or negative, this was attributed to low marks at admission to secondary level, past belief that mathematics and science subjects are difficult, peer influence, lack of facilities, harsh teachers, absenteeism, and theoretical approach to teaching, (SMASSE (c),2004). The teachers' attitude was generally neutral. They were reluctant to perform experiments which were deemed difficult and dangerous. In some cases experiments

failed, most practical sessions were teacher demonstrations, (Hodson, 1993). The head teachers' attitude was reflected in the priority in development projects, provision of text books, laboratories equipment ranked lowly in the priorities. On the other hand, parents did not take progress reports as a matter of concern. Some were ignorant; others felt that paying school fees was their only role. (Kisaka, 2004).

Teachers did not take time to plan, think about delivery with their learners in mind and most often not student centered. Some could not interpret the syllabus correctly hence left their students stuck. On the other hand are those who lacked content mastery to the extent that they could not explain concepts satisfactorily often misleading students unknowingly. From the baseline study it was noted that teachers did not have fora where they could meet and share challenges in their teaching. The only forum though for a few teachers was during the marking of the KCSE National Examinations or the District Mock Examinations. Most workshops were in languages mainly because of set books for literature varies after some time, (SMASSE (b) 2004)

The Kenyan Government has been working tirelessly to improve science and mathematics education in primary and secondary schools, which have been a challenge from the perspective of human resources capable of promoting industrialization (Obanya, 1980). For five years, since July 1998, Japan has been extending its support in training in in-service teachers for mathematics and science in pilot regions in Kenya. Throughout this project, the teachers familiarize themselves with student-centered curriculum in line with the achievements of the students.

2.12 In-service Education and Training (INSET)

It is no longer a matter of having qualified teachers in the school but "quality" teachers who will deliver. The quality of teaching and learning must be reflected in the quality of grades attained

by the students at the end of the secondary course. In an increasingly competitive society the minimum entrance requirements into various institutions of higher learning has gone up. Attaining high grades at secondary level is therefore imperative. With new trends in education teachers have to keep abreast by implementing the changes in teaching whose training will be beneficial to students. The In-service providers in turn must provide quality INSETS whose training will be beneficial to students (Ndirangu, 2006).

INSET encompasses the whole range of activities by which serving teachers and other categories of educationists with formal school system may extend and develop their competence and general understanding of the roles which they and their schools are expected to play in their changing societies (UNESCO, 1983). Dean (1991) postulates in-service as the education intended to support and assist professional development that teachers ought to experience throughout their working lives. He adds that in-service is a process whereby teachers become more professional. He stresses that all strategies employed by trainers and teachers in partnership to direct teaching programmes in such a way as to meet the identified needs of the schools and to raise the standards of teaching and learning in the classroom falls under in-servicing. He observed that educational changes are rapid; the speed of change and the explosion of knowledge require people to learn afresh at intervals and throughout their lives. Watkins (1973) highlights that societies also change. The society is enlightened and will demand for accountability even in the school system. The teachers are therefore expected to keep abreast with societal needs and aspirations. It is therefore necessary to ensure that teachers grow in their professions to boost their morale and take their job positively. For this reason, the mere avoidance of staleness is one of the great justifications of in-service training.

Harris (1998) describes in-service as "any planned programme of learning opportunities afforded to staff members of schools, colleges, or other educational agencies for the purpose of improving performance of individual in already assigned positions." Although professional development and staff development are used interchangeably; in-service is commonly reviewed as a subset of the activities that help to promote professional growth.

Fullan (1987) observes that in all countries throughout the world, whatever the system of education in existence, teachers must be given continuity opportunities for learning. A single course of teacher training, however long it takes and however excellent it may be, no longer suffices in view of any intervening radical changes (UNESCO, 1970). The report further states that, the sole reason for training and further training of teachers is to improve the overall quality which must also depend on the relevance of curricula, methods, textbooks and teaching-learning resources employed.

Pre service training introduces and inducts the teacher trainees to the teaching profession but in-service makes the teacher professionals and enhances their performance (JICA, 2000). According to Bolam (1978), while Britain had the following as INSET programmes purposes; to equip head teachers with the necessary skills and expertise to help them cope with the increasingly complex tasks of leadership. It was also meant to ensure that there were sufficient teachers available to teach shortage subjects as crafts, physics and mathematics in secondary schools and to assist schools in obtaining maximum benefit from new technology such as the introduction of micro computers.

2.13 INSET Programmes outside Africa

Australia, Canada and New Zealand had the following purposes for INSET programmes;

To improve job performance skills of an individual teacher, to improve the job performance skills of the whole staff or groups of staff, to develop the professional knowledge and understanding of the teacher, and to also extend the experience of an individual teacher for career development or promotion.

In Kenya the strengthening of mathematics and sciences in secondary education (SMASSE) in-service teacher education and training project was launched with the purpose to Strengthen mathematics and science education at the secondary and Training of serving teachers in selected pilot districts (SMASSE, 2002)

Consequently, this would be geared toward upgrading the capability of young Kenyans (students) in Mathematics and science (Physics, Biology and Chemistry). The project had been set up as a joint venture between the Kenyan government and the Japanese government through the Japan International cooperation Agency (JICA, 1998).

2.14 Evaluation of INSET programmes

Evaluation is a systematic and objective assessment or judgement of the value or worth of an ongoing or completed project, programme or policy. This assessment is done after careful consideration of various factors or features against some predetermined baseline information. Evaluation is recognized as a key stage in the staff development cycle. However, Smith (1986) noted that it is frequently a stage which is least well carried out in practice and most often ignored. For many, it is a threatening activity since it may expose deficiencies in the provision of INSETs.

In Kenya, various educational programmes have been set up, some of which have been evaluated in the past. Kenya Educational Staff Institute (KESI) which offers in-service training to schools'

administrators was evaluated in 1993 by Morumbasi. In his research report on the effectiveness of the programmes, he reported that the program was effective because it provided the principals with the basic skills of managing their schools. The report recommended that KESI develops more definite strategies to reach a wider audience than they did.

Another example of an INSET programme in Kenya that has undergone through the process of evaluation is the Teachers Advisory Centers. The success of the Teachers Advisory Centers in the in-service education of teachers has been highlighted in the National Development Plan (1979-1983). However, Omulando (1992) reports that the INSET programmes had some implementation problems. Generally, the purpose of evaluation was to provide information that could be used for making descriptive and relative decisions regarding the efficiency of an educational programme; and to provide feedback data which would be useful for improving educational programmes (Cronbach, 1970).

2.15 Teaching Mathematics

In the past decade there have been several calls for reforms in mathematics that are based on the assumption that well prepared mathematics teachers are available to furnish opportunities for teachers to develop in ways that will enable them to enhance the recommended changes (Jaworki,2004).

2.16 Why teach mathematics?

The cultural and practical significance of mathematics in our society contrasts strikingly with the way adolescents experience mathematics in school. Mathematics teaching, it appears, succeeds in promoting abilities related to systematic and critical thinking, to problem solving and to

formulating rational arguments only for a minority of students. Hence there should develop a modern concept of general education that helps clarify both the curricula and pedagogical deficits involved in conventional Mathematics instruction (Jaworki, 2004).

The role of Mathematics education in our society is complex. There is no simple consensus as to which mathematics is important or how it should be taught (Westwell, 1999). The scope of the Kenyan Secondary School curriculum has been criticized for being too wide, and the Ministry of Education promptly acted by reducing the number of examinable subjects in line with the Koech report (Koech 1999), but Mathematics as a subject and its content have remained intact.

Historically, Mathematics curriculum has been influenced largely by four mathematical perspectives of four different social groups (Westwell, 1999). The four perspectives have impacted both on the content and teaching of mathematics. The first perspective by Plato (1987) is held by the Mathematics purists. They believe that Mathematics is studied for the sake of knowledge and not for commercial ends. The second perspective is held by "industrial pragmatists" who believe that the study of Mathematics began because it was useful and continues because it is useful and is valuable to the world because of the usefulness of its results. The third perspective is by the progressive educators who are primarily concerned with the personal development of the student as a focus of attention. This means that it is therefore the responsibility of the teacher to create an appropriate learning environment both in terms of stimulating resources and supportive social dynamics.

The fourth perspective that impacts on the content and teaching methodology of Mathematics is held by the social reformers who are concerned with the social development of pupils by empowering them to participate fully and critically in a democratic society and Mathematics is viewed as a "social construction; tentative, growing by means of human creation and decision

making and connected with other realms of knowledge, culture and social life" (Ernest, 1991). They have to be able to think for themselves to make judgments on all issues affecting them; they have to be able to interpret the decisions made through the democratic institutions of our society. The above perspectives have definitely impacted on the contents of Mathematics and moreso on the teaching methods employed in the teaching of mathematics today.

2.17 Issues in planning and delivery of mathematics lessons

An observation of an effective Mathematics teacher can be seen through the results of their planning. This planning is based on their accumulated professional knowledge of Mathematics and effective teaching strategies. In most pre-service training institutions, student teachers are given the skills in writing a lesson plan- done through the use of per-printed proforma plans. This therefore acts as a guide on how to manage their time in classrooms while ensuring that the lesson objectives are met.

The perception of mathematics subject by the teachers of Mathematics influences the teachers' ideas on planning a Mathematics lesson and hence the long term success of Mathematics. For instance, a research by John (1991) revealed that mathematics teachers who saw Mathematics as a predominantly hierarchical subject were heavily influenced by their own vision on how they should plan and teach the subject. As a result they planned lessons consisting of a pattern of expositions by the teachers; example by the teachers; and exercises by the students.

However evidence from international comparisons of mathematical achievements suggest that such a format may not necessarily develop the form of collected knowledge necessary for long term success in mathematics (Jones,1997) This is why the teachers need to be equipped with other approaches to lesson planning other than the traditional ones which are dictated by their

rigid perception. A vital skill in planning mathematics lesson is being able to recognize good tasks that will work with a given mathematics lesson. A mathematics teacher is a good source of ideas but needs to develop such skills himself. According to the US National council of teachers of Mathematics; professionals' standards for teaching mathematics (NCTM, 1991), teachers should pose tasks that bare, based on; Sound and significant mathematics, Knowledge of the range of ways that diverse students learn mathematics and Knowledge of students understanding, interests and experiments.

And tasks that; engage students' intellect, develop students' mathematical understanding and skills, stimulate students to make connections and develop a coherent framework for mathematical ideas, call for the problem-solving and mathematical reasoning, promote communication about mathematics, represent mathematics as an on-going human activity, display sensitivity to, and draw on the students diverse background experiences and dispositions and to promote the development of all students' dispositions to do mathematics.

This suggests that the mathematics teacher should choose and develop tasks that are likely to promote the development of the students' understanding of concepts and procedures in a way that also fosters their ability to solve problems and to reason and communicate mathematically.

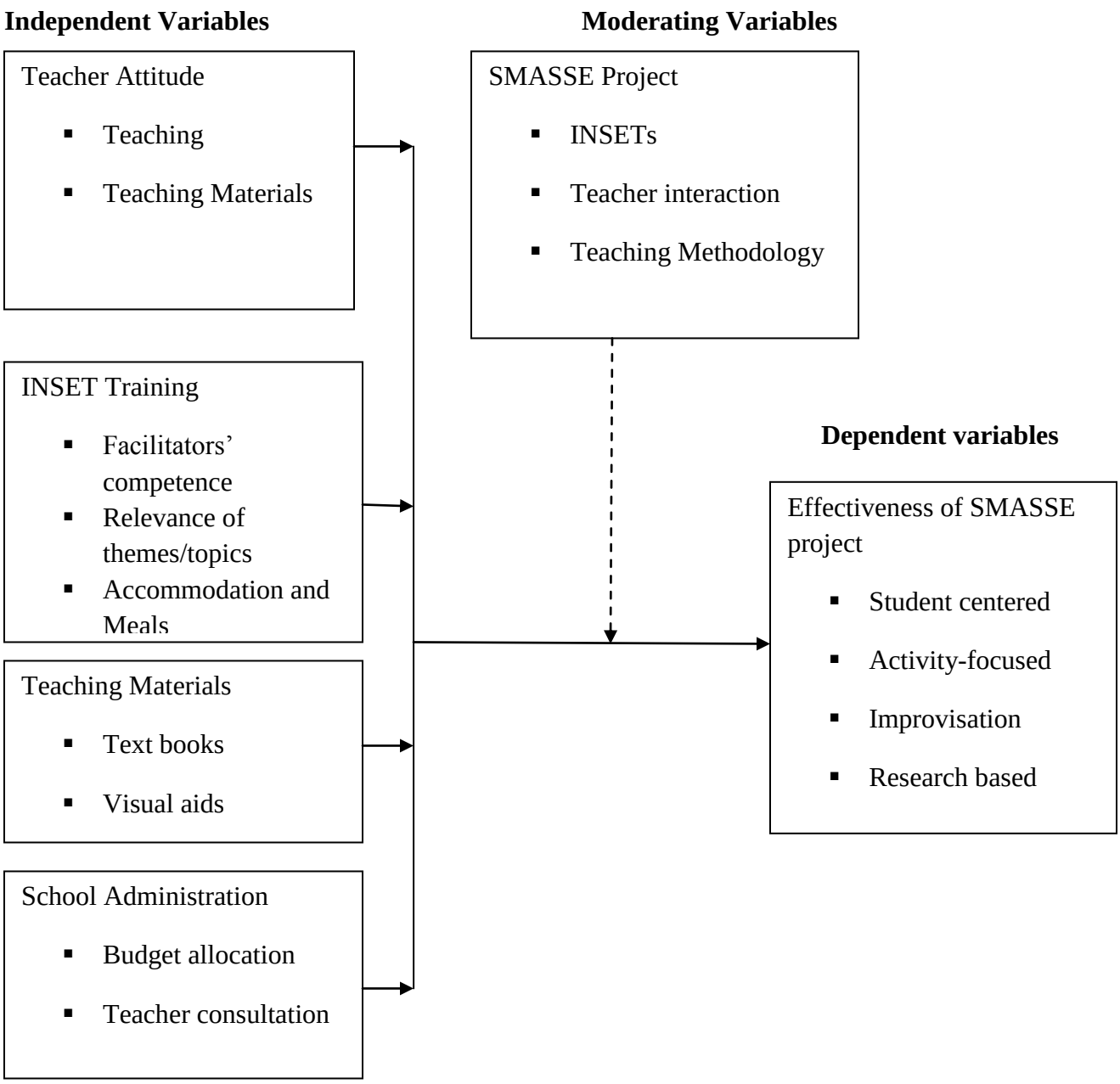


Figure 2: Conceptual Framework

The framework was premised on the concept of teachers' perception of the SMASSE project. How they perceive the project will influence many factors positively or otherwise in terms of teaching methodology, pedagogy and content delivery. These variables may have negative or positive effects to a teacher's willingness to implement the skills learnt during the INSET. The positive effects tend to influence the teachers positively by making them like what they do, achieve better and have positive attitude towards the subject. Thus they record better grades in the subject. The negative effects influence them negatively by making them dislike what they do, have low morale to teaching and thus record poor grades in the subject.

The conceptual framework as illustrated above presents the variables that shape teachers perception of the SMASSE project. The teachers' attitude, perception, availability of adequate teaching materials and school administration as the independent variables, form the input to the process that affects the teachers' perception.

The teachers' perception of the SMASSE project in turn affects the effectiveness of SMASSE project which is the dependent variable. The SMASSE project as the moderating variable acts as the process through which the effectiveness of the SMASSE project can be realized. The variables relate to the project a great deal in that they are the driving force behind its success. Obstacles in the SMASSE project implementation may be neutralized by ensuring that teachers of mathematics are trained, taken for in-service training and provided with adequate teaching materials and resources.

2.18 Summary of Chapter Two

Based on the preceding discussion we note that there are different factors that interplay to influence the perception of teachers of the SMASSE project and how it affects their teaching of Mathematics. The introduction of the SMASSE project as an intervention to improving the

quality of teaching Mathematics and performance in the subject can only be realized through the INSET training where trained teachers are made professionals and the quality of teaching improved. Notwithstanding are the challenges of implementing the project that impede on its success. Therefore effort needs to be put in place to address these challenges to ensure the overall success of the project and the enhancement of education for the realization of the national development goals.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter dealt with the research methodology applied in carrying out this study. It was organized under the following thematic areas: Research design; Target population; Sample and Sampling procedures; Data collection instruments; Pre-testing the research instruments, Validity and Reliability of the instrument and Data analysis technique

3.2 Research Design

This study was conducted using the Survey design. According to (Gay, 1983) Survey designs attempt to collect data from members of a population in order to determine the current status of that population with respect to one or more variables. It systematically gathers information that describes the characteristics of respondents (sample) for the purpose of building generalizations or theories about the population they represent. Survey method was employed in this study because it is considered the most efficient method due to time constraint and cost.

3.3 Target population

A population is an entire group of individuals, objects or items from which samples are taken for measurement. (Kombo and Tromp, 2006). The target population for this study included teachers of Mathematics, Heads of Mathematics Department and the Head teachers of public schools within Westlands district. The location was considered to ascertain indeed that the SMASSE project has been expanded country wide and not just within the pilot regions. Westlands district

has ten (10) public schools and forty eight (48**)** teachers of Mathematics and ten (10) head teachers. The target population is presented in Table 3.1

Table 3.1 Target population

Type	**Target population**
Head teachers	10
Heads of Mathematics department	10
Teachers of Mathematics	48
Total	**68**

3.4 Sample size and sampling procedure

There are ten (10) public secondary schools in Westlands district. Eight (8) were involved in the main study while two (2) schools were picked for piloting purposes. Out of the eight (8) head teachers, only five (4) head teachers and eight (8) heads of Mathematics department participated in the study. All the teachers of Mathematics from the two schools were used in the pilot study. All the Teachers Service Commission (TSC) employed Mathematics teachers were given questionnaires to complete. According to Krejcie and Morgan (1970) for a target population of 65 the recommended sample is 56. This study had a target population of 68 and used a sample size of 52. This is closer to what Krecje and Morgan has recommended.

In the main study eight schools were purposively sampled. All the eight (8) head teachers and the eight (8) heads of Mathematics department were given questionnaires to complete. The thirty six (36) teachers of mathematics used were purposively sampled since the study targeted

mathematics teachers who had undergone SMASSE in service training. In total fifty two (52) respondents were used as shown in Table 3.2

Table 3.2 Sample of population

Type	Target population	Sample size
Head teachers	10	8
Heads of Mathematics department	10	8
Teachers of Mathematics	48	36
Total	**68**	**52**

3.5 Data collection instruments

The researcher used three questionnaires namely: Mathematics Teachers Questionnaire (MTQ), Head teachers' Questionnaire (HTQ) and Heads of Department Questionnaire (HDQ). The questionnaires were used to solicit information from the Mathematics teachers, head teachers and the Mathematics heads of department. The questionnaires had both structured and non-structured questions. The researcher preferred questionnaires because they are easy to administer to respondents and are convenient for collecting information within a short span of time (Mulusa, 1990).

The Head teachers' questionnaire (HTQ) had four parts with twelve (12) items. Part A was on the demographic data of the head teachers and the background information of the school, Part B was on SMASSE INSET, Part C was on supervision and Part D was on the School Administration.

The Mathematics Teachers' Questionnaire (TQ) had five parts and thirteen (13) items. Part A was on the demographic data of the teachers. Part B was on the attitude of the teachers. Part C was on the perception of the teachers. Part D was on planning and organization while Part E was on SMASSE INSET all designed to answer the questions of the study**.** The Questionnaire for the heads of departments contained five (5) questions. Question 1 was establishing the attitude of teachers towards the implementation of the SMASSE project. Question 2 was determining the teachers' preparedness in the implementation of the SMASSE project and sought ways of improving the teachers' preparedness to implementing the SMASSE project. Question 3 was to establish the adequacy of in-service session attendance and the facilitators. Question 4 was to determine the adequacy of teaching and learning resources that facilitate effective implementation of the SMASSE project. Question 5 was to establish the role of the school administration and management in the implementation of the SMASSE project.

3.6 Validity of research instruments

Validity is the appropriateness, meaningfulness and usefulness of the inferences made by the researcher. Content validity is the degree to which the test items measure what they were designed to measure (Borg and Gall, 1989). To enhance validity of contents, the researcher carried out a trial run for the instruments within the pilot schools. Instruments were appraised by the project supervisor who is a lecturer at the Department of Extra Mural Studies at the University of Nairobi. The pilot study was also used to assess the validity and reliability of each item in the instruments. Based on the pilot study, the instruments were reviewed to incorporate

findings in the study. Some items were removed, others included and some questions were paraphrased in order to increase levels of clarity before going out for the actual study.

3.7 Reliability of research instruments

Reliability is refers to the consistency of scores or answers from the administration of an instrument to another and from one set of items to another. Nachmias and Nachmias (1996) states that the split-half method during pre-testing can be used to establish the internal consistency (coefficient of a test). The researcher carried out the split-half technique which involved splitting the instruments into two. One half of even numbered items and the other half of odd numbered items. The correlated results value provided the internal consistency of one half that is the degree to which the two halves of the test are equivalent or consistent in terms of items. The co-efficient was obtained through the Pearson product moment formula. To obtain the full reliability of the instruments Spearman Brown Prophecy formula was used.

Reliability of the entire test

$$R2 = \frac{2(\text{reliability of 0.5 test})(r)}{1+(\text{reliability of 0.5 test})(r)}$$

That is: - $$R2 = \frac{nr}{1+(n-r)\,r}$$

Where R2 = correlated reliability

R = uncorrelated reliability

N = number of parts

N = 2 Tuckman (1978)

3.8 Data analysis Techniques

Data was first edited to identify items wrongly responded to and to check on spelling mistakes in the responses. Information was then categorized into topics. The responses were coded and processed using the Statistical Package for Social Science (SPSS version 10) which is computer software. Descriptive statistics such as the frequency distribution graphs, percentages, graphs and charts were used to analyze the qualitative data. Qualitative data obtained from the open-ended questions were organized into themes and patterns done by content analysis. The information was then presented in tables and then analyzed using the descriptive statistics.

3.9 Operational definition of Variables

The operationalization of the variables Table 3.3 showed the summary of the operational definition in relation to the study, the indicators of the variable, measurement of the variables, measurement scale used data collection methods and the tools of analysis.

Table 3.3 Operationalization of variables

Research Objectives	Variable	Indicator	Measurement	Scale	Data collection method	Data Analysis
To establish teachers' attitude towards the effective implementation of SMASSE project in the teaching of mathematics	Independent Variable	-Teaching -Teaching Materials - Administrative support	-Level of liking or disliking teaching -Level of being able to use the available teaching materials - Level of administrative support	Ordinal	Questionnaires	Frequency distribution tables
To investigate the effect of INSET training on the effective implementation of SMASSE project on teaching of mathematics	Independent variable	-Facilitators' competence -Relevance of themes/ topics -Accommodation and meals	-Level of facilitators' competence -Level of appropriateness of themes / topics -Quality of accommodation and meals	Ordinal	Questionnaires	Frequency distribution tables
To determine the adequacy of	Independent	- Adequacy of teaching	Number of	Nominal	Questionnaires	Frequency

the teaching materials in the effective implementation of SMASSE project	Variable	materials - Use of the available materials while teaching	materials (text books, visual and audio- visual aids) in use during the lesson			distribution tables
To assess the role of the school administration in the effective implementation of the SMASSE project towards the teaching of mathematics	Independent Variable	- Budget allocation for the required materials -Consultation with teachers before purchasing the materials	- Amount allocated for the materials - Records of consultation with the teachers on materials to be purchased	Ordinal	Questionnaires	Frequency distribution tables
To examine the extent to which effective implementation of the SMASSE project has been achieved	Dependent Variable	-Shift from teacher centeredness to student centeredness -Shift from knowledge/content based to activity based lesson -Shift from chalk and talk to experimentation -Fewer teacher	-Number of times students participate in the learning process -Number of times students carry out activities in class -Occurrence of improvisation	Ordinal	Questionnaires and observation checklist	Frequency distribution tables

		demonstration to small scale and improvisation	during the lesson			

3.10 Ethical Issues in Data collection

Before distributing the questionnaires, the researcher and the research assistants explained the purpose and confidentiality of the study. Specifics of respondents (name, address etc) were not recorded during the process of data collection, analysis or in the study report. Throughout the research exercise, the researcher observed ethical principles in the constitutional rights of every person and as such sought informed consent of the respondents and assuring confidentiality of data and information collected. The researcher promised not to reveal the identity of the respondents and ensured that the data and information obtained will only be used for research purpose.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter presents an analysis, presentation, interpretation and discussion of the data collected on respondents' demographic information that included age, level of education and marital status. Other areas tackled are the teachers' attitude towards the effective implementation of SMASSE project, teachers' perception and its effect on the implementation of SMASSE project, role of planning in enhancing the teaching of mathematics, implementation of SMASSE project, and the role of school administrators in the implementation of SMASSE Project.

4.2 Questionnaire Return Rate

In order to accomplish the collection of data that would be analyzed to answer the research questions, eight questionnaires were administered to head teachers, eight to the heads of departments and thirty six (36) to the mathematics teachers. Fifty percent (50%) of the head teachers, seventy five percent (75%) of the Heads of Department and eighty six point one percent (86.1%) of the mathematics teachers responded. This return rate was considered acceptable for the study.

4.3 Demographic Characteristics of Respondents

The study sought to establish the demographic characteristics of the respondents. To accomplish this task, several questions targeting the respondents' age, gender, marital status and level of education was asked and completed. Data collected under demographic characteristics of the respondents was analyzed and discussed as follows;

4.3.1 Age distribution of respondents

The study sought to establish the age of the respondents. The findings are presented in Table 4.1

Table 4.1 Age of respondents

	Teachers		**HODs**		**Head teachers**	
Age category	**F**	**%**	**F**	**%**	**F**	**%**
20-29 Years	7	22.6	-	-	-	-
30-39 Years	5	16.1	-	-	-	-
40-49 Years	16	51.6	1	16.7	4	80
50 and above	3	9.7	5	83.3	1	20
Total	**31**	**100.0**	**6**	**100.0**	**5**	**100.0**

According to Table 4.1 majority of the respondents (51.6%) were aged between 40-49 years. Overall 90.3% of the respondents stated that they were aged between 20 years and 49 years. This is a clear indication that majority of the teachers are far from retiring hence are in a position of making crucial contributions in the implementation process of SMASSE project. Out of the

head teacher respondents 80% were aged between 40-49 years while 20% were fifty years and above. Majority of the HODs (83.3%) in the district were aged over 50 years.

4.3.2 Gender of respondents

This gives us the picture of gender representation in the teaching of mathematics in secondary schools. The findings on the gender of Mathematics teachers are presented in Table 4.2.

Table 4.2 Gender of the respondents

	Teachers		**HODs**		**Head teachers**	
Age category	**F**	**%**	**F**	**%**	**F**	**%**
Male	23	74.2	4	66.7	1	20
Female	8	25.8	2	33.3	4	80
Total	**31**	**100.0**	**6**	**100.0**	**5**	**100.0**

Table 4.2 shows that 74.2% of the teachers were male as compared to 25.8% o f their female counterparts. This can be attributed to the perception that mathematics as a subject is considered a difficult subject that can only be handled by the males hence the low number of female teachers. With regard to the HODs 66.7% were male while 33.3% were female. For those that returned their questionnaires among the head teachers 80% were female. This explains the fact that majority of the secondary schools in Nairobi are girl schools which have females as head teachers

4.3.3 Professional Qualifications

In order to establish the extent to which the respondents level of education influence their participation in the implementation of the SMASSE project, they were asked to indicate their highest level of education. This is presented in Table 4.3 below.

Table 4.3 Professional Qualifications of respondents

	Teachers		**HODs**		**Head teachers**	
Qualification	**F**	**%**	**F**	**%**	**F**	**%**
M.Ed	2	6.5	1	16.7	1	20
B.Ed	21	67.7	4	66.7	4	80
PGDE	5	16.1	1	16.7	-	-
Diploma	3	9.7	-	-	-	-
Total	**31**	**100.0**	**6**	**100.0**	**5**	**100.0**

According to the findings, 6.5% respondents had a Masters in Education as their highest level of education. Majority of the teachers (67.7%) had Bachelors of Education Degree, 16.1% PGDE and 9.7% had a Diploma in Education. Overall the findings reveal that the majority of respondents (90.3%) were graduates. This is in line with the Ministry of Education policies of eliminating the untrained teachers from the profession. The respondents therefore have the necessary academic background to contribute effectively to the teaching of Mathematics. The study also sought to establish the professional qualifications of the HODs and the head teachers. Eighty percent of the head teachers were Bachelor of Education degree holders. Only 20% had Masters qualifications. For the HODs, 66.7% were B.Ed graduates and 16.7% were Masters graduates.

4.3.4 Major teaching subjects

The study sought to establish the respondents' major teaching subjects as shown in table 4.4

Table 4.4 Frequency table for major teaching subjects

Subject	Frequency	Percentage
Mathematics	21	67.6
Physics	3	9.7
Chemistry	2	6.5
Biology	2	6.5
Business Studies	3	9.7
Total	**31**	**100.0**

Table 4.4 reveals that 67.6% of the respondents teach mathematics as their major subject, 9.7% teach Physics, 6.5% apiece teach Chemistry and Biology while 9.7% Teach Business related subjects. This therefore indicates that a majority of the respondents are authorities in the subject of study hence are well positioned to contribute positively to the teaching of mathematics

4.3.5 Number of lessons taught in a week

The researcher sought to investigate the distribution of lessons in a week per respondent as a way of gauging the difference in the distribution and if indeed there are any underlying reasons.

Table 4.5 Number of lessons taught in a week

Lessons	Frequency	Percentage
11-20	5	16.1
21-30	26	83.9
Total	**31**	**100.0**

The information in Table 4.5 shows that 83.9% of the teachers have between 21 and 30 lessons per week while 16.1% have 11 to 20 lessons per week. This could be attributed to the fact that there is a shortage of Mathematics teachers hence leading to overload.

4.3.6 Other responsibilities besides teaching mathematics

The other responsibilities that teachers have in the school are bound to affect the time they spend in the actual teaching of mathematics which is their core duty when employed. The researcher sought to establish the responsibilities that teachers have other than teaching mathematics as presented in Table 4.6

Table 4.6 Other responsibilities besides teaching mathematics

Responsibility	Frequency	Percentage
Deputy Head	1	3.2
Head of Department	8	25.8
Subject Head	3	9.7
Class Teacher	10	32.3
Subject Teacher	9	29.0
Total	**31**	**100.0**

Among the respondents, as shown in Table 4.6, only 3.2% served as deputy head, 25.8% were HODs, 9.7% were subject heads, 32.3% were class teachers while the remaining 29% were subject teachers. From this it is evident that the teachers have various responsibilities within the school that hinders them from having equal work load in terms of lesson distribution and by extension their effectiveness in implementing the requirements of SMASSE.

4.3.7 Responsibilities outside school

The study also set out to establish whether the mathematics teachers had other responsibilities outside the school. The findings revealed that 38.7% of the respondents were engaged as examiner, subject panel members or SMASSE trainers. This would be a pointer towards their view that SMASSE was not necessary. They have many responsibilities hence they are unable to undertake SMASSE activities as expected. It was necessary for the researcher to establish the responsibilities that teachers have outside school that might impact on their teaching of mathematics.

4.4 Teacher attitude towards the effective implementation of SMASSE project

The first objective of the study was to establish teachers' attitudes towards the effective implementation of SMASSE project in the teaching of mathematics. In order to achieve this objective, the attitude of teachers and HODs was measured using a questionnaire that focused on items of attitude. These items (statements) captured the impact of SMASSE/ INSETs on the teaching of mathematics as perceived by teachers and the HODs.

4.4.1 Effectiveness of planning in teaching mathematics

SMASSE INSETs through the ASEI/PDSI approaches advocates for teachers to plan their lessons before getting down to the business of teaching. The researcher therefore sought to establish the effectiveness of planning in the teaching of mathematics. From the findings 80.6% of the teachers strongly felt that planning ensured effective teaching of mathematics. This was also confirmed by the HODs who all indicated planning was important. This underscores the importance of planning in teaching. From this, it can be deduced that for a teacher to achieve the teaching and learning objectives, it is imperative for proper planning to be done.

4.4.2 Effects of ASEI/PDSI approaches in teaching mathematics

The study considered the impact that the application of ASEI/PDSI approaches during the teaching of mathematics would have in meeting teaching and learning objectives. The findings revealed that 88.9% of the teachers concurred that ASEI/ PDSI approaches helped them to focus more on the learning objectives. This therefore means that indeed the application of ASEI/PDSI approaches during the teaching of mathematics helps not only the teacher but the student in meeting the learning objectives. The HODs also concurred that the approaches were useful in meeting learning objectives.

However 69.3% of the teachers and 67.6% of the HODs agree that SMASSE activities delay the coverage of the syllabus. From the analysis, this would then be taken to mean that most of the teachers were not keen on using the ASEI/PDSI approaches as advocated in the SMASSE INSETs hence impacting negatively on the implementation of the SMASSE project.

Interestingly this is the case despite the fact that 64% of the teachers and 60% of HODs indicating that SMASSE INSETs had influence on the teaching of Mathematics. They acknowledged that thought the activities are involving; their full implementation would lead to improved teaching of mathematics.

4.4.3 SMASSE Implementation

The study sought to find out the implementation of SMASSE project. This was looked at in terms of the levels of preparedness of teachers to implement SMASSE Project, attendance of SMASSE training and adequacy of teaching materials. According to the findings, 42.9% of the heads of departments confirmed that their teachers were not so prepared for the implementation of SMASSE.

Additionally, 14.3% indicated that their teachers were poorly prepared for the implementation of the project. None the less, 28% of the heads of the departments confirmed that their teachers were well prepared, while 14.3% indicated that their teachers were very well prepared for the implementation of SMASSE. The study further revealed that 42.9% of the respondents headed departments in which all teachers had attended the SMASSE, while 28.6% led departments in which majority of the teachers had attended SMASSE. Similarly, 28.6% of the respondents had departments in which only some teachers had participated in SMASSE. In regard to participation in SMASSE, district trainers were the main facilitators (71.4%). Surprisingly, 85.7% of the respondents did not participate in SMASSE frequently. Additionally, all respondents confirmed that the teaching materials for mathematics that are available in their schools are not adequate.

Anecdotal evidence reveals that lesson planning is necessary for effective teaching. The study also attempted to establish whether the teachers planned their lessons. Though all the teachers agreed that lesson planning was necessary, they observed that the working load affected their ability to plan. Findings indicate that 88.9% of the teachers agreed that teaching load affected their performance. This is further aggravated by the fact that the HODs who were critical in supervising implementation, 66.7% never checked lesson plans. They only concentrated on checking schemes of work (76.7%) and the records of work (70%). SMASSE requires the management to assist in supervision of the activities. The study however revealed that 60% of the HOD rarely observed the Mathematics lessons. This may be contributing to small gains noted in performance in mathematics in the studied schools. The subject mean score is still low.

4.5 Effect of inset training on SMASSE implementation

The second objective of the study was to investigate the effect of INSET Training on the effective implementation of SMASSE project in the teaching of mathematics. Consequently, 15 items (statements) were used to investigate the effect of INSET Training on the effective implementation of SMASSE Project in teaching of mathematics.

The study therefore sought to investigate if indeed teachers' personal interest, knowledge and confidence in teaching mathematics and professional development had improved after attending the cycles of SMASSE training. Seventy two percent (72%) of the teachers felt that their personal interest improved after participating in SMASSE Insets. However, 12% of the teachers indicated that they were better off without SMASSE INSET training. This implies that participating in SMASSE INSETS had no impact on their interest in teaching mathematics.

Additionally, 40.8% of the teachers indicated that despite having attended the INSET, their confidence in teaching Mathematics had not improved. Sixty eight percent (68%) of teachers believed that their professional development improved greatly following their participation in SMASSE project.

4.5.1 Funds towards SMASSE implementation

Funds are necessary for proper implementation of programmes in schools. The study sought to establish the level of funding in schools to facilitate implementation after INSET. Majority of the teachers (57.7%) felt that funding to mathematics had not increased. Only 26.9% of the teachers agreed that the amount of funds they have been able to access increased substantially. This is a pointer that there has been minimal increase of funds availed to facilitate the teaching of mathematics thus slowing the process of implementing the SMASSE project.

4.5.2 SMASSE INSETS Evaluation

The perceptions of teachers about SMASSE may have been shaped during the training. The study set out to establish how the teachers felt about the training. Eighty eight percent (88%) of the teachers and 83.3% of the HODs felt that their interaction with the other participants during INSETs added value to them as teachers. An evaluation of the relevance of the themes and topics revealed that, 83% of the HODs and 72% of the teachers felt that the SMASSE content was relevant. However the participants indicated that the rooms used and the meals provided during the training were inappropriate

Time spent during the INSET was not managed properly according to 48% of the HODs. This view was also echoed by 40% of the Mathematics teachers. Majority of the teachers and the HODs felt that the timing was appropriate (66.7%) and the duration spent during the course was adequate (67.6%). They however indicated that SMASSE management structures were unclear and inadequate.

4.6 Adequacy of teaching materials

The third objective of the study was to determine the adequacy of teaching materials in the effective implementation of SMASSE project in the teaching of mathematics. Consequently, 15 items (statements) were used to determine the extent to which the implementation of SMASSE project is influenced by adequate teaching materials and to ascertain if the number of times students failed to do the activities had generally reduced. The results are recorded in Tables 4.7, 4.8 and 4.9 respectively.

Table 4.7 Adequate teaching materials are necessary for effective teaching.

	Frequency	**Percentage**
Strongly Agree	16	51.6
Agree	11	35.5
None response	4	12.9
Total	**31**	**100.0**

Table 4.7 reveals that 51.6% of the teachers strongly agreed that availability of adequate teaching materials is necessary for effective teaching of mathematics. The remaining 35.5% of the

respondents also agreed with this view. None of the respondents were of the contrary opinion. It therefore goes without saying that it is imperative for a school to not only have teaching resources but ensure they are adequate enough so as to enhance effective teaching of mathematics.

Table 4.8 Number of textbooks available in class

	Frequency	**Percentage**
Strongly Agree	3	9.7
Agree	14	45.2
Not Sure	4	12.9
Disagree	2	6.4
Strongly Disagree	2	6.4
None response	6	19.4
Total	**31**	**100.0**

According to Table 4.8, majority of the teachers at 54.9% as recorded affirmed that the availability of mathematics textbooks had tremendously increased in their classes. However, 10.8% of the teachers stated that the number of mathematics textbooks did not increase substantially in their classes. Yet another 12.9% of the teachers were not sure if there was any increase in textbooks availability in their classes. In reference to the analysis it can be said that there is sufficient textbooks in schools to enhance the teaching of mathematics though there's still need to have more textbooks in schools to ensure effective teaching of mathematics and consequently ensuring the implementation of SMASSE project.

Table 4.9 Number of times students fail to carry out activities

	Frequency	Percentage
Strongly Disagree	1	3.2
Disagree	12	38.7
Not sure	4	12.9
Agree	5	16.1
Strongly Agree	3	9.7
None response	6	19.4
Total	**31**	**100.0**

As recorded in Table 4.9 above, 25.8% of the teachers confirmed that students' failure to carry out activities due to resource inadequacy had generally reduced. 41.9% of the teachers, however, did not believe that there was a reduction in students' failure to participate in activities. 12.9% were not sure whether or not the number of times students failed to carry out activities had reduced. From the analysis, it is sufficient to conclude that despite the increase in the number of mathematics textbooks in school students would still fail to carry out activities.

4.7 Role of the school administration in the implementation process

The other objective of the study was to assess the role of the school administration in the effective implementation of the SMASSE project towards teaching of mathematics. Respondents were thus asked to indicate whether the demonstration by the school administration on priority of mathematics had substantially increased and also if indeed the understanding of how SMASSE

project should be implemented had improved. The results are shown in Tables 4.10 and 4.11 respectively.

Table 4.10 Demonstration of the school administration on priority of mathematics

	Frequency	**Percentage**
Strongly Agree	6	19.4
Agree	12	38.7
Disagree	7	22.6
Strongly Disagree	1	3.2
None response	5	16.1
Total	**31**	**100.0**

A majority of teachers at 58.1% as shown in Table 4.10 agreed that the demonstration of their school's administration to prioritize mathematics improved substantially. Those who disagreed with this statement were 22.6% while 3.2% of the teachers strongly disagreed with the statement that the commitment of their schools to prioritize mathematics improved greatly. In regard to the above analysis, it's sufficient to conclude that the school administration was playing its role in the implementation of SMASSE project by giving the necessary priority to mathematics as a subject.

Table 4.11 School administration's understanding of how SMASSE project

	Frequency	Percentage
Strongly Agree	2	6.4
Agree	11	35.5
Not Sure	4	12.9
Disagree	6	19.4
Strongly Disagree	3	9.7
None response	5	16.1
Total	**31**	**100.0**

Findings indicated in Table 4.11 reveal that 41.9% of the teachers (6.4% strongly agreed and 35.5% agreed) confirmed that their school's administration greatly improved their understanding of how SMASSE project should be implemented. This percentage is comparable to the 29.1% (19.4% disagreed and 9.7% strongly disagreed) who believed that their administrators did not improve their understanding of SMASSE implementation. 12.9% of the teachers were not sure if there was any improvement in their administrators' understanding of SMASSE implementation. As per the analysis, it is deemed that the school administration has not fully understood how SMASSE project should be implemented and this can therefore be suggested as a topic to be researched on in future.

4.8 Challenges Associated with the Implementation of SMASSE INSETs

The main challenges experienced by the Heads of Departments and their teachers in regard to the implementation of SMASSE INSETs include the following. First, lack of adequate resources was

identified by 70% of the respondents as the main challenge in the implementation of SMASSE project. These include inadequate funds, human capital and information and communication facilities. Similarly, most participants indicated that there were insufficient facilities for training and seminars.

Second, there is a negative attitude towards SMASSE INSETs, especially, among teachers. Sixty percent (60%) participants were not motivated to participate in SMASSE simply because they felt that the project had no value. However, some participants had low motivation to participate since the participants were not given any allowances (monetary compensation) for their time.

Third, school administrators are also barriers to the implementation of the project. In particular, the participants cited lack of cooperation between them and school heads/ administration as the main challenge in the implementation of the project.

Fourth, lack of adequate time has a negative impact on the implementation of the SMASSE project. Sixty percent (60%) of the teachers indicated that they had heavy workload. Consequently, they found it difficult to participate in SMASSE INSETs and to complete the syllabus in time. Finally, there has been a difficulty and hence, a failure to harmonize the SMASSE programs.

4.9 Ways of Improving the Implementation of SMASSE

According to the teachers and heads of departments, implementation of the SMASSE project can improve if the following suggestions are considered by the school administrators and the SMASSE management. First, school administrators should give more support to their teachers to enhance implementation of the project. Second, teachers should be motivated to participate and to implement SMASSE. In this context, teachers should be well paid to implement the project.

In addition, the participants should be given certificates of participation. Third, there should be adequate materials to facilitate the implementation of the project. In particular, there should be enough teaching materials. More teachers should be employed to ease the workload. Similarly, professional facilitators who can best manage the seminars and training should be employed. Additionally, the project should target schools with less teaching facilities. Consequently, there should be more financial support from the government and nongovernmental organizations to facilitate implementation of the project. Fourth, time management should be improved.

According to the respondents, this can be achieved by decentralizing the training programs to school level and to increase the time allocated for the training. The training should be within term dates, especially, in the first term rather than during the holidays. Additionally, some teachers felt that the syllabus and the number of the lessons should be reduced. Fifth, some respondents felt that SMASSE can be best implemented if it is incorporated in the teachers training programs in universities and colleges. Finally, the school administrators should be sensitized on the priority areas. Equally, important is the fact that there should be more emphasis on the students rather than teachers.

CHAPTER FIVE

SUMMARY OF FINDINGS, DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter is made up of presentation of this study's summary of findings, discussions and conclusions made from the findings and ends with the researcher's recommendations for action and further research. This was as a result of this study's main purpose to investigate factors influencing teachers' perception on the effectiveness of SMASSE project on teaching of mathematics in secondary schools in Kenya.

5.2 Summary of findings

The study sought to investigate factors influencing teachers' perception on the effectiveness of SMASSE project on teaching mathematics in secondary schools. The researcher identified four main factors that were likely to have an impact on the above mentioned subject. The factors include; teachers' attitude on the SMASSE project, effect of INSET Training on the effective implementation of SMASSE project, adequacy of teaching materials and role played by the school administration in the effective implementation of SMASSE project in the teaching of mathematics

The study established that a majority of the teachers at 70.4% were of the age between 30 and 49 years old and that 70.4% of the respondents were male as compared to 29.6% of their female counterparts. Most of them at 63% had Bachelors of Education as their highest level of education and this is in line with the Ministry of Education policies of eliminating the untrained teachers

from the profession. The respondents therefore had the necessary academic background to contribute to the SMASSE project.

5.2.1 Teachers' attitude on SMASSE project

The study revealed that 80.6% of the teachers strongly felt that planning ensured effective teaching of mathematics. This was also confirmed by the HODs who all indicated planning was important. The findings revealed that 88.9% of the teachers concurred that ASEI/ PDSI approaches helped them to focus more on the learning objectives. This therefore means that indeed the application of ASEI/PDSI approaches during the teaching of mathematics helps not only the teacher but the student in meeting the learning objectives. The HODs also concurred that the approaches were useful in meeting learning objectives.

However 69.3% of the teachers and 67.6% of the HODs agree that SMASSE activities delay the coverage of the syllabus. From the analysis, this would then be taken to mean that most of the teachers were not keen on using the ASEI/PDSI approaches as advocated in the SMASSE INSETs hence impacting negatively on the implementation of the SMASSE project. They acknowledged that though the activities are involving; their full implementation would lead to improved teaching of mathematics. Findings also indicate that 88.9% of the teachers agreed that teaching load affected their performance. This is further aggravated by the fact that the HODs who were critical in supervising implementation, 66.7% never checked lesson plans. SMASSE requires the management to assist in supervision of the activities. This may be contributing to small gains noted in performance in mathematics in the studied schools.

5.2.2 Effect of INSET training on the effective implementation of SMASSE project

The perceptions of teachers about SMASSE may have been shaped during the training. The study revealed that 88% of the teachers and 83.3% of the HODs felt that their interaction with the other participants during INSETs added value to them as teachers. An evaluation of the relevance of the themes and topics revealed that, 83% of the HODs and 72% of the teachers felt that the SMASSE content was relevant. However, the participants indicated that the rooms used and the meals provided during the training were inappropriate.

Time spent during the INSET was not managed properly according to 48% of the HODs. This view was also echoed by 40% of the Mathematics teachers. Majority of the teachers 67.6% and 66.7% of the HODs felt that the timing was appropriate and the duration spent during the course was adequate. They however indicated that SMASSE management structures were unclear and inadequate.

5.2.3 Adequacy of teaching materials

The study revealed that 51.6% of the teachers strongly agreed that availability of adequate teaching materials is necessary for effective teaching of mathematics. It therefore goes without saying that it is imperative for a school to not only have teaching resources but ensure they are adequate enough so as to enhance effective teaching of mathematics.

It was also established that majority of the teachers at 54.9% affirmed that the availability of mathematics textbooks had tremendously increased in their classes. In reference to the analysis it

can be said that there is sufficient textbooks in schools to enhance the teaching of mathematics though there's still need to have more textbooks in schools to ensure effective teaching of mathematics and consequently ensuring the implementation of SMASSE project.

5.2.4 Role of school administration in the implementation of SMASSE project

Findings established that majority of teachers at 58.1% agreed that the demonstration of their school's administration to prioritize mathematics improved substantially. Those who disagreed with this statement were 22.6% while 3.2% of the teachers strongly disagreed with the statement that the commitment of their schools to prioritize mathematics improved greatly. In regard to the above analysis, it's sufficient to conclude that the school administration was playing its role in the implementation of SMASSE project by giving the necessary priority to mathematics as a subject.

The study further revealed that 41.9% of the teachers confirmed that their school's administration had greatly improved their understanding of how SMASSE project should be implemented. This percentage is comparable to the 29.1% who believed that their administrators had not improved their understanding of SMASSE implementation. As per the analysis, it is deemed that the school administration has not fully understood how SMASSE project should be implemented and this can therefore be suggested as a topic to be researched on in future.

5.3 Discussion of findings

The study aimed at establishing the factors that influence teachers' perception on the effective implementation of SMASSE project in teaching Mathematics in secondary schools.

5.3.1 Teacher attitude on SMASSE project

An analysis of the data collected revealed that majority of the teachers 77.4% agreed that planning makes a teacher more effective in teaching as compared to 22.6% of the respondents who disputed this view. A further 83.8% of the teachers agreed that ASEI/ PDSI approaches helped them to focus more on the learning objectives. The study also revealed that a majority of the respondents at 68.1% felt that SMASSE INSETs have no influence on the teaching of mathematics. This means that these teachers are of the opinion that SMASSE INSETs do not influence their teaching of mathematics.

5.3.2 Effect of INSET training on the implementation of SMASSE project

The study also aimed at investigating the perception of teachers on how the training is done. The findings indicated that most of the teachers believed that the INSET themes and topics were relevant to their teaching needs hence being beneficial to them as teachers. Just over half of the teachers (54.8%) indicated that the facilitators communicated the information clearly while 32.3% indicated that the information was not communicated clearly. Interestingly, 48.4% of the teachers confirmed that the time spent on the INSET is not properly managed. This is 12.9% more than those who believed that the time was properly managed.

This study also indicated that 71.0% of the teachers agreed that there is a need to invite outsiders to facilitate during INSET and that 83.9% confirmed that interaction with other participants during INSET added value to them as teachers. Only 6.4% of the teachers did not believe that interactions with other participants added any value.

The rooms used during subject sessions were considered to be appropriate by 61.3% of the teachers. However, the rooms were not considered to be appropriate by 29.1% of the teachers. Only, 41.9% of the teachers considered the meals to be of acceptable standards while 38.8% indicated that the meals were not of acceptable standards.

Finally, 71% of the teachers believed that SMASSE INSET is useful. Only, 19.4% of the teachers opposed this view.

5.3.3 Adequacy of teaching materials

The study established that majority of the teachers (54.9%) affirmed that the availability of mathematics textbooks tremendously increased in their classes.

Over half of the teachers (51.6%) agreed that improvisation of teaching and learning materials for teaching mathematics increased substantially as is advocated by the ASEI approach

Interestingly, 67.8% of the teachers confirmed that their use of charts/ models during lessons increased tremendously.

However, a relatively large percentage of teachers (22.6%) were not sure if the frequency with which they used charts increased tremendously. Only 3.2% of the teachers stated that they did not greatly increase the use of charts/ models during lessons. Finally, despite the fact that the number of mathematics textbooks having substantially increased, 25.8% of the teachers confirmed that students' failure to carry out activities due to resource inadequacy had generally reduced. 41.9% of the teachers, however, did not believe that there was a reduction in students' failure to participate in activities.

5.3.4 Role of school administrators in the implementation of SMASSE project

This study found that nearly half of the respondents at 58.1% concurred that there was a remarkable improvement in the demonstration by the school administration to prioritize mathematics as a subject. It was evident in the increase in the amounts of funds allocated to facilitate the teaching of mathematics.

The study also found out that a majority of respondents at 29.1% felt that the school administrators did not improve their understanding of SMASSE project implementation as compared to 41.9% of the respondents who confirmed that their school's administration greatly improved their understanding of how SMASSE project should be implemented.

5.4 Conclusion of the study

The study intended to establish the factors that influence teachers' perception on the effectiveness of SMASSE project in teaching mathematics in secondary schools in Kenya. Based on the findings of this study it is concluded that teachers' attitude, perception of the INSET training, adequacy of teaching materials and the role of school administrators in the implementation process has an influence on teachers' involvement in the effective implementation of SMASSE project and how they perceive its effectiveness in the teaching of mathematics.

The study therefore concludes that teachers have a positive attitude towards the SMASSE project since it has affected their teaching and enhanced their professional development and that the

application of ASEI/PDSI approaches in the teaching of mathematics greatly improved the achievement of teaching and learning objectives.

The study further concludes that there is a negative attitude towards SMASSE INSETs, especially, among teachers. Some participants were not motivated to participate in SMASSE simply because they felt that the project had no value. However, some participants had low motivation to participate since the participants were not given any allowances (monetary compensation) for their time.

In addition, this study concludes that school administrators are also barriers to the implementation of the project. In particular, the participants cited lack of cooperation between them and school heads/ administration as the main challenge in the implementation of the project.

Lastly, the study concludes that most teachers indicated that they had heavy workload. Consequently, they found it difficult to participate in SMASSE INSETs and to complete the syllabus in time thus hindering the successful implementation of SMASSE project.

5.5 Recommendations of the study

The study dwelt with specifically factors that influence the perception of teachers on the effectiveness of SMASSE project in the teaching of mathematics in secondary schools in Kenya. In order to have teachers with a positive attitude getting involved in the effective implementation

of the SMASSE project, recommendations were made statistically and informed conclusions were made.

In a bid to investigate the factors that influence the perception of teachers on the effectiveness of SMASSE project in the teaching of mathematics in secondary schools in Kenya, the study made the following recommendations;

1. Teachers should be motivated to participate and to implement SMASSE project. In this context, teachers should be well paid to implement the project. Additionally, the participants should be given certificates of participation.

2. There should be adequate materials to facilitate the implementation of the project. In particular, there should be enough teaching materials. More teachers should be employed to ease the workload. Similarly, professional facilitators who can best manage the seminars and training should be employed. Additionally, the project should target schools with less teaching facilities. Consequently, there should be more financial support from the government and nongovernmental organizations to facilitate implementation of the project.

3. School administrators should give more support to their teachers to enhance implementation of the project. The school administrators should also be sensitized on the priority areas.

4. The SMASSE project can be best implemented if it is incorporated in the teachers training programs in universities and colleges.

5.6 Suggestions for further studies

This research study suggests the following issues for further research

1. School administrators' level of understanding of how SMASSE project should be implemented.

2. A study should be carried out to establish whether SMASSE in service training has had an effect on students' attitude towards mathematics based on teachers' perception on the SMASSE project.

3. A repeat of this study should be carried out after some time to find out if there are any changes that have taken place and comparison done with the current data be done. From this, a definite recommendation should be made.

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APPENDICES

APPENDIX I: Letter to Respondents

Department of Extra Mural Studies
University of Nairobi
P.O Box 30197
Nairobi

Dear Sir/Madam,

I am a post- graduate student registered at the Department of Extra Mural studies, University of Nairobi. I am currently carrying out a research on ***"Factors Influencing Teacher's Perception on the effectiveness of SMASSE Project on teaching of Mathematics in Secondary Schools in Westlands district Kenya***".

Since you are directly involved in the subject of this study, your completion of the attached questionnaire is important. All responses will be confidentially treated. All responses will be reported only in terms of entire population. Therefore, do not write your name or that of your school in this questionnaire.

Thanking you in advance for your anticipated cooperation.

Yours faithfully,

Asembo Eunice Ngesa

M.A (Project Planning and Management) student

APPENDIX II: Head teacher's Questionnaire (HTQ)

This questionnaire is for the purpose of investigating the factors influencing teachers' perception of SMASSE project on teaching mathematics in secondary schools in Westlands division. You are kindly requested to complete this questionnaire indicating your honest response by putting a tick (√) against your answer. Please respond to all questions.

SECTION A: BACKGROUND INFORMATION

1. Please indicate your gender Male ( ) Female ( )
2. How old are you?
   - 20 - 29 years ( )
   - 30 - 39 years ( )
   - 40 - 49 years ( )
   - 50 - 55 years ( )
   - Over 55 Years ( )
3. What is your highest professional qualification?
   - MED ( )
   - B.Ed ( )
   - PGDE ( )
   - Diploma ( )
   - Others, please specify……
4. What is the student population of your school?
   - Form I ……
   - Form II……
   - Form III……..
   - Form IV……..
5. a) How long have you served as a head of school in
   - Westlands district……years
   - Other districts ……years

b) Indicate your teaching subjects

i) ……..

ii)……

iii)……

c) Have you attended the SMASSE INSET?

Yes ( )

No ( )

d) If yes, which cycles?

Cycle 1 Yes ( ) No ( )

Cycle 2 Yes ( ) No ( )

Cycle 3 Yes ( ) No ( )

Cycle 4 Yes ( ) No ( )

6. How many mathematics teachers does the school have? ……..
7. Do you consider the number of mathematics teachers adequate?

Yes ( ) No ( )

Kindly provide the mean scores in mathematics in your school for the last five years

2010 ……

2009 ……

2008 ……

2007 ……

2006 ……

a. What reason (s) do you attribute the performance trend in the subject in your school to?

……

……

…….....

.....

……

……

PART B: Supervision

8. How often do you do the following things? Please tick (√) using the following key

KEY: A- Always O- Often S- Sometimes R- Rarely N- Not at all

	STATEMENT	A	O	S	R	N
a.	I check that teachers write mathematics schemes of work.					
b.	I check that lesson plans are made by teachers.					
c.	I check the records of work kept by the departments					
d.	I supervise teachers and encourage them to use teaching aids					
e.	I supervise facilities maintained by the mathematics department.					
f.	I observe mathematics lessons					
g.	I encourage teachers to attend seminars and symposia in mathematics					
h.	I meet with mathematics teachers to discuss issues in the students' performance					
i.	I encourage teachers to attend SMASSE activities					
j.	I make comments in assemblies about mathematics					
k.	I encourage students to attend mathematics symposia					
l.	I encourage students to like mathematics					

PART C: SCHOOL ADMINISTRATION

9. What do you think about the following in your school? Please indicate using a tick (√) to what extent you agree with the following statements.

   KEY: SA- Strongly Agree A- Agree NS- Not sure D- Disagree SD- Strongly Disagree

	STATEMENT	SA	A	NS	D	SD
a.	It is important to consult the mathematics teachers when procuring equipment and teaching materials					
b.	It is important to spend more on mathematics materials and resources					
c.	Most of the mathematics materials are affordable					
d.	The school policy on sourcing of mathematics teaching materials is adequate					
e.	The BOG adequately helps in the maintenance of the materials					
f.	The school adequately rewards good performance in mathematics to the teachers					

10. What challenges do you face during the implementation of the SMASSE project?

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11. What suggestions can you give in order to improve the implementation of the SMASSE Project?

Thank you for the thought, time and effort you have put into completing this questionnaire.

APPENDIX III: Mathematics Teacher's Questionnaire (MTQ)

This questionnaire is for the purpose of investigating the teachers' perception of SMASSE project on teaching mathematics in secondary schools in Westlands division. You are kindly requested to complete this questionnaire indicating your honest response by putting a tick (√) against your answer. Please respond to all questions.

SECTION A: BACKGROUND INFORMATION

1. Please indicate your gender Male ( ) Female ( )
2. How old are you?

   20 - 29 years ( )

   30 - 39 years ( )

   40 - 49 years ( )

   Over 50 years ( )
3. What is your highest professional qualification?

   MED ( )

   B.Ed ( )

   PGDE ( )

   Diploma ( )

   Others, please specify……
4. a. What is your major teaching subject? .....

   b. What is your minor teaching subject? .....
5. Which class (es) do you teach mathematics to and how many students do you have in each class?

   Form I ( ) Number in class ……..

   Form II ( ) Number in class ……..

   Form III ( ) Number in class ……..

   Form IV ( ) Number in class ……..
6. How long have you taught mathematics?

   Below 1 year ( )

   1-5 years ( )

   6-10 years ( )

   11-15 years ( )

   16 and above ( )

7. How many lessons do you teach in total in a week? ……..
8. Apart from teaching mathematics what are your other responsibilities in the school?

   Head of school ( )

   Deputy Head of school ( )

   Head of department ( )

   Subject head ( )

   Class teacher ( )

   Subject teacher ( )

   Others, please specify……

   What are your professional responsibilities outside school?

   Examiner ( )

   Subject panel member ( )

   SMASSE trainer ( )

   Others, please specify …….
9. Have you attended the SMASSE INSETs?

   Yes ( ) No ( )

   If yes, indicate the subjects for which you have attended

   Mathematics ( )

   Biology ( )

   Chemistry ( )

   Physics ( )
10. Which cycles have you attended?

    Cycle 1 Yes ( ) No ( )

    Cycle 2 Yes ( ) No ( )

    Cycle 3 Yes ( ) No ( )

    Cycle 4 Yes ( ) No ( )

PART B: ATTITUDE

11. Please consider the statements written and then tick (√) to indicate to what extent you agree or disagree

KEY: SA- Strongly Agree A- Agree NS- Not sure D- Disagree SD-Strongly disagree

	STATEMENT	SA	A	NS	D	SD
a.	Planning makes a teacher more effective in teaching					
b.	The ASEI/PDSI approaches help a teacher focus more on the learning objectives					
c.	SMASSE INSETs have no influence on the teaching of mathematics					
d.	Planning lessons helps a teacher evaluate learning more effectively					
e.	The teaching load does not affect the planning of lessons					
f.	Adequate teaching materials are necessary for effective teaching					
h.	Activities help students understand difficult concepts					
i.	Activities delay the coverage of syllabus					

PART C: PERCEPTION

12. Please consider the statements written in line with the SMASSE INSET and then tick (√) to indicate to what extent you agree or disagree

KEY: SA- Strongly Agree A- Agree NS- Not sure D- Disagree SD- Strongly disagree

	STATEMENT	SA	A	NS	D	SD
a.	The number of hands-on mathematics activities in my class has increases substantially since I attended SMASSE INSET					
b.	My own personal interest in teaching mathematics has substantially improved as a result of the SMASSE INSET					
c.	The amount of time a colleague would observe students doing mathematics activities without my help has increased greatly					

d.	The number of times that student questions have led to students investigation has increased					
e.	The amount of funds I have been able to obtain from the institution to facilitate teaching mathematics has increased substantially					
f.	My knowledge of mathematics concepts and confidence in teaching mathematics has greatly improved					
g.	The demonstration of the school administration on priority of mathematics has substantially increased					
h.	The school administration's understanding of how SMASSE project should be implemented has improved greatly					
i.	Parents support on the implementation of the SMASSE project has been tremendous					
j.	Improvisation of teaching and learning materials for teaching Mathematics has substantially increased					
k.	The time to plan and prepare for instructional activities related to ASEI has improved greatly					
l.	The number of text books available in my class for teaching mathematics has tremendously increased					
m.	My professionally development based on the SMASSE INSETs has greatly improved					
n.	The number of times I use charts/ models during a lesson has increased tremendously					
o.	The number of times students fail to carry out activities due to lack of resources has generally reduced					

PART D: LESSON PLANNING

13. Please consider the statements written and then tick (√) to indicate to what extent you agree or disagree

KEY: SD- Strongly Disagree D-Disagree NS- Not sure A- Agree SA-Strongly Agree

	STATEMENT	SD	D	NS	A	SA
a.	Planning makes a teacher more effective in teaching					
b.	Planning helps a teacher focus more on the learning objectives					
c.	Planning lessons does not consume a lot of time					
d.	Planning lessons helps a teacher evaluate learning more effectively					
e.	The teaching load does not affect the planning of lessons					
f.	Lesson notes are necessary for effective teaching					
h.	Activities help students understand difficult concepts					
i.	Activities delay the coverage of syllabus					

PART E: SMASSE INSET

14. Please consider the following statements on SMASSE INSET and then tick (√) to indicate to what extent you agree or disagree with each of the statements

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

	STATEMENT	SD	D	NS	A	SA
a.	The INSET themes and topics are relevant to my teaching needs					
b.	The facilitators communicate the information clearly					
c.	The time spent on the INSET is properly managed					
d.	There is need to invite outsiders to facilitate during the INSETs					
e.	Interaction with other participants during the INSETs adds value to me as a teacher					
f.	The media used for the presentation is of good quality and is relevant					
g.	The write-ups are useful reference for teaching and learning afterwards					

h.	Implementing the acquired skills in the classroom is easy					
i.	The rooms used in for plenary/ subject sessions are appropriate and conducive for learning					
j.	Quality meals during the INSETs are of acceptable standards					
k.	Accommodation facilities provided are of acceptable standards					
l.	The 10 days duration of the INSET is adequate					
m.	Timing of the INSET during the holidays is appropriate					

15. What challenges do you face during the implementation of the SMASSE Project?

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16. What suggestions can you give in order to improve the implementation of the SMASSE Project?

Thank you for the thought, time and effort you have put into completing this questionnaire.

APPENDIX IV: Heads of Department's Questionnaire (HODQ)

This interview schedule is for the purpose of investigating the factors influencing teachers' perception of SMASSE project on teaching mathematics in secondary schools in Westlands division. You are kindly requested to complete it indicating your honest response by putting a tick (√) against your answer. The information given below will be treated with utmost confidentiality and you are therefore requested not to write your name/ school anywhere on the questionnaire. Please respond to all questions.

SECTION A: BACKGROUND INFORMATION

1. Please indicate your gender Male ( ) Female ( )
2. How old are you?

a. 20 - 29 years ( )
b. 30 - 39 years ( )
c. 40 - 49 years ( )
d. 50 - 55 years ( )

3. What is your highest professional qualification?

a. MED ( )
b. B.Ed ( )
c. PGDE ( )
d. Diploma ( )
e. Others, please specify……

PART B: The SMASSE INSET

4. To what extent do you agree with the following statements about the SMASSE INSET? Please tick (√) using the following key

KEY: SA- Strongly Agree A- Agree NS- Not sure D- Disagree SD- Strongly disagree

	STATEMENTS	SA	A	NS	SD	D
a.	The ten days duration of the INSET is adequate					
b.	Timing of the INSET during the holiday is appropriate					
c.	The interaction of the mathematics teachers with others during the INSET has added value to the teachers					

d.	The teachers are using the knowledge and skills acquired during INSET in their teaching					
e.	The INSET trainers provide adequate feedback to the heads of schools on the in-service of their teachers					
f.	Write-ups provided during INSETs are used by the teachers to improve their teaching					
g.	The head teachers are adequately prepared on the management of the teaching and learning resources					
h.	The teachers' lesson plans are adhering to the ASEI lesson plans					

SECTION C: IMPLEMENTATATION OF SMASSE PROJECT

5. What is the level of your teachers preparedness in handling the implementation of the SMASSE

   Very well prepared ( )

   Well prepared ( )

   Not so prepared ( )

   Poorly prepared ( )

6. What suggestions can you give in order to improve the teachers' preparedness to handle the implementation?

   ……

   ……

   ……

   ……

   ……

   ……

7. How many Mathematics teachers in your department have attended SMASSE INSET sessions?

   All ( )

   Majority ( )

   Some ( )

   None ( )

   Others (specify) ( )

8. Who were the facilitators?

   National trainers ( )

   District trainers ( )

   Trained teachers ( )

   Others specify……..

9. What is the frequency of the in-service programme?

   ……

   ……

10. What challenges do you face in implementing the SMASSE project in your school?

   ……

   ……....

   ……

   ……....

   ……

   ……....

11. What actions have you taken to address the challenges?

   ……

   ……

   ……

   ……....

   ……

   ……....

12. What teaching materials for mathematics are available in your school?

   Text books ( )

   Models ( )

   Audio visual Aids ( )

   Visual Aids ( )

   Others specify……..

13. Are these materials adequate? Yes ( ) No ( )

PART D: Supervision

How often do you do the following things? Please tick (√) using the following key

KEY: A- Always O- Often S- Sometimes R- Rarely N- Not at all

	STATEMENT	A	O	S	R	N
a.	I check that teachers write mathematics schemes of work.					
b.	I check that lesson plans are made by teachers.					
c.	I check the records of work kept by the departments					
d.	I supervise teachers and encourage them to use teaching aids					
e.	I supervise facilities maintained by the mathematics department.					
f.	I observe mathematics lessons					
g.	I encourage teachers to attend seminars and symposia in mathematics					
h.	I meet with mathematics teachers to discuss issues in the students' performance					
i.	I encourage teachers to attend SMASSE activities					
j.	I make comments in assemblies about mathematics					
k.	I encourage students to attend mathematics symposia					
l.	I encourage students to like mathematics					

14. What challenges do you face during the implementation of the SMASSE project?

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15. What suggestions can you give in order to improve the implementation of the SMASSE Project?

Thank you for the thought, time and effort you have put into completing this questionnaire.

APPENDIX V

TABLE FOR DETERMINING SAMPLE SIZE FROM A GIVEN POPULATION

N	S	N	S	N	S	N	S	N	S
10	10	100	80	280	162	800	260	2800	338
15	14	110	86	290	165	850	265	3000	341
20	19	120	92	300	169	900	269	3500	246
25	24	130	97	320	175	950	274	4000	351
30	28	140	103	340	181	1000	278	4500	351
35	32	150	108	360	186	1100	285	5000	357
40	36	160	113	380	181	1200	291	6000	361
45	40	180	118	400	196	1300	297	7000	364
50	44	190	123	420	201	1400	302	8000	367
55	48	200	127	440	205	1500	306	9000	368
60	52	210	132	460	210	1600	310	10000	373
65	56	220	136	480	214	1700	313	15000	375
70	59	230	140	500	217	1800	317	20000	377
75	63	240	144	550	225	1900	320	30000	379
80	66	250	148	600	234	2000	322	40000	380
85	70	260	152	650	242	2200	327	50000	381
90	73	270	155	700	248	2400	331	75000	382
95	76	270	159	750	256	2600	335	100000	384

Note: "N" is population size

"S" is sample size.

Krejcie, Robert V., Morgan, Daryle W., "Determining Sample Size for Research Activities", Educational and Psychological Measurement, 1970.

APPENDIX VI: LIST OF SCHOOLS

School
Nairobi School (Boys National School)
Kenya High (Girls National School)
St. Georges (Girls provincial)
State House (Girls provincial)
Kangemi High (Boys provincial)
Hospital Hill (Mixed provincial)
Nairobi Milimani (Boys provincial)
Parklands Arya (Girls provincial)
Lavington united (Mixed day provincial)
High ridge (Mixed provincial)

Source: District Education office records-2011