FACTORS INFLUENCING THE ADOPTION OF STRENGTHENING OF MATHEMATICS AND SCIENCE IN SECONDARY EDUCATION (SMASSE) SKILLS: A CASE OF MATHEMATICS IN ELDORET EAST DISTRICT, KENYA

BY

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DECLARATION

Declaration by Candidate

This thesis is my original work and has not been presented either partially or wholly for any academic program in any institution.

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DEDICATION

To my beloved parents who had difficult time convincing me to go to school

TABLE OF CONTENTS

LIST OF TABLES

TABLE OF FIGURES

ABBREVIATIONS AND ACRONYMS

ASEI	Activity, Student, Experiment, Improvisation
CEMASTEA	Centre for Mathematics, Science and Technical Education in Africa
D.P.C	District Planning Committee
DSSHA	District Secondary Schools Heads Association
GOK	Government of Kenya
INSET	In-service Training
JICA	Japan International Cooperation Agency
K.C.S.E	Kenya Certificate of Secondary Examination
MOE	Ministry of Education
MOEST	Ministry of Education, Science and Technology
NCEOP	National Committee on Educational Objectives and Policies
O.D.A	Overseas Development Agency
PDSI	Plan, Do, See and Improve
SMASE	Strengthening of Mathematics and Science Education
SMASSE	Strengthening of Mathematics and Science in Secondary Education
SMASSE –WECSA	Strengthening of Mathematics and Science in Secondary Education West, East, Central and South Africa.
H/Ts	Head Teachers
QASO	Quality Assurance and Standards Officer

ABSTRACT

The overall objective of this study was to assess the factors that influence adoption of SMASSE skills among mathematics teachers in Eldoret East District in Rift Valley Province, Kenya. The specific objectives were: To assess the level of mathematics teachers' appreciation of the role of the SMASSE INSET in continuing professional development, to establish the student and the teacher factors that influence the adoption of SMASSE skills by mathematics teachers and to determine the role played by the principals in the adoption of SMASSE skills by mathematics teachers in the district. The survey research design was utilized in this study. The teachers of mathematics and secondary school principals from the district constituted the target population. All the serving mathematics SMASSE trained teachers and principles from the district were selected for inclusion in the study. Data was collected using questionnaires, structured interview guide and document analysis. The data validity was ensured by consulting experts and discussion with colleagues while reliability of the tools was determined through test-retest method. The data was analyzed using both descriptive and inferential statistical techniques. The means and percentages for descriptive and the chi-square for testing the hypothesis. It was established that most of the teachers apply relevant practical mathematical activities in over half of their mathematics lessons. The study established that teaching experience of a teacher, duration of training, age of teachers, teaching methods, mastery of content, teachers' attitude towards the inset, workload, teachers' self motivation and teachers' capacity to improvise are the main teacher factors influencing the adoption of SMASSE skills. It was also established that availability of support materials, student teacher ratio and classroom size influenced the adoption of SMASSE skills by mathematics teachers. The study found that age and entry behavior, socio-economic background of the students and students' attitude towards mathematics also influenced the adoption of SMASSE skills. It was also established that principals encouraged staff to undergo the INSET, motivated the staff to practice the SMASSE skills, mobilized resources for the implementation of SMASSE skills, rewarded SMASSE implementation successes and promptly supplied information about the INSET. The study recommended that SMASSE skills to be taught in teacher-tertiary institutions. The findings are to be useful to policy makers such that they can address the Challenges raised.

CHAPTER ONE

1.0 INTRODUCTION TO THE STUDY

1.1 Introduction

This chapter comprises of the background information related to the study, a statement of the problem under study, the purpose of the study, specific objectives of the study, research questions, and hypothesis of the study, the significance of the study, assumptions of the study, scope of the study, limitations of the study, theoretical framework, conceptual frame work and definitions of terms.

1.2 Background of the Study

Many African countries hope to be industrialized by the year 2020 and Kenya is no exception. However, looking at the performance of mathematics and science subjects at secondary education level in Kenya, the vision to be industrialized is in doubt because the performance by the students in these subjects has been very poor. Improving the performance of Mathematics and Science education is a great societal need in Kenya not only for industrialization of the country but also for producing scientifically empowered citizens. Research by one of the key stakeholders in secondary education in Kenya, the **S**trengthening of **M**athematics **a**nd **S**cience in **S**econdary **E**ducation (SMASSE) project has shown that consistent failure and negative attitude by students, towards Mathematics, continues to characterize the classroom. Based on this same research, teachers have been found to present lessons that are too much teacher-centred with the teacher as the main actor and sometimes the only actor in the classroom as students remain passive recipients(Wambui, 2005).

The role of mathematics and science in industrialization can not be overemphasized. The Republic of Kenya, under its National Development Plan, aims at transforming the nation into a newly industrialized country by 2030. However, in order to develop human resources capable of promoting industrialization, Kenya urgently needs to improve its education system, especially in the fields of mathematics and science (MoE, 2005). The government of Kenya therefore recognizes the important role science and mathematics should play in the realization of vision 2030 and to become a globally competitive and prosperous country by 2030. This has been reflected in the amount of resources channelled towards enhancing the teaching and learning of science and mathematics at all levels of the education system. At secondary school level, there have been a number of intervention strategies that the government has put in place to ensure effectiveness in the teaching/learning of these subjects. In addition to strategies such as: providing schools with qualified mathematics and science teachers and improving their remuneration and terms of service; providing schools with science equipment and even constructing laboratories, the government has also institutionalized In-service Education and Training (INSET) of serving science and mathematics teachers under Strengthening of Mathematics and Science in Secondary Education (MoE, 2005).

The Strengthening of Mathematics and Science in Secondary Education(SMASSE) which is a joint venture between Government of Japan and Government of Kenya was initiated to boost the learning and teaching of mathematics and science in an effort to enhance Kenya's industrialization dream. Japan which is technologically advanced has for decades defined its presence in Kenya through provision of aid to various government sectors such a infrastructure projects, agribusiness and education. For

instance the SMASSE project is one such involvement of the Japanese Government in the education sector on Kenya (MOEHRD, 1997).

The Ministry of Education considered evolving appropriate pre- and in-service training so as to raise relevance and quality in secondary education (MOEHRD, 1997). Indeed, MOEST (2003) considered developing and operationalising focused in-service programs as one of the indicators for attainment of enhanced quality of education. The Ministry of Education with technical assistance of Japan International Cooperation Agency (JICA) initiated the SMASSE pilot program in 1998 in 9 out of 72 districts in the country then.

Kenya National Examinations Council (KNEC) reports indicate that mathematics and sciences have continued to post poor examination results. For instance, in Mathematics the average mark obtained by candidates between 1999 and 2003 was below 20%. A similar trend has been exhibited in Physics and Chemistry. In Physics the problem of poor performance has been also coupled by dwindling numbers of candidates taking the subject. In 2002 alone only 54,180 out of 197,090 representing 27% of the total candidature did Physics while in 2003, 55,877 candidates out of 207, 730 candidates, representing 26.8% of the total candidature sat for Physics. (KNEC: 2003)

This poor performance has been attributed to several factors ranging from the abstract nature of the subjects, the attitude of the teachers and learners , the community etc. The Government therefore on realizing that attainment of vision 2030 may be a dream, sought assistance from the Japanese Government on the possible remedy to

the situation. The Japanese government was better placed for this because their new education system in Mathematics and Science was better than other countries as revealed in a series of International Mathematics and Science Studies (IMSS).

. The Project in-services science and Mathematics teachers based on a cascade system. In this regard, four senior teachers in each subject (biology, Chemistry, mathematics, and Physics) were selected from the original 9 pilot districts in 5 pilot provinces through interviews to be trained at the national level. Those trained at the national level were to train their colleagues at the district level in their respective areas. Kenya has 8 administrative provinces with a total of 254 districts. The outcomes of the 5-year SMASSE Project were to be used in seeing whether there was a possibility of starting all year round national in-service teacher education courses for science teachers by the end of the project period in July 2003.

It is important that teachers identify the teaching/learning problems in Mathematics and seek solutions in a forum where Mathematics teachers can exchange ideas (SMASSE Project, 1998). . However, it is not unusual to see a Mathematics teacher relying almost entirely on a textbook for his/her teaching with no schemes of work, lesson plan, lesson notes and only occasionally refers to the syllabus (Wambui, 2005). She further observes that, teachers have been found to present lessons that are too much teacher-centred with the teacher as the main actor and sometimes the only actor in the classroom as students remain passive recipients. The mathematics lessons have been found to be difficult, boring and lacking in effective teaching and learning materials. The challenge thus has been how to make mathematics more “alive”, more “real” and more “accessible.

The project focuses on lesson improvement as its key concept and established a training system using the cascade approach at the national and district levels, which facilitated the diffusion of training effects to all participants including those who are at the lowest level of the cascade. It has also set up mechanisms by which a part of school tuition fees is used to cover the costs for district-level training, thus ensuring the sustainability of training management and implementation. After the launch of Phase II in 2003, the Kenyan government established the national training centre and INSET was extended both domestically, to cover the entire Kenyan territory, and intra-regionally, to conduct activities to the strengthening of mathematics and science in secondary education in 30 Sub-Saharan countries (JICA, 2009).

SMASSE is managed regionally by SMASSE-WECSA co-ordinating committee, which comprises of ODA official from Japan and ministry of Education officials from each member of the member countries. Then at individual country's level there are joint co-ordinating committees comprising of ODA officials and MOE-officials from the country in question. Initially the SMASSE headquarters was at Kenya Science Teachers College but in 2004, it moved to CEMASTEA- located in Karen area of Nairobi. The programme has since been extended to include primary teacher training colleges which saw the first batch of tutors being in-serviced in 2007. There has also been a country wide sensitization exercise of Education officials and H/Ts on SMASSE conducted in 2009. The training at secondary school level involves teachers in Chemistry, Physics, Biology and Mathematics. The programme is managed at District level by a District Planning Committee (DPC) comprising of the District Education Officer as the Chairman, the district quality assurance and standards officer as the secretary, the chairman- DSSHA as treasurer and the inset

centre principal as well as the chairman of the trainers as members. The trainers are selected from among the teachers and 3 teachers are trained per subject by CEMESTEA, such that each inset centre normally has 12 trainers and from the trainers a chairman is selected. Eldoret East District, has had the mathematics and science teachers undergoing through the 4 cycles.

1.3 Statement of the Problem

Kenya hopes to be industrialized by the year 2030, hence the need for faster development in technological and scientific advancement .Hence the need to equip the youth with relevant capacities. The current initiative SMASSE is one such strategy; however even with SMASSE being in operation, the performance at KCSE in mathematics nationally has been poor ;since the year 2002 the mean score has not gone beyond 40% (Waititu m.2008), infact between the year 2008 and 2009 the mathematics mean score was20%. Eldoret east mathematics mean score at KCSE was at 3.4 in 2008 and 3.12 in 2009(DQASO KCSE analysis report 2008 and 2009).

A report on SMASSE impact assessment done by Uasin Gishu district SMASSE planning committee in the year 2006 indicated that a good number of SMASSE trained teachers were not applying SMASSE skills learned in there teaching. (Uasin Gishu SMASSE impact assessment report,2006)

This prompted the researcher to conduct the current study to establish the factors that influence adoption of SMASSE skills by mathematics teachers in Eldoret east district.

1.4 The Purpose of the Study

The purpose of this study was to assess the factors that influence adoption of SMASSE skills among mathematics teachers in Eldoret East District.

1.5 The Objectives of the Study

The specific objectives of this study were:

i. To assess the level of mathematics teachers appreciation of the role of the SMASSE INSET in continuing professional development.
ii. To establish the teacher-factors that influence the adoption of SMASSE skills by mathematics teachers.
iii. To determine the role played by the principal in influencing the adoption of SMASSE skills by mathematics teachers.
iv. To establish the student-factors that influence the adoption of SMASSE skills by mathematics teachers.

1.6 Research Questions

The study sought to answer the following research questions:

i. What is the level of mathematics teachers' appreciation of the role of the SMASSE INSET in continuing professional development?
ii. What are the teacher-factors that influence the adoption of SMASSE skills by mathematics teachers?
iii. What is the role played by the principals in influencing the adoption of SMASSE skills by mathematics teachers?
iv. What are the student-factors that influence the adoption of SMASSE skills by mathematics teachers?

1.7 The Hypotheses of the Study

The following were the hypothesis for this study. They were stated in null hypothesis.

HO_1: There is no significant relationship between the levels of mathematics teachers' appreciation of the role of the SMASSE INSET in continuing professional development and the adoption of SMASSE skills in the teaching of mathematics subject.

HO_2: There is no significant relationship between Teacher-related factors and the adoption of SMASSE skills in the teaching of mathematics subject.

HO_3: There is no significant relationship between the role played by the principal and the adoption of SMASSE skills by mathematics teachers in Eldoret East district.

1.8 Significance of the Study

One way of addressing the difficulties students experience in Kenyan science classrooms is through appropriate teaching interventions that can be realized through professional development of science teachers (SMASSE Project, 1998). It is hoped that professional development programs for Mathematics teachers will equip teachers with appropriate teaching skills and instruction strategies that are necessary to effectively implement science curricula in schools. By so doing, the Kenyan authorities with assistance from the Government of Japan hope to strengthen the teaching learning of mathematics and science education in public schools through a pilot project called "Strengthening Mathematics and Science in Secondary Education (SMASSE)". It should be remembered that a course largely succeeds or fails due to the way it is taught. On the other hand, it should be noted that Mathematics teaching is such a personal art that it would be wrong to suggest any single, rigid approach to Mathematics teaching or learning. The effectiveness of what is taught depends, to a large extent, on the amount of planning put in before class. This study is to provide

vital information to policy makers on the main challenges, which face mathematics teachers with regard to implementation of SMASSE skills. The results are to also serve as a baseline survey since there has not been a similar study in the district before. Also, the methodology developed for this study is to be of relevance to other researchers who may be interested in similar studies elsewhere. To be realized this study has brought out the issues that could be making SMASSE skills not to reach the classroom, hence ones this challenges are addressed then expected SMASSE output could

1.9 Scope of the Study

The research was conducted within Eldoret East District and to involve SMASSE trained secondary school mathematics teachers. The mathematics teachers were categorised as per types of schools they were teaching in their sex: male or female, level of professional qualification and level of teaching experience, such that factors affecting adoption of SMASSE skills were assessed using those categories. The survey research design was used to conduct this research using questionnaires and interview schedules as the data collection tools.

1.10 Limitations of the Study

These are aspects that can easily influence the results negatively, over which the researcher has no control. This study was conducted in Eldoret East District, which may not allow generalisability to the other districts; however it can be applicable to districts with similar characteristics. The study was also limited to head teachers and SMASSE trained teachers. Other groups such as the ministry officials, other teachers, other students and other stakeholders might have had different views concerning the

issues addressed by this study. However, it is hoped that the key points were captured from the study sample.

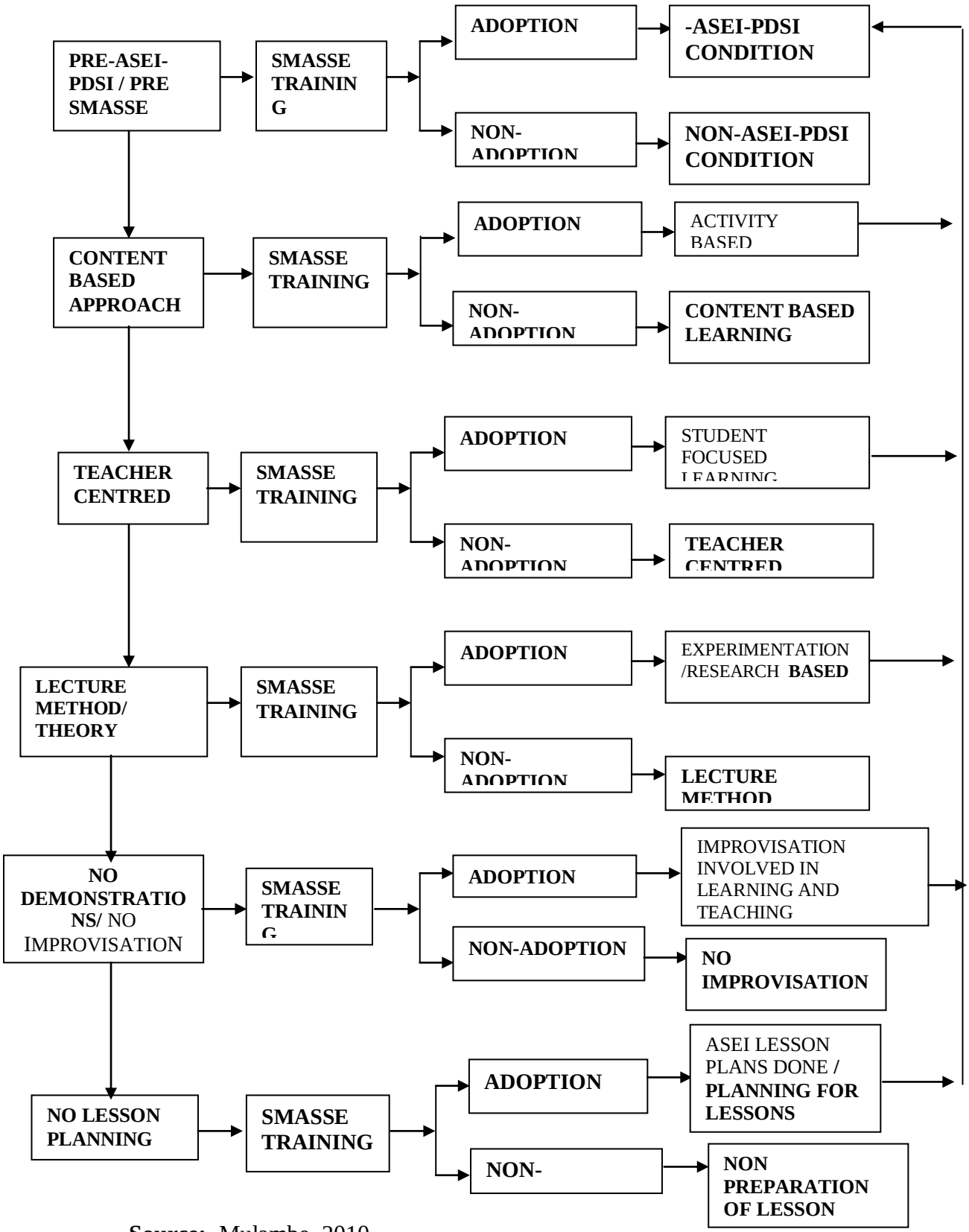
1.11 Assumptions of the Study

The Assumption in this study is that each public school in the District has at least one mathematics teacher who has undergone the SMASSE INSET; that the mathematics teachers would be honest when filling the questionnaire such that the true picture is captured and also that the roads would be passable during the study period, such that all schools sampled would be accessed.

1.12 Theoretical Framework

The study was based on the cognitive response theory whose proponent was Ortony et al (1990). This theory seeks to understand attitudes and attitude change processes by understanding the thoughts people generate as a result of being given some information. The key assumption of the cognitive response view is that people are active processors of information which generate cognitive responses to messages but not just passive recipients of the messages that they happen to be exposed to (Ortony et al, 1990). The theory can be applied in this study and to this research. It implies that when mathematics teachers receive information, that information is cognitively processed, perceived, then either liked or disliked and finally leads to an action or behavior. However, the cognitive processing and perception may be influenced by individual's personal characteristics. This theory is applicable in this study since the adoption of the SMASSE skills by the mathematics teachers depends on teacher factors, learner factors, institutional factors and the role of the school headteacher. These are the aspects that were covered in this study.

1.13 Conceptual Framework



Source: Mulambe, 2010

The above conceptual framework explains transition from a pre-SMASSE condition through SMASSE training stage then followed by a decision by the trainee to either adopt the skills learnt or not. When one adopts the skills a SMASSE condition is attained, when one fails to adopt then the original status quo is maintained; meaning that SMASSE will not have reached the classroom which is supposed to be its final destination. Hence, this study aims to find out what causes one to decide to adopt or not to adopt SMASSE skills. The specific teaching learning concepts on the left of the chart above transform to specific SMASSE skills on the right side of the diagram above.

1.13 Operational Definitions of Terms

Adoption: Refers to the application or implementation or use.

Mathematics teachers: Refers to the secondary school teachers who teach students mathematics.

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

SMASSE skills: Refers to the teaching and learning techniques learnt by Mathematics teachers during SMASSE INSETs. They include ASEI-PDSI approach, i.e. having; **A**ctivity based lessons, **S**tudent centered learning, **E**xperimentation in learning and **I**mprovisation to get needed equipment for learning .SMASSE also involves Planning for **D**oing teaching, activities, **S**eeing /observing and aiming to **I**mprove.

1.14 Summary of the Chapter

This chapter has covered background of the study, statement of the problem, purpose of the study, objectives of the study, research questions, the hypothesis of the study, significance of the study, scope of the study, limitations of the study, assumptions of the study, theoretical and conceptual framework and operational definition of terms.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter deals with a review of information from research studies, journals, newspapers, seminar papers, conferences reports and books on past studies on Kenyan educational system related to the problem and information on the SMASSE project and how it relates to the current study. The strengths and weaknesses of the past studies are highlighted. Therefore, the position of this study is to consolidate in so far as it links and at the same time deviates from these past studies. The key aspects covered in this chapter are: importance of education to economic growth and development, education system in Kenya, SMASSE project in Kenya, SMASSE skills for teaching mathematics and summary of the chapter.

2.2 Importance of Education to Economic Growth and Development

Education is clearly an important tool for all aspects of economic and social development, it is through education that people acquire knowledge, skills, attitudes and values necessary for the country's economic growth and development. Education contributes to aggregate economic growth by: Creating more productive labour force and endowing it with increased knowledge and skills; Providing widespread employment and income-generating opportunities for teachers, school and construction workers, textbook and paper printers, school uniform manufacturers and related workers; Creating a class of educated leaders to fill vacancies left by departing expatriates or otherwise vacant positions in governmental services, public corporations, private businesses and professions; Providing the kind of training and

education that would promote literacy and basic skills while encouraging “modern” attitudes on the part of diverse segments of the population, and providing essential skilled manpower for both the industrialized and informal sector of the economy, provides the means of developing the knowledge, skills and productive capabilities of the labour force and acts as a catalyst in encouraging modern attitudes and aspiration (Psacharapoulos and Woodhall, 1985). In essence education is the road to a country’s economic growth and development as research has shown that education is related to income, health and nutrition, productivity, community development, population control, equality, nationalism and culture.

In 1989-93 development plan the Kenyan government declared that; Education is one of the most important influence on the quality of life. Government has therefore been committed to provision of equal opportunities for all through the provision of free primary and secondary education and production of skilled and high level manpower to meet the growing and changing demands of the education. Additionally education contributes to development by providing and developing attitudes necessary for production through the change in attitude towards work. Traditional way of laxity to modern way of being active rather action oriented, this increases occupational mobility with closely prescribed work conditions. Education and skilled manpower too is a necessary condition of sustaining economic growth and development. This is the reason behind the ninth national development plan of Kenya (2002-2008) which recognizes that education is a fundamental strategy for human resource development which in turn mobilizes and manages the other resources for the country to achieve economic growth and development. According to Ali (2000), education is perceived as a vehicle not only of promoting socio-political consciousness, but also of providing

the quality and quantity of skilled manpower required for economic development based on social demands.

Education is a critical component for economic development of a country. The quality and level of education in a country determines the wealth of its people. Education to a large extent is known to serve as a weapon against poverty, disease and ignorance. Good education is widely known to improve people's quality of life. Eshiwani (1986) noting the need for educational research in Kenya stated that "it has already been observed that schools have failed to adequately provide for the needed scientific and technological education". It is for this reason that improvement of academic performance continues to interest educational researchers and practitioners alike. Since the 1980s concern for quality of Science education offered in Kenyan schools has grown rapidly thereby generating tremendous body of research in education cycles. This has led to active involvement on the part of education specialists and other stakeholders in developing strategies and techniques for monitoring educational concerns with an aim of improving the teaching and learning of science and mathematics in secondary schools notably through SMASSE.

It is because of the importance of education to the country's economic growth and development that the G.O.K and JICA came up with the SMASSE project to improve the students' performance in Sciences and mathematics. The current study seeks to establish the factors that influence the adoption of the SMASSE skills specifically by the mathematics teachers in Eldoret East District.

2.3 The Education System in Kenya

Until 1985, the education system in Kenya was 7-4-2-3 comprising 7 years of primary, 4-year ordinary secondary, 2-year of advanced secondary education and 3-

year basic university degree, besides 2-year certificate and 3-year diploma programmes in tertiary institutions. Recommendations to extend primary education from 7-years to 9-years were made by the National Committee on Educational Objectives and Policies (NCEOP) in 1976 (Republic of Kenya, 1976). This report had also recommended that prevocational studies be introduced into primary school curriculum to include woodwork, masonry, bricklaying and business education such as typing and bookkeeping. It also stressed that children should be left to use their creative talents towards self-employment in the fields of art, writing music painting and curving. These recommendations were reinforced by the Mackay Presidential Working Party that recommended the 8-4-4 system of education which came into effect by 1985, that is 8 year- primary, 4-year secondary and 4-year university basic degree education.

The Working Party evaluated the cost implication of 9-year primary cycle and instead recommended 8 years (Republic of Kenya, 1981; World Bank, 2004). Unlike the previous system of education, the 8-4-4 was intended to inspire self-reliance and all roundedness among graduates of every cycle of education through emphasis on vocational subjects. The subject contents also changed with some secondary subject content being moved to primary and A-level content moved to O-level. In addition, the Government of Kenya (GOK) changed its policy of providing teachers and grants only to its maintained and assisted public secondary schools. Due to resource constraints, the GOK officially introduced cost-sharing in education (Republic of Kenya, 1988). The continued growth, coupled with resource constraints and curricular changes negatively affected education quality as these were not accompanied by

adequate teacher preparation despite challenges of subject content and pedagogical approaches.

2.4 The Innovation Process Decisions

Rogers (1983) defines innovation-decision process as the process through which an individual (or other decision- making unit) passes from just, knowledge of an innovation, to forming an attitude toward the innovation, to a decision to adopt or reject, to implementation of the new idea and to confirmation of this decision. He highlights a five stage process of making a decision on an innovation, that is, to either adopt or reject it. This he did in his revised article entitled: "Diffusion of Innovations, 4th edition (New York free press: 1995, pg 190)".

The innovation-decision process goes through the following stages:

1. Knowledge

The first stage is the knowledge which commences when the individual (or other decision-making unit) is exposed to the innovation's existence and gains some understanding of how it functions. Knowledge of an innovation can arise from previous practice or felt needs/ problems. Roger (1983) identifies two types of knowledge about an innovation as software information which is embodied in an innovation and serves to reduce uncertainty about the cause-effect relationships that are involved in achieving a desired outcome and knowledge principle which consist of information dealing with the functioning principles underlying how the innovation works.

2. Persuasion

The second state is persuasion where the individual forms a favorable or unfavorable attitude toward the innovation. At this state the individual is more psychologically involved with the innovation. He or she actively seeks information about the new idea. Here, selective perception is important in determining the individuals' behaviour at the persuasion stage, for it is at this stage that a general perception of the innovation is developed.

An individual is motivated at the persuasion stage to seek innovation- evaluation information which is the reduction in uncertainty about an innovation's expected consequences. Here an individual usually wants to know the answers to such questions as; "What will its advantages and disadvantages be in my situation?" Answers to these questions form a firm basis on making a decision on the innovation. It is assumed that the persuasion will lead to a subsequent change in behavior (that is adoption or rejection) consistent with the attitude held. This is in line with the current study indicating that the attitude an individual develops over an idea determines whether one would adopt or reject the information given. The first SMASSE cycle involves addressing teachers attitude towards sciences and mathematics, this takes two weeks in a year. This being enough time to effect attitude change could be a topic for another research but in my view this duration is too short to achieve any meaningful attitude change among the teachers. The planning of the training did not involve the input of all stakeholders (Wabwile, 2008).The teachers were not actively involved at the planning stage hence ownership of the programme among teachers is still a problem.

a. Relative Advantage

This is the degree to which an innovation is perceived as being better than the idea it supersedes. The degree of relative advantage can be expressed in economic profitability, in status giving or other ways. In the case of SMASSE, improved student performance in Mathematics and Science in KCSE examinations. Relative advantage affects the rate of adoption of an innovation. It may also indicate the strength of the reward or punishment resulting from the adoption of an innovation. The sub dimensions of relative advantage include the degree of economic profitability, low initial cost, a decrease in discomfort, a savings in time and effort, and the immediacy of the reward.

The immediacy of the reward normally explains why preventive innovations have an especially low rate of adoption. A preventive innovation is a new idea that an individual adopts in order to prevent the possibility of some unwanted future event. Sometimes incentives are used to speed up the rate of adoption especially in preventive innovations. The age and level of teaching experience of teachers has been a possible factor in determining teachers acceptance of SMASSE, older teachers in the profession have been keen to find out if the new skills learned are better than the old approaches they had been using teachers in performing schools have also raised issues regarding how better are the new skills over and above the ones they had successfully used in the past. Hence the need to ensure the contents of the SMASSE training is above board to convince the teachers that it is better. The SMASSE project providers should evaluate their courses to know whether the target groups do benefit from the inservice training of the biology teachers(Waruguru 2009)

b. Compatibility

This is the degree to which an innovation is perceived as consistent with the existing values, past experiences and need of potential adopters. An innovation can be compatible or incompatible with socio-cultural values and beliefs, previously introduced ideas or client needs of innovations.

c. Compatibility can be affected by:-

(i) Technology Clusters- This consist of one or more elements of technology that are perceived as being closely related.

(ii) Naming an innovation- The selection of a name of innovation is a delicate and important matter because the potential adopter's perception of the name affects his/her rate of adoption.

(iii) Positioning an innovation – The basic assumption here is that an individual will behave toward a new idea in a manner that is similar to the way he or she behaves towards other ideas that the individual perceives as similar to the new idea.

d. Complexity

This is the degree to which an innovation is perceived as relatively difficult to understand and use.

c. Trialability

This is a degree to which an innovation may be experimented with on a limited basis. New ideas that can be tried on the installment plan will generally be adopted more rapidly than innovations that are not divisible.

e) Observability

This refers to the degree to which the results of an innovation are visible to others. Decision making is the third stage. This occurs when an individual (or other decision

making unit) engages in activities that lead to a choice to adopt or reject an innovation. Four categories of decisions can be deduced i.e. continued adoption, later adoption, discontinuance and continued rejection. This is supposed to be a driving force in making SMASSE more acceptable to the stakeholders. However the continued dismal performance particularly in mathematics makes it difficult for some stakeholders to admire using SMASSE skills just because favourable outcomes have not been felt by many people.

3. Implementation

The third stage is implementation which occurs when an individual (or other decision-making unit) seeks reinforcement for the innovation decision already made, but he/she may reserve this decision if exposed to conflicting messages about the innovation. These conflicting messages are likely to be among the factors influencing adoption of SMASSE skills in mathematics teaching.

4. Confirmation

The forth stage is confirmation where an innovation is declared to be successful or a flop. In summary it takes a lot more to convince one to take up a concept mainly due to the existing challenges which this study seeks to establish.

2.5 The SMASSE Project in Kenya

The government of Kenya recognizes the important role science and mathematics should play in the realization of vision 2030; to become a globally competitive and prosperous country by 2030. This has been reflected in the amount of resources both human and otherwise that are channeled towards enhancing the teaching and learning of science and mathematics at all levels of the education system. At secondary school

level, there have been a number of intervention strategies that the government has put in place to ensure effectiveness in the teaching/learning of these subjects. In addition to strategies such as: providing schools with qualified mathematics and science teachers and improving their remuneration and terms of service; providing schools with science equipment and even constructing laboratories, the government has also institutionalised In-service Education and Training (INSET) of serving science and mathematics teachers under Strengthening of Mathematics and Science in Secondary Education (SMASSE) project and quite a substantial amount of the Ministry of Education's budget goes towards this course (MoE, 2005). SMASSE is a Technical Cooperation initiative between the Governments of Kenya and Japan signed in 1998 for purposes of implementation of the project.

The SMASSE (Strengthening of Mathematics and Science in Secondary Education) initiative in Kenya was in response to students continued poor performance in the mathematics and sciences, despite a number of efforts that had been implemented to address some of the challenges facing the mathematics and science education. These efforts included: providing schools with qualified mathematics and science teachers; improving remuneration and terms of service for the mathematics and science teachers; providing schools with science equipment and even constructing laboratories.

The Ministry of Education considered evolving appropriate pre- and in-service training so as to raise relevance and quality in secondary education (MOEHRD, 1997). Indeed, MOEST (2003) considered developing and operationalising focused in-service programs as one of the indicators for attainment of enhanced quality of

education. The Ministry of Education with technical assistance of Japan International Cooperation Agency (JICA) initiated the SMASSE pilot program in 1998 in 9 out of 72 districts in the country.

2.5.1 Background of SMASSE project in Kenya

SMASSE (Strengthening of Mathematics and Science in Second in Secondary Education) arose from the concern about poor performance of students in Mathematics and Science at K.C.S.E over the years in Kenya. The project is a joint venture between the Government of the Republic of Kenya, represented by the MoEST (Ministry of Education of Education, Science and Technology) and the Government of Japan, represented by JICA. It was started in July 1998 (National Office- SMASSE Project, July, 2001).

Initially, the project covered nine district namely Kisii, Gucha, Kakamega, Butere-Mumias, Lugari, Kajiado, Makueni, Murang'a and Maragua. In October 2000 an extension to the project was made to include six additional districts. Through the In-country Training programme for SMASSE. This made the project to cover seven provinces from the initial five. The added districts were Kiambu, Baringo, Meru South Kilifi, Taita Taveta and Garissa. (National office- SMASSE project, July, 2001).

The core function of the project is to strengthen the teaching and learning of Mathematics and Sciences (Chemistry, Physics and Biology) at secondary level education through in-service training of teachers in the whole country. The aim is to upgrade the capacity of Kenyans in Mathematics and Science. However, creating

better prepared students requires more than just changing the types of problems to which they are exposed. Instructional design must also change to align with the goals and assessment tools (Lamoureux, 2004). This involves, at the least, the following:

1. Incorporating technology to support the implementation of mathematical procedures,

2. Having students articulate their assumptions and judgments through writing,

3. Providing feedback so that students may re-think the problem and revise their work, and

4. Providing classroom activities that support the learning and mimic the authentic problems being used.

A Cascade system is being used to guarantee INSET system institutionalization, human capacity development and project sustainability at all levels (SMASSE, Home Page, 2005).

The INSET is organized at three levels. There are:

1. National: - Senior teachers from the districts are trained to become trainers at the district.
2. District: - The teachers trained at the national level, carry out INSET activities at this level. The training takes place at the SMASSE District INSET centre.
3. Cluster Level: This level targets teachers who are neither trained at the National nor District level. The INSET is to be conducted in leading schools within the reach of teachers and is non-residential. (SMASSE, Home page 2005).

The project became national in the year 2004 where teachers in all other non-pilot districts started training at the national and district levels. However due to logistical problems the cluster level is not yet operational. (SMASSE Home page 2005).

The baseline studies conducted by SMASSE in 1998, established the status of secondary school Mathematics and Science Education. The study isolated the following major areas of concern as causative factors for negative attitude towards Mathematics and science not only in schools but also in the society;

- Pedagogical factors
- Methodology factors
- Subject context factors
- Distribution and utilization of resources
- Development of teaching / learning resource manuals
- Administrative and management factors.

2.5.2 Financing of SMASSE project

SMASSE has three main sources of funds and these are:

(i) JICA:- Whose funds are mainly used on equipment at national and district levels

(ii) Ministry of Education – Provides funds mainly for training materials for insets, accommodation and meals for the national INSET and assistance of District SMASSE account.

(iii) District Head teachers Associations – through District Education Boards, provide funds for the accommodation for trainers and trainees at the District INSET, organizational costs within districts, facilitation

allowances for trainers at District level and the at a later date, repair and maintenance of the provided equipment. (SMASSE Project National Office, 2001).

2.5.3 The Organization of the INSET Programme

The programme is organized into 4 cycles:

Cycle one

Addresses attitude change among teachers, students and members of the society in general.

Cycle two

Deals with hands on activities with emphasis on experiments and practicals.

Cycle three

This is concerned with the actual practice that is, putting what has been learnt into practice.

Cycle four

Deals with students' growth. It is at this point that a need arises to evaluate the effect of the training on the students' performance.

2.5.4 The ASEI – PDSI Practice

The approach towards the solution to the problems arising from pedagogy, inadequate teaching and learning materials is pegged on ASEI approach towards teaching. ASEI stands for Activity which is Student- Centered, Experiment and Improvisation. In other words this is a situation where teaching is learner-centered or student – focused. The students are involved in learning through "hands on", "minds on", "heads on", "eyes-on" and "mouth-on" activities and develop their own knowledge.

PDSI- Stands for Plan, Do, See and Improve. The PDSI, approach encourages teachers to practice the PDSI against the traditional schemes of work and lesson plan. It encourages teachers to evaluate their lesson and be able to redesign their teaching approaches and materials to improve on their teaching (SMASSE project, 2004).

The ASEI movement principles and PSDI approach may be enhanced through:

(i) Team teaching

(ii) Exchange of ideas- symposia

(iii) Science club activities

(iv) Inclusion of practical work in C.A.Ts (Continuous Assessment Test)

(v) Provision of Practical materials by headteachers

(vi) Subject association activities

(vii) School based inspections by head teachers on the quality of practical work conducted by science teachers.

(viii) Science congress activities

(ix) Adequate preparation for practical lessons.

The approach to teaching/ learning requires the teachers to be creative, competent and committed. In order to improve, the teachers should be aware of their environment. They should also be ready to dedicate more of their time and even resources to identify existing resources, plan and study to be able to improve on the previous plan (SMASSE project, 2002). As much as the tenets of ASEI/PDSI appear easily adoptable, study by Ndirangu (2006) in Kajiado District, indicated that ASEI and PDSI tenets had not been fully implemented by the in-serviced Biology teachers involved in this study. This being an indication that there must be specific factors that affect adoption of these approaches by teachers

2.5.5 SMASSE INSET Challenges

According to the stakeholders meeting held at Kenya Science Teachers' College in 2003 (SMASSE Home page, 2005) the following factors were identified as those that may affect INSET attendances.

(i) Poor organization and facilitation.

(ii) Negative attitude by teachers

(iii) After being in the profession for long, some do not see the need for INSET.

(iv) Assumption that school holidays are free for teachers

(v) Opportunity cost elsewhere (such as tuition, parallel degree programmes, training for marking, other workshops and seminars on guidance and counseling HIV-AIDS etc).

(vi) No payment for attending INSET.

They also identified possible reasons for poor attendance as:

(i) Head teachers and heads of departments feel belittled where their junior teachers are facilitating the INSET activities in their districts.

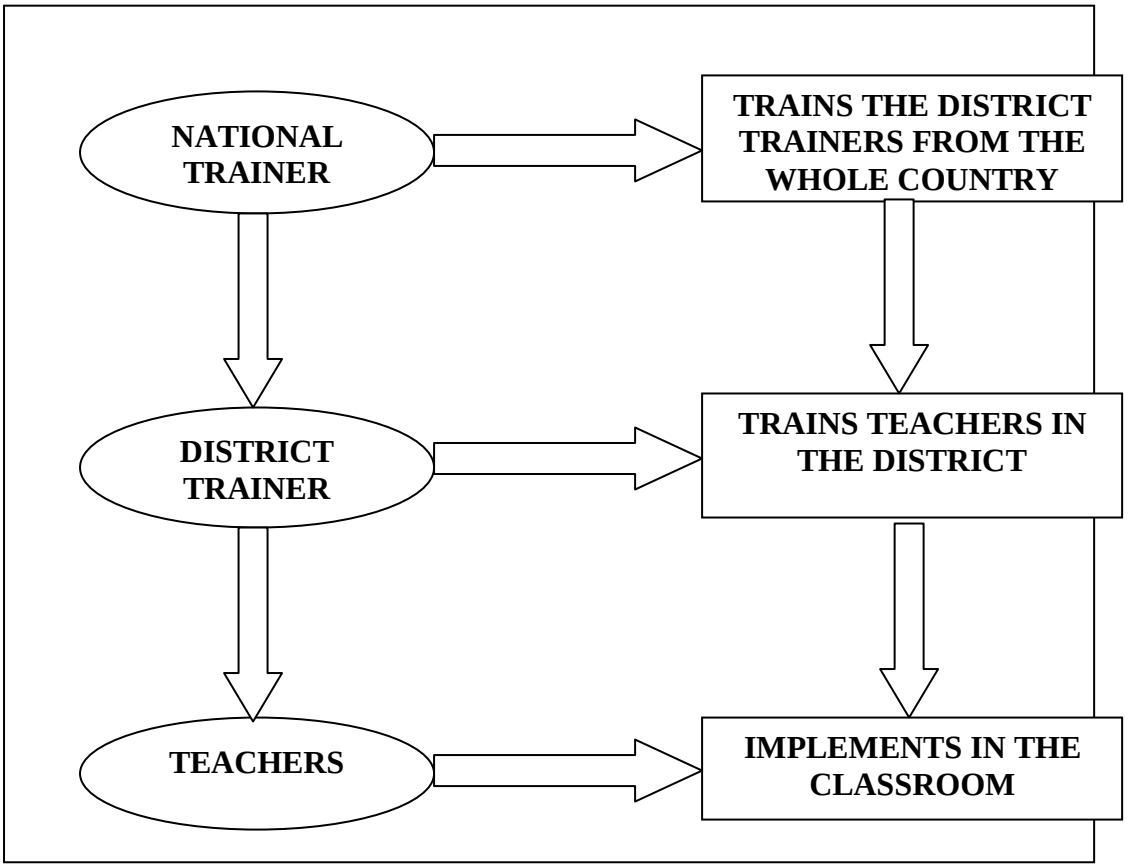
(ii) Fear of TSC (Teachers' Service Commission) to deduct salary in case of non-attendance

(iii) Other holiday commitments

These observations were very much in line with the findings of Wamboi and Nyacomba (2006) who observed that despite the successes attained in SMASSE there were considerable challenges which needed to be addressed for the INSET to achieve its objectives. As already observed, the SMASSE Project is a joint venture between

the Kenya government through MOE, and Government of Japan through JICA initially on pilot basis. SMASSE Project is mainly involved in In-Service Training (INSET) of Serving Teachers in Mathematics and Science in Secondary Schools in Kenya. The System of operation is through the Cascade System (Figure 2.1).

Figure 2.1: Cascade System of Training in Kenya



Source: Noboru and Kim (1998)

The SMASSE project came into being mainly as a result of the consistent poor performance in Mathematics and Science (Biology, Chemistry and Physics), which thus became a matter of serious concern by education stakeholders (Injenga and Norman (2002). Broad curricula, lack of facilities and inadequate staffing were always cited as the major causes of the problem. Although dismal performance in these subjects had almost been accepted as the norm in some schools, the Ministry of Education Science and Technology (MOEST) and other stakeholders felt there had to be an intervention, hence the Strengthening of Mathematics And Science in Secondary Education (SMASSE Home page, 2005)

Injenga and Norman (2002) observe that for evaluation of SMASSE, there is need to establish a system follow-up and monitoring to determine whether the resolutions arrived at in science seminars and workshops are actually being used to improve the situation in the classroom. It is not unusual even today to get a secondary school teacher with no work plan at all, and to see these teachers relying absolutely on what is in the textbooks for their teaching, even though they have undergone the SMASSE training. However it is also possible to get teachers who have improved on their work planning as to play ASEI and PDSI approaches in their teaching. It is on this note that the current study seeks to establish the factors which influence the adoption of SMASSE skills which emphasize on child-centred 'hands on' and 'minds on' activities in the teaching and learning process.

The SMASSE project has been in Kenya since the year 1998. To date, all districts have done the 4 cycles and have embarked on mop up programmes to train those teachers who missed out during the normal training. The programme has also moved in to involve primary school and it has already started with the teachers training colleges, where by the tutors have been trained, so they are expected to train the trainees to apply those skills at primary school level in addition sensitization workshops for SMASSE have been done involving primary school H/Ts, QASOS and other education officials.. The abbreviations for the project have now changed to SMASE, meaning strengthening of mathematics and science education. Several studies have shown that the programme has been beneficial to schools. A study by SMASSE revealed positive results for SMASSE in terms of improvement of communication skills, process skills and effective aspects by teachers. SMASSE terminal evaluation document also indicate similar successes (Kunio, 2002).

Through the SMASSE project, teachers have shown improvement in the relevant skills, knowledge and attitudes; the learners have also appreciated being taught the SMASSE way (Nancy Wamboi Noi and Alice Nyacomba Wahome-2002). The net impact on teachers have revealed that teachers; Plan better and more consistently, attend students needs more, teachers are more open to team work, teachers are more confident to carry out practical work, teachers are ready to try out new methods, better face the challenges of lack of resources and better face the challenges of large class sizes. Despite the successes registered, the project has faced several challenges which include: some teachers have not appreciated the role of INSET in their individual continuous professional development; few field officers and principals have not been supportive enough; lack of effective incentives beyond getting students to do well in their studies; conflict of interests; SMASSE being only for mathematics and science teachers and being conducted during the holiday when other teachers are attending their personal interests; non-collection and/or non-remittance of SMASSE funds to DPC due to poverty level which diminishes DEB capability in managing the INSET; high staff turnover and transfer of trainers to non-curriculum implementing posts; interferences in recruitment process of INSET trainers; different educational levels among participants, limited opportunities for further training for trainers and harmonization and collaboration of QASO and SMASSE Monitoring and Evaluation activities/duties (SMASSE Project,2008).

Since the inception of the project in Kenya in 1998, a lot of research had been going on alongside the implementation process. After the baseline study which was conducted in1998, to establish the needs in the areas of teaching mathematics and science in secondary school. The project was implemented and was to run up to the

year 2003 for the 9 in-country districts (Njuguna, 1999). Then the out-country districts joined in the year 2004, from that time a lot of research had been conducted to study the following areas mainly: NET impact on teachers, NET impact on students, Reforms expected, Efficiency of the programme, Effectiveness of the programme, Relevance of the programme, and Sustainability.

2.5.6 SMASSE Skills for Teaching Mathematics

SMASSE project puts more emphasis on student-centered learning. Student-centered learning is a pedagogical paradigm shift that is currently attracting immense attention. The definition of student-centered learning appears to differ among authors as some equate it with active learning, while others take a more comprehensive interpretation including: active learning, choice in learning, and the shift of power in the teacher-student relationship (O'Neill & McMahon, 2005). Suffice it to say, in student-centered approach to learning, teachers move from the center position to the side, from dispensers of knowledge they become advisors and facilitators of learning. Student-centered learning does not necessarily imply a particular methodology of teaching just like constructivism and inquiry learning, from which it borrows or relates heavily (O'Neill & McMahon, 2005). Nevertheless, certain methodologies may be better suited than others for student-centered classrooms. Nonetheless, the definition by Cannon and Newble (2000) will be adopted as the working definition for this research. They define student-centered learning as: ways of thinking about teaching and learning that emphasize student responsibility and activity in learning rather than content or what the teachers are doing. Essentially student-centred learning has student responsibility and activity at its heart, in contrast to a strong emphasis on teacher control and coverage of academic content found in much conventional,

didactic teaching. Student-centred learning (also called child-centred learning) is an approach to education focusing on the needs of the students, rather than those of others involved in the education process, such as teachers and administrators. This approach has many implications for the design of curriculum, course content, and interactivity of courses. For instance, a student-centred course may address the needs of a particular student audience to learn how to solve some job-related problems using some aspects of mathematics. In contrast, a course focused on learning mathematics might choose areas of mathematics to cover and methods of teaching which would be considered irrelevant by the student. Student-centred learning, that is, putting students first, is in stark contrast to existing establishment/teacher-centred lecturing and careerism. Student-centred learning is focused on the student's needs, abilities, interests, and learning styles with the teacher as a facilitator of learning. This classroom teaching method acknowledges student voice as central to the learning experience for every learner. Teacher-centred learning has the teacher at its centre in an active role and students in a passive, receptive role. Student-centred learning requires students to be active, responsible participants in their own learning (Pedersen, Susan & Liu, Min., 2003).

The literature on student-centered learning abounds with the features which the various authors and researchers propose as distinguishing marks of student-centered learning from teacher centered learning (Cannon & Newble, 2000; Geelan, 2000; Lea, Stephenson, & Troy, 2003; O'Neill & McMahon, 2005; Rutto, 2005; Serbessa, 2005). These characteristics are crystallized as follows: Active rather than passive learning (the student doing more than the teacher).Involvement and participation are necessary for learning; Emphasis on deep learning and understanding of concepts; The teacher valuing and supporting (indirect) verbal and non-verbal interactions; The teacher

utilizing students' prior knowledge and experiences; Organizing learning around learning communities (for example groups, peers) and the teacher becomes a facilitator and resource person.

The second SMASSE skill for learning mathematics is by use of climbing learning method as stated by Wambui (2002) who asserted that many African countries envision being industrialized by the year 2020 and Kenya has set its target of industriliazation by the year 2030. However, looking at the performance of mathematics and science subjects at secondary education level in Kenya, the vision to be industrialised is in doubt because the performance by the students in these subjects has been very poor. Improving the performance of Mathematics and Science education is a great societal need in Kenya not only for industrialization of the country but also for producing scientifically empowered citizens.

Research by one of the key stakeholders in secondary education in Kenya, the Strengthening of Mathematics and Science in Secondary Education (SMASSE) project in 1998 has shown that consistent failure and negative attitude by students, towards Mathematics, continues to characterize the classroom. Based on this same research, teachers have been found to present lessons that are too much teacher-centred with the teacher as the main actor and sometimes the only actor in the classroom as students remain passive recipients. Mathematics Lessons have been found to be difficult, boring and lacking in effective teaching/learning materials Wambui (2002). This is the practice also widely employed in Africa. The challenge thus has been how to make Mathematics more "alive", more "real" and more "accessible. It is, therefore, strongly felt that students' involvement during lessons must be enhanced to increase motivation, effective teaching/learning materials used

and lessons should be made more interesting. The author therefore realised that a student-centred lesson should be enhanced from two complimentary elements; (i) placing more responsibility in the hands of students, and (ii) requiring the teacher to serve as a mentor and facilitator in presenting knowledge especially to students and fellow teachers in the teaching /learning process.

This is with the understanding that increased use of senses enhances understanding and promotes retention by learners. With the use of activities, mathematics is made more real, and this arouses students' interest and curiosity as they relate mathematics to their real life experiences. The use of hands-on and minds-on activities during the teaching/learning process as applied in the research is yet another paradigm shift from theoretical, chalk and talk, talk and talk and Knowledge/ Content Based approach to Activity focused Teaching/Learning. The Kenyan Traditional Method of Teaching Mathematics implies instruction, practice and evaluation as the simple pattern of activities in the classroom.

Therefore the Climbing Learning Method is highly effective for raising Cognitive ability than 'Traditional' Method of teaching and learning mathematics in Kenya. With a proper understanding in these two categories improves the computational skills as reflected in the results. Therefore Climbing Learning Method proved to be more effective in developing this ability than the 'Traditional' method of learning in Kenya and especially for the Low Ability students. From the results of the test given, it was found that Climbing Learning Method can be useful for effective mathematical communication, use of mathematical language and elimination and remedy of misconceptions.

Since the results of Wamboi's study show a great improvement in students' Cognition and Attitude towards mathematics with the Climbing Learning Method she recommends that Kenyan teachers implement this method in the classroom as an alternative teaching method that will assist learners in; Achieving higher cognition, Instilling the right attitudes to students thus having an increased student interest, confidence and enthusiasm towards learning mathematics.

The research by Wamboi concentrated on the impact of SMASSE on teachers and students, which did bring out important trends that had started developing by then. However this study did not look at the area of adoption of the learned skills by the teachers. This according to my study would create a missing link that was omitted. This could easily make the project to fail, even if the training of the teachers succeeds.

The success of SMASSE as a technical project was evaluated under five important headings i.e. relevance, effectiveness, efficiency, impact and sustainability. This was done for both the pilot programme (1998-2003) and the National Phase (2003-2008). The findings were as follows (JICA, 2007).

- Relevance: The project was rated quite high, it was found to relate well with policies of the recipients and the co-operating partners.
- Effectiveness: Thus it was rated fairly high; due to the challenges that existed then which include the factors being sort in this study.
- Efficiency: The project was rated high; particularly when relating inputs to outputs. This may not have been true in the area of mathematics taking into account that its performance at KCSE has been quite dismal. The performance in mathematics has since the year 2002 not gone beyond a mean

of 40% (Waititu and Oredo, 2008) in the last two years the mean was only 20%. In mathematics a lot of input is still being pumped into our systems but we have been getting quite a low output.

- Impact: the project was rated fairly because quality of teaching and learning had not attained as revealed by the KCSE results in areas of science and mathematics (Waititu, 2008). This is quite a clear example to show that there are still issues to be addressed as regards this project. It could be found out also if these skills are being practiced by the teachers of science and mathematics or not.

The lesson observations and interviews conducted by SMASSE team doing monitoring and evaluation has revealed an improvement in terms of teachers and students attitude towards SMASSE from their report (SMASSE Project Monitoring and Evaluation Progress Report, 2007). There were quite a number of teacher activities that had changed for the better, where teachers were seen to have adopted SMASSE skills in their teaching. This report also revealed that teachers who were not SMASSE trained did not apply SMASSE skills in their teaching, though it had always been preferred upon the trained ones to share with the rest back at school. The SMASSE trained teachers though they applied SMASSE skills in their teaching but to a very low level. This still indicating that there must be some factors which determine whether one has to apply the SMASSE skills or not. However, this study only stopped at the level of adoption among SMASSE trained teachers, hence forms a good baseline for the current study which seeks to determine the factors influencing adoption of SMASSE skills. As (J. Wabwile 2009) says in this paper presented to Kenya Institute of Education national conference May 2010: SMASSE goals will only

be achieved if concerns raised about class sizes, teachers' workload and equipments are addressed. The planning for this training did not include all stakeholders hence making it hard for certain key players such as the teachers to own the programme. Further more when SMASSE first came into the public limelight more around the year 2004, it appeared like teachers were being forced to attend the INSET. Hence making some teachers to have low opinion about the programme. There is need for SMASSE project providers to evaluate the SMASSE curriculum to establish whether they are user friendly or not (Caroline Ndirangu, 2008). It could be that the curriculum put in place is not interesting or challenging enough to captivate the interest of the teachers trained. Hence this could be probably a factor to influence adoption of SMASSE skills by teachers.

2.6 Summary of the Chapter

This chapter has presented literature related to the current study. It has covered aspects on the rationale for SMASSE project and the historical development of the project since inception. Literature on the achievements of the project has also been covered under this chapter. However it should be noted that no study has been done to look at the factors that influence the adoption of the skills learnt during SMASSE INSETs by the teachers, especially mathematics teachers. This is the gap that this current study sought to bridge. The next chapter presents the research design and methodology used in this study.

CHAPTER THREE

3.0 RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

This chapter covers the methodology and procedures that were followed when carrying out the study. The purpose of this section is to provide a description of the research area, the study population, sample size and sampling techniques, data sources and instruments, data collection procedures, analysis and presentation. Each of the sub-headings mentioned above is separately discussed below.

3.2 Research Design

Descriptive Survey research design was used in this study. Orodho, (2005) says that the design gathers data at a particular point in time with the intention of describing the nature of the existing conditions, identifying the standards against which existing conditions can be compared and determining the relationship that exists between specific events. This is because the study aimed at bringing out the status with regard to adoption of SMASSE skills which provided an opportunity for assessment of the factors that determine adoption of the learned teaching skills in mathematics.

3.3 Study Area

This study was conducted in the Eldoret East District of Rift Valley Province, Kenya. The district headquarters is in Eldoret town as shown on the map, appendix 4. All the secondary schools in the district were considered for this study. The district borders Eldoret West district to the West, Wareng District to the south, Keiyo district to the

East and Marakwet as well as Trans nzoia East Districts to the North. The study area was selected because the researcher had earlier worked in this area and had informally gathered information on teachers' attitude towards SMASSE, the researcher had also been party to SMASSE impact assessment in this area in year 2006, hence developing an interest in the subject and in this particular area as regards to the adoption of SMASSE skills in the teaching and learning of Mathematics.(refer appendix 5). The researcher ensured there was no bias by strictly observing ethical issues as regards research. This involved being focused and fair to ensure credible results were arrived at.

3.4 Target population

The study population involved a total of 40 secondary schools among which there are private, national, provincial and district schools. The research involved all teachers of mathematics and principals of secondary schools in the district.

3.5 Sample Frame and Sampling Procedure

A sample must always be large enough to represent the salient characteristics of the accessible population (Olive Mugenda and Abel Mugenda1999). In this study, 83 serving Mathematics SMASSE trained teachers in the district were selected for participation in this study. This was purposely done since the teachers had undergone the training and therefore better placed to provide the required information. All the secondary schools in the district were selected for this study. The 40 headteachers from the district were automatically included in the study, since they are the officers in charge of overseeing the adoption of the SMASSE skills at the school level. The

larger the sample the more likely are its mean and standard deviation to be representative of the mean and standard deviation of the target population (Paul A. Ogula 2004).Where time and resources allow, a researcher should take as big a sample as possible to be confident that the salient features of the target population are included(A .Mugenda and O. Mugenda 1999)

Table 3.1: Study Sample

The researcher sampled all the secondary schools in the district .The total number of schools in district were 40, and were in the categories shown below. All the head teachers of the schools were included in the sample. All the mathematics SMASSE trained teachers in the schools were included in the sample.

Category	**Number of head teachers sampled**	**Number of teachers sampled**
National	1	4
Provincial	7	21
District	26	52
Private	6	6
Total	**40**	**83**

3.6 Research Instruments

In this study, primary and secondary data was used. The primary data was obtained from secondary school teachers who teach mathematics and are SMASSE trained as

well as school principals. The secondary data was obtained from the district education office in Eldoret East District. The data collection instruments used were questionnaire, interview Schedule and document analysis.

3 .6.1 The Questionnaire

One set of the questionnaire developed by the researcher was administered to the Mathematics SMASSE trained teachers in the district. The questionnaire contained both structured and semi-structured questions so as to allow the respondents to give their own views. The advantage of the questionnaire is that it generates a considerable amount of questionnaire data and enables the researcher to obtain a wider coverage of description data at a comparatively low cost in terms of time, money and effort. Since it is a standard research instruments it allows for uniformity in the manner in which questions are asked and makes comparisons possible across respondents (Cohen & Manion, 2003).

3.6.2 Interview Method

The study also employed the use of interviews as a method of collecting data. This method was specifically used for collecting information on the mathematics teachers' adoption levels of SMASSE skills. Structured and semi-structured interview questions were designed for this exercise and administered to the headteachers of the schools under study. The reason for use of interviews was that they were easy to administer since the questions were prepared in advance. They also allow a great deal of information to be gathered in a short period of time. Interviews also eliminate many sources of bias common to other instruments like observations. In addition, interviews

help seek clarification through probing (O. Mugenda and A. Mugenda 1999) The questions that were asked were confidential between the researcher and the respondent. Interviews are also used to collect information that cannot be directly observed or are difficult to put down in writing such us attitudes, feelings etc.(Willis Oso and David Onen 2005). When conducting research of descriptive type involving survey then one can obtain primary data through either observation or direct communication with respondents through personal interviews (C.R. Kothari 2004).

3.6.3 Document Analysis

This is critical examination of records containing information on the problem under study. Records regarding the implementation of the SMASSE project were accessed from the headteachers' and the DEO's offices. These documents were subjected to a thorough analysis and conclusions deduced and compared with the primary data. Document analysis enabled the researcher to review the trends in the teaching of mathematics since the inception of the SMASSE project. The researcher also used this method so as to critically examine recorded information that were related to the issue under investigation, which also enabled the researcher to obtain the language and words of the respondents. This way, the researcher obtained data that were thoughtful since the respondents gave attention to compiling them.

3.7 Reliability and Validity of the Research Instruments

3.7.1 Reliability

Reliability of a data collection instrument is a measure of its consistency to produce similar results each time it is used under the same conditions. A measure is considered

reliable if a research's finding on the same test given twice is similar. Reliability ensures that there is precision with which data is collected. If the same results are gained time after time, no matter how many times you conduct a piece of research, this suggests that the data collected is reliable (Cohen & Manion, 2003).

To test reliability of the questionnaire used in this study, Pearson's Product moment correlation was used in which the tools were administered to respondents similar to the study sample in the neighbouring Eldoret West District. This was repeated after a period of two weeks. From the responses obtained, a Pearson Product Moment formula was used to calculate the coefficient of correlation and a correlation coefficient of 0.6 was obtained implying that the research instruments were reliable. In this study a minimum correlation of 0.5 was taken as a good measure of reliability.

3.7.2 Validity

Validity is the degree to which results obtained from analysis of the data actually represents the phenomenon under study (Orodho, 2005). It is the accuracy and meaningfulness of inferences, which are based on research results. Poor validity reduces ability to characterize relationships between variables of data in a research. In this study, the researcher consulted his supervisors as well as his colleagues. The experts' advice, in the field of Educational administration, School of Education, Moi University was also sought. Their comments were incorporated and hence improved the validity of the instrument. This ensured that the data submitted for analysis was legitimate.

3.8 Data Collection Procedures

Before collecting data, the researcher sent a letter to the sampled schools requesting to be allowed to collect data from the schools. This letter had a copy of the permit obtained from the Ministry of Higher Education, Science and Technology. The same documents were also sent to the Eldoret East District Education officer. This was done two weeks before the actual date of data collection so as to enable the respondents to prepare for the study.

During the day of the data collection, the researcher went to the schools and sought permission from the head teacher to carry out the study. After permission was granted, the researcher proceeded to the respondents to whom he also explained the purpose of the visit. The respondents were assured of the confidentiality of any information they gave.

The researcher then administered the questionnaire to the teachers and the interview guide to the head teachers. Filling of the questionnaire was done in the presence of the researcher so that the researcher gave clarification on questions or items in the questionnaire that were not clear. However, in some cases they were not filled immediately, and then the researcher allowed respondents time to fill them and then he collects them later.

3.9 Data Analysis Techniques

The data collected was organized, presented, analyzed and interpreted using descriptive and inferential statistics. Descriptive statistics that were used included

frequencies, percentages, tables, means and charts. The inferential statistics chi-square (x^2) was used to test and verify on the relationship between the variables under study.

3.10 Ethical considerations

The respondents were assured that the responses they gave were to be used in complete confidentiality and for the purpose of the research study only. The researcher also took individual responsibility for the conduct and consequences of the research by adhering to the time schedule as agreed upon with the officers and school administration. The researcher was open and honest when dealing with other researchers and respondents. The respondents were also assured of getting the feedback from the research if they needed it after the study. This was aimed at securing co-operation from them.

3.11 Summary of Chapter

In this chapter research design for the current study, the study area, the target population, the sampling frame, the data collection instruments, data analysis techniques and ethical considerations have been discussed in relation to the current study.

CHAPTER FOUR

4.0 DATA PRESENTATION ANALYSIS, INTERPRETATION AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter provides information on data analysis, data presentation, data interpretation as well as discussion of results. The chapter presents descriptive statistics on background information of the respondents and inferential statistics in testing the hypotheses in this study. The above activities were guided by research objectives which were:

i. To assess the level of mathematics teachers appreciation of the role of the SMASSE INSET in continuing professional development in Eldoret East district.
ii. To establish the student-factors that influences the adoption of SMASSE skills by mathematics teachers in Eldoret East district.
iii. To establish the teacher-factors that influences the adoption of SMASSE skills by mathematics teachers in Eldoret East district.
iv. To determine the role played by the principal in influencing the adoption of SMASSE skills by mathematics teachers in Eldoret East district

4.2 Analysis of Background Information of the Respondents

This variable was important since it enabled the researcher to establish the background of the respondents in terms of age, educational level and teaching experience. The responses on each of the mentioned aspects are presented in the following sub-sections:-

4.2.1 Responses on Age Bracket of the Respondents

This variable captures the age bracket of the teachers who participated in this study. Their responses are shown in Table 4.1

Table 4.1: Age of the Respondents

	n=83		n=37		
Age	**Teachers**		**Headteachers**		
	Frequency	**Percentage**	**Age**	**Frequency**	**Percentage**
21-25	4	4.8	25- 30	2	6
26-30	10	12.0	31- 35	7	19
31-35	51	61.4	35- 40	12	32
Above35	18	21.8	Above 40	16	43
Total	**83**	**100**	**Total**	**37**	**100**

It is indicated that majority (51) 61.4% of the teachers were aged between 31 and 35 years while, (18) 21.7% were above 35 years old. Another (10)12% and (4)4.8% were aged between 26 – 30 and 21 – 25 years respectively. This therefore implies that majority (79)96.2% were above 26 years old. This was expected since for one to qualify to teach in a secondary school one must have a minimum of diploma in education. For one to attain this, he/she must have spent more than 22years in schooling. This would be the reason as to why majority of the teachers who participated in this study were aged 26 and above years.

As for the head teachers, Table 4.1 indicates that majority (16)43% of the head teachers were above 40 years old where as (12)32% were aged between 35 – 40 years. It was also revealed that (7) 19% and (2) 6% of the head teachers were aged between

30 -35 years and 25 – 30 years respectively. It should be noted that there were no head teachers who were below 25years old. Among the teachers it was evident that majority of the teachers were within the ages of between 30 and 35, this was a fairly youthful group ready to learn and are not scared of technology hence quit an advantage to the development of SMASSE. The same reason applies to the headteachers majority of which were at the ages of around 40 years old.

4.2.2 Responses on Highest Education Level of the Respondents

The study sought to establish the educational level of the teachers and head teachers who participated in this study and their responses are shown in Table 4.2.

Table 4.2: Highest Educational Level of Teachers

	n=83		n=37	
Educational level	**Teachers**		**Head teachers**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Diploma in education	5	6.0	0	0
Degree in education (BED)	68	81.9	3	8
Post graduate Diploma in education	7	8.4	28	76
Masters	3	3.7	6	16
Total	**83**	**100**	**37**	**100**

It is instructive to note that (68)81.9% of the teachers were degree holders whereas (7) 8.4% and(5) 6% were PGDE and Dip. Ed holders, respectively. It is worth noting that only (3)3.6% of the teachers were holders of master's degree. Therefore, a majority of the secondary schools and thus had acquired the required pedagogical skills to enable them deliver quality services.

Table 4.2 further reveals that (28)76% of the Head teachers who participated in this study were bachelor of education degree holders while (6)16% had a master's degree. It is worth noting that (3)8% of the head teachers were diploma in education holders.

4.2.3 Responses on teaching Experience of the Respondents

It was believed that teaching experience had an effect on the adoption of SMASSE skills in the teaching and learning of mathematics in secondary schools. Therefore, the study sought to determine the teaching experiences of the teachers and headteachers who participated in this study. Table 4.3 gives a summary of the responses on this item.

Table 4.3: Teaching Experience

	n=83		n=37	
Experience in years	**Teachers**		**Headteachers**	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Less than 1	1	1.2	0	0
1 – 5	16	19.3	1	3
5 – 8	23	27.7	6	16
Above 10	43	51.8	30	81
Total	**83**	**100**	**37**	**100**

Table 4.3 indicates that (43) 51.8% of the teachers had teaching experiences of more than 10 years and (23) 27.7% had a teaching experience of 5 – 8 years. Further, (16)19.3% had a teaching experience of 1 – 5years whereas only (1) 1.2% had taught for less than 1 year. This implies that majority of the teachers had taught for over 5 years in secondary schools thus they had enough teaching experience.

During the interview between the researcher and Head teachers, the head teachers were required to state their teaching experience in years and as indicated in Table 4.3 majority (30)81% of the head teachers had a teaching experience of over 10 years while (6)16% had taught for a period of 5- 8 years. Only (1) 3% had taught for a period of between 1 -5 years. These results were expected since experience is one of the factors considered by TSC for one to get a promotion to school headship position. This might have been the reason as to why the number of head teachers above 10 years experience was high (81%). This implies that they had the required experience for that position and therefore able to give valuable information concerning the topic under study.

4.3 Analysis of Teachers' and Head teachers' Responses on Level of Adoption of SMASSE Skills

The first objective of this study was to assess the level of mathematics teachers' appreciation of the role of SMASSE INSET in continuing professional development. The research instruments therefore required the teachers to state the extent to which they apply SMASSE skills in teaching mathematics. The SMASSE skills that the teachers were expected to apply were: application of relevant practical mathematical activities in every mathematics lesson they taught, the use of ASEI lesson plans in mathematics and improvisation in mathematics lessons. Improvisation refers to making use of the locally available resources to serve as teaching aids when teaching particular concepts to the learners. Table 4.4 presents a summary of the teachers' responses on this variable.

Table 4.4: Level of Adoption of SMASSE Skills

n=83

Level	100%		75%		50%		25%		0%		Total	
	F	%	F	%	F	%	F	%	F	%	F	%
Percentage of mathematics lessons in which practical SMASSE skills were applied	4	4.8	29	34.5	40	48.2	10	12.0	0	0	83	100
Percentage of mathematics lesson you make use of ASEI lesson plans	1	1.2	21	25.3	22	26.5	33	39.8	6	7.2	83	100
What extent do you apply improvisation in your mathematics lessons	7	8.4	35	42.2	23	27.7	18	21.7	0	0	83	100

Key: F-frequency, %- percentage

As shown in Table 4.4 ;(40) 48.2% of the teachers stated that they apply relevant practical mathematical activities in 50% of their mathematics lessons and (29)34.9% apply relevant practical mathematical activities in 75% of their mathematics lessons. Table 4.4 further indicates that (10) 12% and (4)4.8% apply relevant practical Mathematical activities in 25% and 100% of their mathematics lessons respectively.

This implies that (73) 88% of the teachers apply relevant practical mathematical activities in over 50% of their mathematics lessons.

Further, (33)39.8% of the teachers asserted that they made use of ASEI lesson plans in 25% of mathematics lessons they taught for the last one year. Another (22)26.5%

and (21)25.3% had used ASEI lesson plans in 50% and 75%, respectively, of mathematics lessons they had taught for the past one year. It should be noted that only (1) 1.2% used ASEI lesson plans in all (100%) of mathematics lessons taught. However, there were (6)7.2% of the teachers who had not used any ASEI lesson plans in teaching Mathematics lessons. The result implies that (44)53% of the teachers use ASEI lesson plans in over 50% of mathematics lessons taught. Table 4.4 also indicates that majority (65)78.3% of the teachers apply improvisation in over 50% of mathematics lessons they taught. But (18)21.7% apply improvisation in only 25% of mathematics lessons taught.

An interview administered to head teachers required them to state the school-related factors that influence the adoption of SMASSE skills and their responses were as shown in Table 4.5.

Table 4.5: Factors Influencing the Adoption of SMASSE skills

n=37

Factors	**Frequency**	**Percentage**
Availability of support materials	35	95
Student- teacher ratio	28	76
Size of classroom	30	81

From Table 4.5 it can be revealed that (35) 95% of the Head teachers said that availability of support materials influence the adoption of SMASSE skills by mathematics teachers. It is also shown that (28)76% mentioned student teacher ratio as a factor influencing the adoption of SMASSE skills. This implies that availability of support materials, student teacher ratio and classroom size influences the adoption of SMASSE skills by teachers of mathematics.

4.4 Analysis of Teachers' Responses on their perception towards the role of SMASSE skills in teaching mathematics lesson

Teachers' responses on the role of SMASSE skills in teaching mathematics lesson is as shown in Table 4.6

Table 4.6: Role of SMASSE skills in teaching mathematics lesson

n=83

Statement	SA		A		N		D		SD		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
The SMASSE training is greatly relevant	67	80.7	9	10.8	4	4.8	3	3.6	0	0	83	100
The SMASSE has improved my teaching	51	61.4	21	25.3	7	8.4	4	4.8	0	0	83	100
The performance of students has improved	13	15.7	24	28.9	33	39.8	13	15.7	0	0	83	100
There are challenges to adoption of SMASSE skills	22	26.5	37	44.5	12	14.5	5	6.0	7	8.4	83	100

Key: f-frequency, %- percentage, SA-strongly agree, A- agree, N-neutral, D-disagree, SD-strongly disagree.

It is revealed in Table 4.6 that (76) 91.6% of the teachers who were included in this study agreed that SMASSE training was relevant to the subject they teach (mathematics) whereas (3)3.6% disagreed. There were (4)4.8% who were neutral. It is also shown that (72)86.7% of the teachers agreed that the SMASSE training had improved their teaching methodology while (4) 4.8% disagreed. The rest were non-committal on this item. Further, (37)44.6 % stated that the performance of students

had improved since they started using the SMASSE skills, but (13)15.7% disagreed and the remaining (33)39.8% were neutral.

It should be noted that (59)71.1% of teachers who participated in this study agreed that there are challenges to adoption of SMASSE skills in Mathematics. Only (12)14.4% disagreed and the rest (12)14.5% did not give their comment on this item. This means in general that majority of teachers agreed that SMASSE training was relevant to teaching and learning mathematics and also improved teaching methodology, improved student performance and was faced with challenges. This agrees with a study that was done by Injenga and Norman (2002). The study established that broad curricula, lack of facilities and inadequate staffing were always cited as the major causes of the poor performance in Mathematics and Science (Biology, Chemistry and Physics).

The researcher used an inferential statistic (chi-square) to show whether there existed a relationship between the levels of mathematics teachers' appreciation of the role of the SMASSE INSET in continuing professional development and the adoption of SMASSE skills in the teaching of mathematics subject. The first hypothesis as stated in chapter one was:

HO_1: There is no significant relationship between the levels of mathematics teachers' appreciation of the role of the SMASSE INSET in continuing professional development and the adoption of SMASSE skills in the teaching of mathematics subject.

The rejection level was set at 0.05. The null hypothesis is rejected if the p-value or sig is less than or equal to 0.05 and if more than 0.05, then we fail to reject the null hypothesis. After testing the above hypothesis the results were as follows:

Table 4.7: Chi-Square Results

	Value	**df**	**Asymp. Sig (2- sided)**
Pearson Chi-Square	18.126(a)	6	.006
Likelihood Ratio	19.266	6	.004
Linear- by- linear Association	2.467	1	0116
N of valid cases	83		

This hypothesis was tested at p=5; and $\chi 2 = 18.126$ df=6 and sig = 0.006. This implies that $p<0.05$. Therefore we reject the null hypothesis. This implies that there was a significant relationship between the levels of mathematics teachers' appreciation of the role of the SMASSE INSET in continuing professional development and the adoption of SMASSE skills in the teaching of mathematics subject.

4.5 Analysis of Teachers' Responses on The role of SMASSE Training in the teaching/learning of Mathematics

It was of great value to this study to assess the value attached by teachers to SMASSE Training. The results are tabulated in Table 4.8

Table 4.8: Value Attached

n=83

Experience	**Frequency**	**Percentage**
Improved attitude towards Mathematics	68	82
Improved students interaction	54	65
Improves mastery of content	43	52
In service course to teachers and improves their skills	51	69
It is good because it uses locally available resources	34	41
It is more student centered	73	88
Only good for equipped schools- otherwise waste of time	22	27
Total	**83**	**100**

It is instructive to note that there were multiple responses for each statement and that (73)88% of the teachers stated that SMASSE training emphasize more of students centered teaching than any other teaching method. There, were (68)82% who said that the training has improved attitude towards mathematics whereas (43)69 % acknowledged that SMASSE training is an in-service course to teachers and therefore it enables the teachers to improve their teaching skills. Further, (54)65% and (43)52 % stated that SMASSE has improved students interactions and mastery of content respectively. It is also shown that (34)41% stated that SMASSE training was good because it makes use of locally available resources. However, (22) 27% stated that SMASSE skills were only good for equipped schools; otherwise it was a waste of time if applied in schools which are not well equipped.

4.6 Analysis of Teachers' and Headteachers' Responses on Teacher Factors

When responding to the item that was asked about the teacher factors that influence the adoption of SMASSE skills by mathematics teachers in secondary schools, the responses were as shown in Table 4.9.

Table 4.9: Analysis of teachers' responses on Teacher Factors

n=83

Statement	SA		A		N		D		SD		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
Teaching experience of the teacher	30	36.1	30	36.1	20	24.1	0	0	3	3.6	83	100
Duration of the teaching	17	20.5	32	38.6	24	28.9	4	4.8	6	7.2	83	100
The age of the teacher	22	26.5	19	22.9	20	24.1	8	9.6	14	16.9	83	100
Teaching methods	30	36.1	49	59.0	0	0	4	4.8	0	0	83	100
The training system	13	15.7	41	49.4	19	22.9	4	4.8	6	7.2	83	100
Mastery of content	55	66.3	17	20.5	1	1.2	4	4.8	6	7.2	83	100
Teachers attitude towards the inset	44	53.0	32	38.6	7	8.4	0	0	0	0	83	100
Teachers workload	39	47.0	36	43.4	4	4.8	4	4.8	0	0	83	100
Teachers self motivation	42	50.6	35	42.2	6	7.2	0	0	0	0	83	100
Teacher capacity to improvise	19	22.9	50	60.2	14	16.9	0	0	0	0	83	100
Prospects for promotion	27	32.5	29	34.9	15	18.1	12	14.5	0	0	83	100

Key: f-frequency, %- percentage, SA-strongly agree, A- agree, N-neutral, D-disagree, SD-strongly disagree.

As shown in Table 4.9; (60)72.3% of the teachers who participated in this study agreed that teaching experience of a teacher is a factor that determines the adoption of SMASSE skills. Only (3)3.6% disagreed whereas (20)24.1% were neutral.

It is also indicated that (49)59% of the teachers stated that duration of training influences the adoption of SMASSE skills in the teaching and learning of Mathematics. It is worth noting that (4) 4.8% disagreed and (24)28.9% were neutral. This implies that the duration of training influences the adoption of SMASSE Skills. Further (41)49.4% of teachers agreed that age of teacher determines the adoption of SMASSE skills while 26.5% disagreed. Also (79)95.2% of the teachers who responded to this item stated that the teaching methods used influences the adoption of SMASSE skills, but (4)4.8% disagreed. Similarly, (54) 65.1% of teachers agreed that training system determines the adoption of SMASSE skills, whereas (10)12% disagreed.

Table 4.9 further reveals that (72)86.7% of the teachers included in this study agreed that mastery of content determines the adoption of SMASSE skills. Another (10)12% disagreed whereas (1)1.2% were neutral. The other teacher related factor influencing the adoption of SMASSE skills as stated by (76) 91.6% of the teachers was the teachers' attitude towards the inset. This implies that if the teachers have a negative attitude towards SMASSE Inset, then the adoption of SMASSE skills.

It is also shown in Table 4.9 that (75) 90.4% of the teachers mentioned teachers' workload as another teacher factor that influences the adoption of SMASSE skills. However (4)4.8% of the teachers' disagreed and (4)4.8% of the teachers' disagreed

and (4)4.8% of the teachers remained neutral. A majority (77)92.8% asserted that teachers' self motivation determines the adoption of SMASSE skills whereas (6)7.2% of the teachers did not state their views on this aspect. Another teacher factor influencing the adoption of SMASSE skills is the teachers' capacity to improvise. This was stated as a factor by (69)83.1% of the teachers while the remaining (14)16.9% were neutral. Table 4.8 also shows that (56) 67.5% of the teachers agreed that prospects for promotion determines the adoption of SMASSE skills but 14.5% (12) disagreed and (15)18.1% were neutral. This implies that prospects for promotion influences the adoption of SMASSE skills.

The structured interview conducted by the researcher on the head teachers, required the head teachers to state the teacher-related factors that influence the adoption of SMASSE skills. Table 4.10 provides details of their responses on this item.

Table 4.10: Head teachers' Responses on Teacher Factors

n=37

Factors	**Frequency**	**Percentage**
Teacher motivation	32	86
Teacher experience	25	68
Teacher's positive attitude towards student/ SMASSE	36	97
Capacity to improvise	22	59
Teachers' workload	30	81

It is indicated in Table 4.10 that (36)97% of the Head teachers said that teacher's positive attitude towards SMASSE INSET influences the adoption of SMASSE skills in teaching and learning Mathematics. This implies that if a teacher's attitude towards the INSET is positive, then they will be willing to implement the skills learnt during

the INSET. The other teacher factors stated is teacher's workload as a factor that influences the adoption of SMASSE skills in the teaching and learning mathematics. Teachers' experience (68%) and capacity of the teacher to improvise (59%) were the other factors influencing adoption of SMASSE skills in the mathematics.

To establish whether there existed a relationship between teacher-related factors and the adoption of SMASSE skills in the teaching of mathematics subject, the researcher used chi-square. This was used to test the second research hypothesis as stated in chapter one, thus:

HO_2: There is no significant relationship between teacher-related factors and the adoption of SMASSE skills in the teaching of mathematics subject

The rejection level was set at 0.05. The null hypothesis is rejected if the p-value or sig is less than or equal to 0.05 and if more than 0.05, then we fail to reject the null hypothesis. After testing hypothesis HO_2, the results were as follows:

Table 4.11: Chi-Square Results

	Value	**df**	**Asymp. Sig (2-sided)**
Pearson Chi-Square	17.786 (a)	6	.007
Likelihood Ratio	17.160	6	.009
Linear- by- linear association	10.130	1	.001
N of valid cases	83		

Concerning this second hypothesis, χ^2 = 17.786 df =6 and sig = 0.007 was found. Since $p<0.05$, we reject the null hypothesis. Therefore, there was a significant

relationship between Teachers' level of qualification and the adoption of SMASSE skills in the teaching of mathematics subject.

4.7 Analysis of teachers' and head teachers' responses on head teachers Factors

Apart from teacher factors, it was the concern of this study to establish the role played by the principal in influencing the adoption of SMASSE skills by teachers of Mathematics. Teachers' responses on this aspect are as shown in Table 4.12.

Table 4.12 Head teacher factors that influence adoption of SMASSE skills

n=83

Statement	SA		A		N		D		SD		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
Principal encourage staff to undergo inset	24	28.9	56	67.5	3	3.6	0	0	0	0	83	100
Principal motivate staff	8	9.6	27	32.5	11	13.3	37	44.6	0	0	83	100
Principal mobilizes the resources	17	20.5	33	39.8	17	20.5	10	12.0	6	7.2	83	100
Principal rewards SMASSE implementation	22	26.5	8	9.6	31	37.3	22	26.5	0	0	83	100
Principal promptly supplies information	22	26.5	31	37.3	20	24.1	5	6.0	5	6.0	83	100
Principal encourage students	20	24.1	28	33.7	16	19.3	13	15.7	6	7.2	83	100
Principal coordinates the implementation	18	21.7	23	27.7	21	25.3	15	18.1	6	7.2	83	100

Key: f-frequency, %- percentage, SA-strongly agree, A- agree, N-neutral, D-disagree, SD-strongly disagree.

Table 4.12 reveals that (80) 96.4% of the teachers stated that head teachers encourage staff to undergo the inset, whereas (35)42.2% agreed that principals motivate the staff

to practice the SMASSE skills. It should be noted that (37)44.4% disagreed and (11)13.3% were neutral. This implies that majority of principals do not motivate the staff to practice the SMASSE skills. A closer look at Table 4.9 reveals that (50)60.2% of the teachers agreed that principals mobilizes the resources necessary for the implementation of SMASSE skills whereas (16)19.2% disagreed.

The other head teacher factor that influences the adoption of SMASSE skills was that principal rewards SMASSE implementation successes. This was stated by (20)36.1% with (22)26.5% who disagreed and (31)37.3% was neutral. Further, (53)63.9% of the teachers stated that head teachers promptly supplies information about the INSET while (10)12% disagreed. This implies that principles of the schools included in this study provide information about the INSET promptly. This will enhance the adoption of SMASSE skills during the Mathematics lessons. This was rejected by (19) 22.9% of the teachers who participated in this study.

Table 4.12 also reveals that less than half (41) 49.4% of the teachers agreed that principals coordinated the implementation of the INSET practice and (21)25.3% disagreed. It is worth noting that (21)25.3% were undecided. This implies thus that most principals do not coordinate the implementation of the Inset practices. This will create an impact on the adoption of SMASSE skills by mathematics teachers.

Table 4.13 Role played by Headteachers

n=37

Role	Frequency	Percentage
Provision of T/L resources	31	84
Supervision of the implementing SMASSE	29	78
Provision of information concerning SMASSE	24	65
Teacher motivation	32	86

It is instructive to note that (31)84% of the Head teachers said that head teachers' role in the provision of Teaching/ learning resources influences the adoption of SMASSE skills. Further, (32) 86% stated that their role in motivating teachers and supervision of the implementation of SMASSE skills (29) 78% were mentioned as the roles influencing the adoption of SMASSE skills. Head teachers' role in the provision of information concerning SMASSE was also mentioned by (24)65% of the head teachers as a factor influencing the adoption of SMASSE skills.

Further analysis was done to test the third research hypothesis as stated in chapter one.

HO_3: There is no significant relationship between the role played by the principal and

The adoption of SMASSE skills by mathematics teachers in Eldoret East district.

The rejection level was set at 0.05. The null hypothesis is rejected if the p-value or sig is less than or equal to 0.05 and if more than 0.05, then we fail to reject the null hypothesis. After testing hypothesis HO_3, the results were as follows:

Table 4.14: Chi-Square Results

	Value	df	Asymp. Sig (2-sided)
Pearson Chi-Square	20.677 (a)	6	.022
Likelihood Ratio	22.973	6	.000
Linear- by- linear association	.941	1	.000
N of valid cases	83		

The third hypothesis was tested and χ^2 = 20.677 df =6 and sig = 0.002 was found. Since $p<0.05$, we reject the null hypothesis. Therefore, there was a significant relationship between the role played by the principal and the adoption of SMASSE skills by teachers of mathematics in Eldoret East district.

4.8 Analysis of Teachers' and Headteachers' Responses on students' characteristics

This was the other objective of this study. The responses on this item are as shown in Table 4.15

Table 4.15 Students characteristics influencing adoption o SMASSE skills

n=83

Statement	SA		A		N		D		SD		TOTAL	
	f	%	f	%	f	%	f	%	f	%	f	%
The age and entry behavior	29	34.9	46	55.4	0	0	0	0	8	9.6	83	100
The class size	60	72.3	10	12.0	7	8.4	0	0	6	7.2	83	100
The sex of the student	9	10.8	22	26.5	27	32.5	10	12.0	15	18.1	83	100
The socio-economic background	10	12.0	46	55.4	7	8.4	9	10.8	11	13.3	83	100
Student's attitude towards mathematics	42	50.6	26	31.3	9	10.8	0	0	6	7.2	83	100
Learners' self motivation	30	36.1	44	53.0	3	3.6	0	0	6	7.2	83	100
Learners' self efficacy	15	18.1	24	28.9	35	42.2	3	3.6	6	7.2	83	100

Key: f-frequency, %- percentage, SA-strongly agree, A- agree, N-neutral, D-disagree, SD-strongly disagree.

It is indicated in Table 4.15 that (75)90.4% of the teachers asserted that the age and entry behaviour of the students influences the adoption of SMASSE skills. Only (8)9.6% disagreed. It is further shown that (70)84.3% of the teachers agreed that class size influences the adoption of SMASSE skills; however (6)7.2% disagreed. Further, (31)37.3% of the teachers stated that student's gender influences the adoption of SMASSE skills by mathematics teachers whereas, (25)30.1% disagreed and

(27)32.5% were neutral. This is an indication that gender of students does not greatly determine the adoption of SMASSE skills.

It is further revealed that (56) 67.5% of the teachers asserted that the socio-economic background of the students influenced the adoption of SMASSE skills. Another (20)24.1% disagreed while the rest (7) 8.4% remained undecided on this issue. Table 4.15 also indicates that (68) 81.9% of the teachers agreed that students' attitude towards mathematics determined the adoption of SMASSE skills by the mathematics teachers.

There were (6)7.2% who disagreed with (9)10.8% who were neutral. A closer look at Table 4.15 reveals that majority(74) 89.2% of the teachers who participated in this study asserted that learner's self- motivation was a determinant in the adoption of SMASSE skills in teaching and learning mathematics in secondary schools. However (16)7.2% disagreed, it is also indicated that (39)47% stated that learners' self efficacy was a leaner related factor influencing the adoption of SMASSE skills whereas (9)10.8% disagreed and (35) 42.2% were neutral.

From the interview guide the head teachers were asked to state the student characteristics that influence the adoption of SMASSE skills in teaching and learning mathematics. Table 4.16 presents a summary of their responses on this item.

Table 4.16: Head teachers' Responses on Student Characteristics

Factors	Frequency	Percentage
Learners entry behavior	23	62
Students attitude towards mathematics	32	86
Students self- motivation	26	70

As shown in Table 4.16,(32) 86% of the head teachers said that students' attitude towards mathematics was a major factor influencing the adoption of SMASSE skills others, (26)70% and(23) 62% of the head teachers said that students' self motivation and learners entry behaviour, respectively were the factors influencing the adoption of SMASSE skills by mathematics teachers. This implies that if the learners' level of motivation is low, adoption of SMASSE skills will be affected.

4.1.7 Discussion of results

The first objective for this study was to assess the level of mathematics teachers' appreciation of the role of the SMASSE INSET in continuing professional development. The findings under this objective were that majority of the respondents indicated that SMASSE was relevant to the subjects they taught, SMASSE had improved their teaching skills and that under SMASSE there were challenges to the adoption of the skills learnt. This confirms that there are factors that do determine adoption and non-adoption among teachers. That SMASSE is relevant to what the teachers were tackling in the classroom was also confirmed by SMASSE Impact assessment report (JICA 2007) and also in the year 2003/2004 by the same report; in this report SMASSE project relevance was rated quite high as it agreed with the policies of both the recipient and the co-oporating partner. It was found to be one

strategy that was the best to help improve performance in sciences and mathematics. Regarding effectiveness of the project the research done by SMASSE headquarters (JICA 2007) gave the project a fairly high grade. The effectiveness was assessed by evaluating the extent to which the project had achieved its purpose. The output and outcomes were yet to be realized at the time. This does agree with the findings of this study in that the respondents who indicated SMASSE had assisted them to have the children performance increase were only (37) 44.6% against (13) 15.7% who disagreed and (33) 39.8% who were neutral. This indicated that most stakeholders have not realized any tangible evidence of good performance or generally good output generated out of adoption of SMASSE skills. The number that agreed that SMASSE had helped them improve their teaching skills was relatively lower at (72) 86.7%.

The second objective for the study was to establish the teacher factors that influence the adoption of SMASSE. The findings revealed a list of 11 factors that respondents raised to be the main teacher factors affecting adoption of SMASSE skill. This meaning that there are certain conditionalities that if not met successful implementation of SMASSE may not be realized. These same sentiments were realized by other researchers. SMASSE goals can not be realized if concerns raised about class size, teachers workload and equipments are not addressed (Justus Wabwile, 2009). The fact that there are issues that are acting as an impediment towards implementation of SMASSE has also been raised by Caroline Ndirangu, (2006) she says the SMASSE project providers should evaluate their course to know whether the target groups benefit from the inservice training of Biology teachers.

The third objective was to determine the role played by the principal in influencing the adoption of SMASSE skills by mathematics teachers. This study indicated that there were some 7 important roles principals play in influencing SMASSE skill adoption. Among them are encouragement of staff to attend inset, most principals appeared to do this (80) 96.4%. This could be also due to pressure from education officials or it could be from their own will, may be it is an area of future research. There were other factors raised like motivation of staff to practice inset; this is quite necessary such that the teachers could own the programme and implement it without supervision. The INSET and workshop activities for SMASSE are guided by findings on baseline survey done in 1998/99 (SMASSE baseline survey report 1998/1999). The survey categorized the challenges into 3: those affecting teachers, those affecting students and those relating to the school. Among factors affecting teachers included poor working conditions feeling foreigners wherever they worked, low esteem, poor attitude about the teaching profession e.t.c. indicating that the principal has quite a big role to ensure his/her teachers are comfortable in school such that they can produce better results. The same report categorized challenges facing SMASSE into two groups.

Challenges within scope of SMASSE	Challenges beyond scope of SMASSE
a) Attitude – head teachers, teachers and subsequently students and parents. b) Lack of appropriate teaching methodology-Pedagogical issues- teacher-centeredness. c) Mastery of Subject content	a) Lack of staff houses and other facilities and/or equipment textbooks; water, electricity b) Poor communication and funding of school activities and programmes c) Interrupted school programmes –fees collection
d) Inadequate use of assignments e) Few or non-existent interactive fora for teachers f) Infrequent inspection from subject inspectors g) Missing link between primary and secondary school teaching methods h) Lack of information about schools by communities	d) Food, child labour, and other family problems e) Teachers' poor working conditions and terms of services including incentives f) Overloaded syllabi and timetables – work load g) Unfair transfers h) Stagnation in one job group, i) Provision of infrastructure and instructional material and equipment to schools

What is evident is that quite a number of these challenges which were there before SMASSE started are still there today several years after SMASSE has been in place. This study has brought out some of these challenges e.g. teacher mastery of content, negative attitude, overloaded syllabus, teachers poor working conditions etc. This in essence indicates that there are still some barriers that are inhibiting the learnt SMASSE skills from reaching the classroom.

The fourth objective was to establish the student factors that influence the adoption of SMASSE skills by mathematics teachers. It is prudent to note that the learners concerns must be considered if this project has to see the light of the day in terms of us Kenyans realizing tangible outputs and outcomes. The current study has brought out important factors which are the ones that can influence teacher adoption of mathematics SMASSE skills in class. The students age is a factor, older children are most probably less curious and may be unwilling to perform hands on activities in class than the younger ones; students attitude towards mathematics, which is quite an issue, if the children will be made to feel that mathematics is a hard subject then they end up not wanting to take up mathematics at higher educational levels. Number of students per class is quite an issue, SMASSE lessons require space to perform the hands on activities, hence an over enrolled class can not successfully conduct a SMASSE lesson. Students self motivation is also important, children with high esteem or high self concept are more willing to interact with others to pursue a task. The student should become active in the learning process while the teacher carefully guides the process and there will be more meaningful learning activities in the mathematics classroom (Nancy Wambui Nui and Alice Nyacomba Wahome, 2002).

All in all this research has brought the factors which do influence adoption of SMASSE skills by mathematics teachers, an area that is quite important and should be addressed both by CEMASTEA and the Ministry of Education in Kenya. The two governments could be spending millions of shillings to have this project through, yet unless some of these challenges are addressed the SMASSE skills are likely to end up

with the mathematics teacher and may not reach the classroom. Hence the expected outcomes may not be realized.

4.1.8 Chapter summary

In this chapter background information of respondents, responses on age brackets of the respondents, responses on higher education level of the respondents, responses on teaching experience of the respondents, analysis of teachers' and headteachers' responses on level of adoption of SMASSE skills, analysis of teachers' responses on their perception towards the role of SMASSE skills in teaching mathematics lessons, analysis of teachers' and headteachers' responses on teacher factors, analysis of teachers and headteachers responses on headteacher factors, headteacher responses on student characteristics and discussion of results have been covered in this chapter.

CHAPTER FIVE

5.0 SUMMARY OF FINDINGS, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter contains a summary of the study findings, conclusions, recommendations and suggestions for further research based on the analysis of data. The major purpose of the study was to assess the factors that influence adoption of SMASSE skills among mathematics teachers in Eldoret East District. To carry out this study, survey research was used, where questionnaires were administered to teachers and interview conducted on head teachers. This chapter is divided into four sections. The first section presents a summary of the research findings, the second part presents conclusion, and the third contains recommendations and lastly suggestions for further research.

5.2 Summary of the Findings

5.2.1 General Information on the respondents

The findings of the study indicate that majority (51) 61.4% of the teachers were aged between 31 and 35 years while (18) 21.7% were above 35 years old. Another (10)12% and (4)4.8% were aged between 26 – 30 and 21 – 25 years respectively. Results from interview indicates that majority (16) 43% of the headteachers were above 40 years old whereas (12)32% were aged between 35 – 40 years. It was also revealed that (7)19% and (2)6% of the headteachers were aged between 30 -35 years and 25 – 30 years respectively. Concerning the level of education, it was found that (68) 81.9% of the teachers were degree holders whereas (7) 8.4% and (5) 6% were PGDE and Dip.

Ed holders respectively. Also, (28)76% of the Head teachers were bachelor of education degree holders while (6) 16% had a master's degree. None were diploma in education holders. Further, majority (68)79% of the teachers had taught for over 5 years in secondary schools thus they had enough teaching experience.

5.2.2 Level of Adoption of SMASSE Skills

This study sought to assess the level of mathematics teachers' appreciation of the role of the SMASSE INSET in continuing professional development in Eldoret East district. The findings show that (40)48.2% of the teachers apply relevant practical mathematical activities in 50% of their mathematics lessons and (29) 34.9% apply relevant practical mathematical activities in 75% of their mathematics lessons. Only (4)4.8% apply relevant practical Mathematical activities in 100% of their mathematics lessons.

As far as the use of ASEI lesson plan was concerned, (33)39.8% of the teachers made use of ASEI lesson plans in 25% of mathematics lessons they taught for the last one year. Another (22)26.5% and (21)25.3% had used ASEI lesson plans in 50% and 75%, respectively. However, only (1) 1.2% used ASEI lesson plans in all (100%) of mathematics lessons taught. Only, (6)7.2% of the teachers had not used any ASEI lesson plans in teaching Mathematics lessons. It was also found that majority (65) 78.3% of the teachers apply improvisation in over 50% of mathematics lessons they taught. But (18) 21.7% apply improvisation in only 25% of mathematics lessons taught.

5.2.3 Use of SMASSE Teaching Skills

The study reveals that (76) 91.6% of the teachers agreed that SMASSE training was relevant to the subject they teach (maths) whereas (3)3.6% disagreed. Another,(72) 86.7% stated that SMASSE training had improved their teaching methodology and (37)44.6 % stated that the performance of students had improved since they started using the SMASSE skills. This means in general that majority of teachers agree that SMASSE training was relevant to mathematics, improved teaching methodology, improved student performance and were faced with challenges.

Concerning the value attached to SMASSE Training, the findings indicate that (73)88% of teachers stated that SMASSE training emphasize more of students centered teaching than any other teaching method. Also, (68)82% stated that the training has improved attitude towards mathematics whereas (43)69 % acknowledged that SMASSE training is an in-service course to teachers and therefore it enables the teachers to improved their teaching skills. Further, (54) 65% and (43)52 % stated that SMASSE has improved students interactions and mastery of content respectively. However, (22) 27% stated that SMASSE skills were only good for equipped schools; otherwise it was a waste of time if applied in schools which are not well equipped.

5.2.4 Teacher Factors Influencing Adoption of SMASSE Skills

The study sought to establish the teacher factors that influence the adoption of SMASSE skills by mathematics teachers in secondary schools. The findings of the study established that (60)72.3% of the teachers and (25)68% of the head teachers agreed that teaching experience of a teacher is a factor that determines the adoption of SMASSE skills. It was also found that (49) 59% of the teachers stated that duration of training influences the adoption of SMASSE skills in the teaching and learning of

Mathematics. Age of teachers was stated by (41) 49.4% of teachers as a factor that determines the adoption of SMASSE and (79) 95.2% stated that the teaching methods used influence the adoption of SMASSE skills. Similarly, (54)65.1% of teachers agreed that training system determines the adoption of SMASSE skills and (72) 86.7% stated that mastery of content determines the adoption of SMASSE skills.

The other teacher related factor influencing the adoption of SMASSE skills as stated by (76)91.6% of the teachers was the teachers' attitude towards the inset. This implies that if the teachers have a positive attitude towards SMASSE Inset, then the adoption of SMASSE skills will be done. This was supported by (36) 97% of the Headteachers. The findings of the study show that (75)90.4% of the teachers stated that workload was another teacher factor that influences the adoption of SMASSE skills whereas majority (77)92.8% asserted that teachers' self motivation determines the adoption of SMASSE skills. Teachers' capacity to improvise was also stated by (69)83.1% of the teachers and (22)59% of the headteachers as factors influencing the adoption of SMASSE skills.

5.2.5 HeadTeacher Factors Influencing Adoption of SMASSE Skills

Apart from teacher factors, it was the concern of this study to establish the role played by the principal in influencing the adoption of SMASSE skills by Mathematics teachers. The study revealed that (80)96.4% of the teachers stated that principals encourage staff to undergo the inset, whereas (35)42.2% agreed that principals motivate the staff to practice the SMASSE skills. It was also established that principals mobilization of the resources necessary for the implementation of SMASSE skills was supported by (50) 60.2% teachers,, rewarding SMASSE implementation successes was supported by (30)36.1%teachers, prompt supply of information about

the INSET was supported by (53)63.9% and coordination of the implementation of the INSET was supported by(41)49.4% were the main headteacher factors influencing the adoption of SMASSE skills. Interview results indicate that (31)84% of the Head teachers said that head teachers' role in the provision of Teaching/ learning resources influences the adoption of SMASSE skills. Further, (32)86% stated that they played an active role in motivating teachers and on supervision of the implementation of SMASSE skills (29) 78% supported the idea mentioning it as an important factor influencing the adoption of SMASSE skills. Head teachers role in the provision of information concerning SMASSE was also mentioned by (24) 65% of the Headteachers as a factor influencing the adoption of SMASSE skills.

5.2.6 Student Characteristics Influencing Adoption of SMASSE Skills

The other objective for the study was to asses student-factors that influence the adoption of SMASSE skills in the teaching and learning of mathematics in secondary schools. The study found that age and entry behaviour (75)90.4%, class size (70)84.3%, student's gender (31)37.3%, socio-economic background of the students (56)67.5% and students' attitude towards mathematics (68)81.9% influenced the adoption of SMASSE skills. This is an indication that gender of students does not greatly affect the adoption of SMASSE skills. The study also established that majority (74)89.2%) and (39)47% of the teachers asserted that learner's self- motivational and learners' self efficacy, respectively, were determinants of the adoption of SMASSE skills in teaching and learning mathematics in secondary schools.

Headteachers responses on this variable shows that (32) 86% of the head teachers said that students attitude towards mathematics was a major factor influencing the adoption of SMASSE skills. Another (26)70% and (23)62% of the head teachers said

that students' self motivation and learners' entry behavior, respectively were factors influencing the adoption of SMASSE skills by mathematics teachers. This implies that if the learners' level of motivation is low, adoption of SMASSE skills will be affected.

5.3 Conclusion

From the findings of the study, it can be concluded that most of the teachers apply relevant practical mathematical activities in over half of their mathematics lessons. It can also be concluded that over half of the teachers use ASEI lesson plans in over half of mathematics lessons taught. Further, majority of the teachers apply improvisation in over half of mathematics lessons they taught.

Concerning teacher factors influencing adoption of SMASSE skills, the study found teaching experience of a teacher, duration of training, age of teachers, teaching methods, training system, mastery of content, teachers' attitude towards the inset, workload, teachers' self motivation and teachers' capacity to improvise as the main teacher factors influencing the adoption of SMASSE skills.

The other concern of this study was to establish the role played by the principal in influencing the adoption of SMASSE skills by Math's teachers. From the findings, it can be concluded that principals' encouragement of staff to undergo the inset, motivating the staff to practice the SMASSE skills, mobilization of the resources necessary for the implementation of SMASSE skills, rewarding SMASSE implementation successes, prompt supplies of information about the INSET and

coordination of the implementation of the INSET were the main headteacher factors influencing the adoption of SMASSE skills.

The other objective for the study was to assess student-factors that influence the adoption of SMASSE skills in the teaching and learning Mathematics in secondary schools. The study found that age and entry behaviour, class size, student's gender, socio-economic background of the students and students' attitude towards mathematics influenced the adoption of SMASSE skills. However it was noted that gender of students does not greatly determine the adoption of SMASSE skills. The other student-related factors include learner's self- motivational and learners' self efficacy, respectively. This implies that if the learners' level of motivation is low, adoption of SMASSE skills will be affected.

The fourth objective was to determine the school- related factors that influence the adoption of SMASSE skills; considering the results from the interview conducted between the researcher and headteachers it can be concluded that availability of support materials, student teacher ratio and classroom size influence the adoption of SMASSE skills by mathematics teachers.

5.4 Recommendations

Based on the findings of this study, the following recommendations are made:

i. That headteachers to motivate teachers and students to embrace the adoption of SMASSE skills in teaching and learning mathematics in secondary schools.

ii. The factors influencing adoption of SMASSE skills should be addressed by the relevant authorities to ensure smooth implementation of SMASSE.

iii. That, the Government, parents, teachers and educational stakeholders to combine efforts in order to equip schools with updated instructional resources.

iv. That, SMASSE skills to be taught in teacher training colleges and universities instead of in-servicing teachers on employment. This will reduce the resistance to the use of SMASSE skills in secondary schools.

5.5 Suggestions for Further Research

In an effort to fill up existing gap, more gaps emerged which need to be filled. The following are the areas that need further research:

i. The same research could be carried out with a larger population in several Districts or nationally. This would allow for more generalization.

ii. A comparative study on the effect of SMASSE skills on academic achievement of students in mathematics can be done on students taught using SMASSE skills and those taught using other teaching methods.

iii. A study on the preparedness of teachers and learners on the adoption of SMASSE skills can be conducted in the same district.

5.3 Chapter summary

This chapter has dealt with summary of findings involving: respondents' general information, level of adoption of SMASSE skills, use of SMASSE teaching skills, level of appreciation of SMASSE training, teacher factors influencing adoption of SMASSE skills, headteacher factors influencing adoption of SMASSE skills, student factors influencing adoption of SMASSE skills and also conclusion of the study, recommendations as well as suggestions for further studies.

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APPENDIX I: LETTER OF INTRODUCTION

Dear Respondent,

I am a postgraduate student in the School of Education in Moi University. In partial fulfillment for the award of my master of philosophy degree, I am collecting survey data to enable me compile a research thesis entitled: '**An Assessment of The Factors Influencing The Adoption of Strengthening of Mathematics and Science in Secondary Education (SMASSE) Skills: A Case Of Mathematics In Eldoret East District, Kenya'.** The results of this project will be used to assess the factors that influence the decision by secondary school teachers to use the skills acquired in SMASSE to teach mathematics subject. Through your participation the researcher hopes to make relevant policy recommendations for improving the mathematics performance in secondary schools. The information provided will be treated with utmost confidentiality. You should not put your name on the questionnaire. I hope you will take the time to complete this questionnaire and return it.

Thank you in advance.

Yours Sincerely,

Silvester Ohene Mulambe

EDU/PGA/1002/08

APPENDIX II: TEACHER'S QUESTIONNAIRE

Part 1: GENERAL INFORMATION

1. Indicate your sex by ticking in the box

Male ☐

Female ☐

2. Select your age bracket from the choices below

Below 20 years ☐

21-25 years ☐

26-30 years ☐

31-35 years ☐

Above 53 years ☐

3. Indicate your highest professional qualification

Certificate in education ☐

Diploma in education ☐

Degree in education ☐

Postgraduate in education ☐

Any other (specify) …….

4. Teaching experience

Less than 1 year ☐

1-5 years ☐

5-8 years ☐

Above 10 year ☐

Part 2: ADOPTION OF SMASSE SKILLS

5. Please indicate the extent to which you agree with each of the following statements involving the use of SMASSE teaching skills in your school. Use the rating below:

Strongly agree	5 (SA)
Agree	4 (A)
Neutral	3 (N)
Disagree	2 (D)
Strongly Disagree	1 (SD)

Item	**Study factors**	**Strongly Agree**	**Agree**	**Neutral**	**Disagree**	**Strongly Disagree**
i.	The SMASSE training was greatly relevant to the subject(s) I teach					
ii.	The SMASSE training has improved my teaching methodology					
iii.	The performance of students has improved since I started using the SMASSE skills					
iv.	There are challenges to adoption of SMASSE skills in my subject-mathematics					

6 Briefly explain the value you attach to SMASSE training with regard to the teaching of the mathematics in your school?

…….....

.....

Level of Adoption of SMASSE Skills

7. What percent of your mathematics lessons do you apply relevant practical mathematical activities? (Tick Appropriately)

100%	75%	50%	25%	Not at all
☐	☐	☐	☐	☐

8. What percent of your mathematics lessons do you make use of ASEI lesson plans in the last one year? (Tick appropriately)

100%	75%	50%	25%	Not at all
☐	☐	☐	☐	☐

9. To what extent do you apply improvisation in your mathematics lessons? (tick appropriately)

100% ☐ 75% ☐ 50% ☐ 25% ☐ Not at all ☐

10. Briefly explain to what extent you have been applying the ASEI and PDSI approaches in teaching your mathematics lessons?

Teacher Factors That Influence the adoption of SMASSE skills by mathematics teachers

11. Rate the following teacher factors that influence the adoption of SMASSE skills by mathematics teachers. Use the rating below:

Strongly agree 5 (SA)

Agree 4 (A)

Neutral 3 (N)

Disagree 2 (D)

Strongly Disagree 1 (SD)

12. Which other teacher factors that influence the adoption of SMASSE skills by mathematics teachers in your school, list in order of preference

i. ----------
ii. ----------
iii. ----------
iv. ----------

Headteacher Factors that influence the adoption of SMASSE skills by

Item no	**Teacher factors**	**SA**	**A**	**N**	**D**	**SD**
i.	Teaching experience of the teacher					
ii.	Duration of the training					
iii.	The age of the teacher					
iv.	Teaching methods					
v.	The training system					
vi.	Mastery of content					
vii.	Teacher attitude towards the inset					
viii.	Teacher's workload					
ix.	Teacher's self-motivation					
x.	Teacher' capacity to improvise					
xi.	Prospects for promotion					

mathematics teachers

13. Rate the following roles of headteachers in relation to the adoption of SMASSE skills by mathematics teachers in your school.

Use the rating below:

Strongly agree 5 (SA)
Agree 4 (A)
Neutral 3 (N)

Disagree 2 (D)

Strongly Disagree 1 (SD)

Item no	**Headteacher's factors**	**SA**	**A**	**N**	**D**	**SD**
i.	Principal encourages staff to undergo the inset					
ii.	Principal motivates the staff to practice the SMASSE skills					
iii.	Principal mobilizes to resources necessary for the implementation of SMASSE skills					
iv.	Principal rewards SMASSE implementation success					
v.	Principal promptly supplies information about the INSET					
vi.	Principal encourage students to practice the SMASSE skills during the mathematics lessons					
vii.	Principal coordinates the implementation of the INSET practices					

14. Which other headteacher-factors that influence the adoption of SMASSE skills by mathematics teachers in your institution, list in order of preference

i. ----------

ii. ----------

iii. ----------

iv. ----------

Student-characteristics influencing the adoption of SMASSE skills by mathematics teachers

15. Rate the following student- factors that influence the adoption of SMASSE skills by mathematics teachers in your school

Item	Student factors	SA	A	N	D	SD
i.	The age and entry behavior of the students					
ii.	The class size					
iii.	The sex of the student					
iv.	The socio economic background of the students					
v.	Students' attitude towards mathematics					
vi.	Learners' self motivation					
vii.	Learner's self efficacy					

16. Which other student-factors influence the adoption of SMASSE skills by mathematics teachers, list in order of preference

i. ----------

ii. ----------

iii. ----------

iv. ----------

APPENDIX III: INTERVIEW SCHEDULE FOR THE HEADTEACHER

1. Age bracket

Below 20 years ☐
21-25 year ☐
26-30 years ☐
31-35 years ☐
Above 53 years ☐

2. Highest professional qualification

Certificate in education ☐
Diploma in education ☐
Degree in education ☐
Postgraduate in education ☐

Any other (specify) …….

3. Teaching experience

Less than 1 year ☐
1-5 years ☐
5-8 years ☐
Above 10 year ☐

4. Please state the total number of students in your school _____

5. Please state the total number of teachers in your school.

Male_____ Female_____

6. How long have you been in this institution as the head teacher? _____years

7. In your own view, what factors do you think influence the adoption of SMASSE skills by mathematics teachers in your schools?

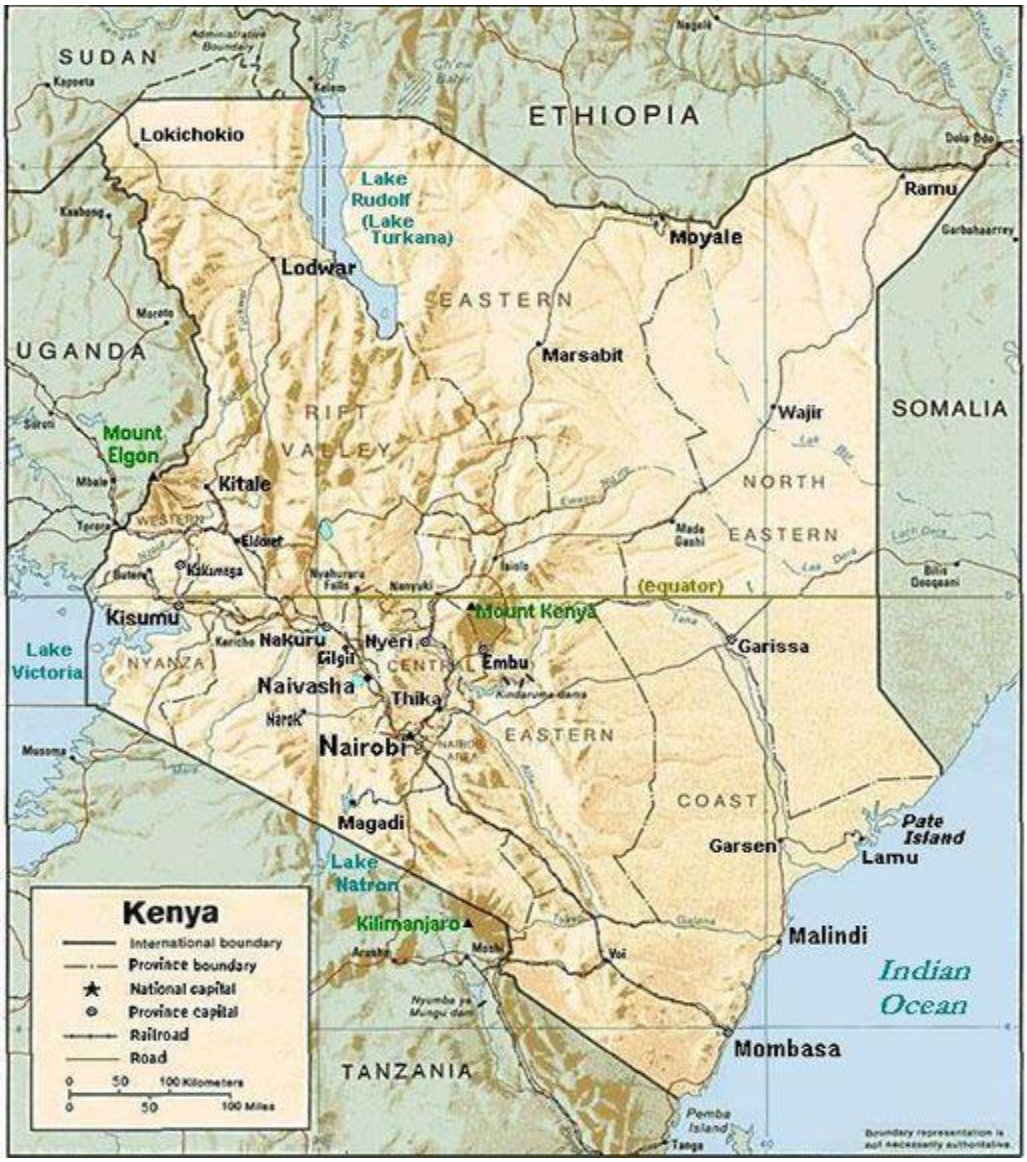
8. What do you think can be considered as teacher-factors that influence the adoption of SMASSE skills by mathematics teachers in your schools?

9. What do you think can be considered as student-characteristics that influence the adoption of SMASSE skills by mathematics teachers in your schools?

10. In your own view, what do you think is the role played by the headteachers in the adoption of SMASSE skills by mathematics teachers in your school?

APPENDIX IV: LOCATION OF ELDORET TOWN

Figure 3.1: The Location of Eldoret Town in Kenya



Source: http://www.en.wikipedia.org/wiki/File:Kenya-relief-map-towns.jpg

APPENDIX V: REPORT ON SMASSE IMPACT ASSESSMENT

APPENDIX VI: RESEARCH PERMIT

APPENDIX VII: RESEARCH AUTHORIZATION

APPENDIX VIII: LETTER FROM DEO

APPENDIX IX: LETTER FROM DEAN

APPENDIX X: LETTER FROM D.C