

**SCHOOL FACTORS INFLUENCING IMPLEMENTATION OF
STRENGTHENING MATHEMATICS AND SCIENCE EDUCATION IN
SCIENCE TEACHING IN PUBLIC PRIMARY SCHOOLS IN KANDARA
DIVISION, MURANGA COUNTY**

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**A Research Project Submitted in Partial Fulfillment of the Requirements for
the Award of the Degree of Master of Education in Curriculum Studies
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DECLARATION

This research project is my original work and has not been presented for award of degree in any university

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DEDICATION

This research work is dedicated to my parents Mr and Mrs Mwangi, Pauline, Alex and Caroline for their encouragement, patience and perseverance throughout my studies.

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LIST OF ABBREVIATIONS AND ACRONYMS

ASEI	Activity, Student, Experiment and Improvisation
CEMASTEА	Centre for Mathematics Science and Technology in Africa
INSET	In-service Education and Training
JICA	Japan International cooperation Agency
KCPE	Kenya Certificate of Primary Education
KESSP	Kenya Support Sector Program
MoE	Ministry of Education
PDSI	Plan Do See Improve
SMASE	Strengthening Mathematics and Science Education
SMASSE	Strengthening Mathematics and Science in Secondary School
UNESCO	United Nation Educational Scientific and Cultural Organization
WECSA	Western Eastern Central and Southern Africa

ABSTRACT

The purpose of the study was to investigate school factors influencing implementation of Strengthening Mathematics and Science Education in science teaching in public primary schools in Kandara division. The objectives of the study were to determine the influence of provision and use of teaching and learning resources, teachers' attitude, teachers' professional qualification and teachers' workload on implementation of Strengthening Mathematics and Science Education approach in science teaching in public primary schools. It was based on constructivist theory by Bruner 1966. The study utilized descriptive survey research design. The target population of the study was 71 public primary schools, 160 science teachers and 3784 class seven pupils. The study sample comprised of 21 headteachers, 32 science teachers and 378 pupils. Simple random sampling and stratified sampling were used to select teachers and pupils from the selected primary schools. Data were collected using an interview guide for head teachers and teachers and pupils questionnaires. Collected data was analyzed both qualitatively and quantitatively. The study findings revealed that head teachers do not avail adequate teaching and learning resource for teachers to use during science lessons for effective implementation of strengthening mathematics and science education. However SMASE programme needs teachers to have a positive attitude towards demonstrative teaching in science lessons which has highly been affected by teachers' negative attitude making learning ineffective among learners. Learning process is effectively implemented by experienced teachers where prior training and in-service training form a basis on the implementation of SMASE. Nonetheless, science teachers are overloaded with high number of pupils per class, more than one subject to teach and heavy workload of lessons to cover per week killing their motivation to implement SMASE INSET. Based on the study findings the researcher recommended that school administrators and other facilitators should organize seminars and workshops to build-up teachers' confidence amongst themselves and particularly on their attitudes concerning SMASE teaching. Therefore the researcher suggested a study to be carried out to cover the effects of other areas like social-background based factors as opposed to school based factors on the implementation of SMASE programme.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

In-service training according to Organization for Economic Cooperation and Development (OECD) project refers to those educational and training activities engaged by primary and secondary school teachers and principals following their initial professional certificates and intended mainly to improve their professional knowledge, skills and attitudes in order for them to be able to educate children more effectively. In-service training is an effective way of increasing the knowledge, skills and positive beliefs of teachers (Dean, 1991). According to Cohen and Hill (1998) in-service training that focuses on specific mathematics and science concepts and way student learn such content is helpful if it is designed for instructions that help students to improve conceptual understanding.

In the United States of America (USA) the government supports both pre-service and in-service training of teachers to strengthen the quality of teaching and enhance student learning. In-service training supplements the brief pre-service training and address social changes. Teachers in public schools are continuously exposed to professional development due to public demand for quality education. In Japan education has succeeded because it embraces continuous in-service programme for its teachers through mentorship, research groups and workshops.

In-service courses are mandatory for new recruited teachers Japan International Cooperation Agency (JICA, 2004).

In Europe concerns had been raised about whether INSET succeeds in equipping teachers with the professional knowledge needed to deliver consistently high-quality instructions. Jurgen, et.al (2010), investigated the significance of teacher content knowledge and pedagogical content for high- quality instructions and students' progress in secondary level mathematics in Germany. In so doing, he wanted to ascertain if there is a correlation between in-servicing a teacher and the class performance.

In Botswana in-service training of teachers are conducted to address curriculum changes at all levels of the education system. The aim is to address the change from teachers-centred method to learners-centred approach in teaching and learning. In South Africa teacher in-service training aims at improving the quality of teaching and learning in the fields of mathematics, natural sciences, environment, languages and social sciences. The INSET programme is learner centred and develops quality teacher support materials.

Associations such as Western Eastern Central and Southern Africa(WECSA) has also been formed to strengthen mathematics and science education and enhance learners ability through improved teacher mastery of content, pedagogical skills and enhancing both teachers and learners attitude towards mathematics and

science through in-service education and training hence the SMASSE- WECSA (Nui & Wahome, 2006).

The Strengthening Mathematics Science Education programme (SMASE) in Kenya was implemented after a need survey was conducted in 2009 and identified teachers' limited pedagogical skills, poor attitude towards science, limited use of teaching resources, poor mastery of content as the main cause of poor performance in science. The INSET programme was to address issues like pedagogy, attitude change and resource mobilization.

In the process of developing SMASE inset curriculum a pedagogical paradigm of ASEI (activity, Student, Experiment and improvisation) movement by application of PDSI (Plan, do, see, Improve) approach was constructed. This paradigm was to rally teachers into learners-centred methods where learners are actively involved in learning process rather than being passive receivers of knowledge with the teacher guiding the process. The curriculum enhances teacher's attitude, pedagogical knowledge and skills, content mastery and skills of making and utilizing teaching and learning materials. The aim of the use of ASEI-PDSI approach in the teaching practices is to make mathematics and science more relevant to learners, more practical and therefore more interesting, less expensive and more accessible.

In Kenya, INSET for mathematics and science teachers have been implemented by strengthening of mathematics and science in secondary education (SMASSE)

Project from a pilot phase (1998-2003) to national phase (2003-2008). Following the consistent poor performance in science subjects over years, the government of Kenya in collaboration with the government of Japan through Japanese international co-operation agency (JICA) carried out research to find the solution to the existing problem in mathematics and science subjects. Some of the factors include poor attitude by learners, poor teaching approaches by teachers, limited knowledge by the teachers, economic factors and community attitude. It was then argued that one way of addressing such difficulties student experience in the science classroom is through appropriate teaching interventions that can be reached through professional development of science teachers, hence the birth of SMASE project in 1998. The goal of the Strengthening of Mathematics and Sciences in Education (SMASE) is to upgrade the capability of young Kenyans in mathematics and sciences (Biology, Chemistry and Physics) through INSET. While its relevance, ownership and sustainability has been established (JICA, 2007), there is need to assess its impact in achieving the goals.

The SMASE (INSET) programme consists of four cycles each with a specific theme. Cycle one deals with attitude change focus being on development of positive attitude as a pre-requisite for quality teaching and learning of mathematics and science. Cycle two deals with activity oriented teaching and learning .The emphasis here is on creating and providing opportunities for learners to actively engage in the teaching and learning process. Third cycle of the INSET deals with actualization of the ASEI-PDSI approach in which course

participants develop ASEI lessons, that they first try out on their peers and later teach actual students in the classroom. The fourth cycle deals with enhancement and sustenance of the ASEI-PDSI approach, participants learn monitoring and evaluation skills to ensure quality teaching and learning (SMASSE, 2009) .

Teacher's professional competency is considered a major element in the implementation of in-service programmes. It is an important tool that raises students achievements (UNESCO, 2003). In a study conducted by Elliot (1998) where teachers qualification was measured by teaching experience and teaching methods revealed that well qualified teachers had a significant influence on high school students achievement in mathematics and science. However, Hanushek (2000) argued that there is no strong relation between the teacher quality and student achievement.

Olouch (2002) posits that educational projects can hardly succeed if teachers are not equipped to implement them. Their training and utilization requires critical consideration. Teacher training programmes should be in tandem with the learners needs in schools to obtain the desired achievements. This calls for radical change in methods of training teachers to strengthen the knowledge base and its connection to both theory and practice. Wanjohi (2006), notes that teachers require appropriate and relevant training to implement innovations in the curriculum. This is important because the teacher is the one who translates broad curriculum goals into instructional objectives.

Teaching and learning resources are essential for effective implementation of in-service programme. These include instructional materials and equipment, writing materials, real objects and science apparatus. Limited procurement and supply of these resources in schools hampers teachers effectiveness (Dean, 1991). This may be particularly so if classrooms are overcrowded and learners are made to share whatever little material is available. In such situations it becomes almost impossible for teachers to render individual pupil attention. SMASE project recommends improvisation and utilization of teaching learning resources when necessary (CEMASTE, 2010). Where teaching and learning resources are available, it is easier for teachers to implement curriculum changes.

Teachers' attitude towards an education programme influences the implementation of the resolution of the said programme. Attitude once formed may be resistant to change since they are wrapped up within a person's feelings, needs and self-concept. To let them go requires a change in the self and this requires much effort. One of the SMASE cycles was organized with the intention of addressing the issue of teachers' attitude towards teaching and learning of science. Some of the indicators of positive attitude are levels to which teachers engage students in practical work and the extent to which the teachers make learning environment friendly to learners. Teachers' understanding and attitude towards implementation of any curriculum is crucial, more so because teachers are the ones who present the curriculum materials to pupils. Whitaker (1997) asserts that teachers view their role in curriculum implementation as an

autonomous one. They select and decide what to teach from the prescribed syllabus of the curriculum. This implies that the teacher has indeed to understand the objective of a particular subject or discipline in order to interpret and approach it appropriately.

High teachers' workload may hinder effective implementation of an innovation. In Ghana, poor teacher ratios particularly in relation to the trained teachers have been attributed to improper implementation of curriculum leading to poor performance. The introduction of free primary education programme in Kenya has led to increased enrolment in primary schools. This implies that teacher-student ratio is low hence teachers cannot control classes especially sciences (SMASSE, 2008). Too much workload for teachers affect their performance on content delivery and encourages them not to assess students regularly. Workload pressures increases time needed for planning, assessment and documentation (Le Blanc, 2000).

The government has made a lot of effort to upgrade teachers through SMASE in-service course. Despite the SMASE inset programme there is consistent poor performance in science across the country that raises concern to all educationists, curriculum developers and other stakeholders. It is against this background that the researcher sought to carry out an investigation on school factors influencing implementation of SMASE project approach in public primary schools in

Kandaradivision. The results also indicate that there are some schools pulling down the national mean score. This is indicated by the results in table 1.1 below.

Table 1.1 National KCPE mean scores for science year 2009-2013

Year	2009	2010	2011	2012	2013
Mean score	29.96	29.82	33.82	32.02	30.91

Source: Kenya National Examination Council Newsletter 2012

Science performance throughout the country has been low over the years. Table 1.1 shows that there was a slight improvement in science performance in 2011 compared to the other years where science performance has been inconsistent.

Table 1.2 2009-2013 KCPE mean scores for science as per division in MurangaSouth district

Division/year	2009	2010	2011	2012	2013	Average
Makuyu	48.08	49.26	46.77	46.97	47.35	47.69
Kigumo	47.05	48.36	47.51	49.44	50.47	48.57
Kandara	46.55	46.51	46.97	46.03	46.55	46.52

Source: DEO's Office Muranga South district (2013)

Table 1.2 shows that the average science performance for the last five years Kandara division recorded the lowest performance in KCPE results compared to

the other divisions in Muranga South district. The trend of the performance is also not consistent. The division recorded mean scores below the ideal mark of 50% which cannot be regarded as good performance in the district. This poses a challenge as to whether teachers are implementing the SMASE (INSET) approach in teaching science in public primary schools and whether the school factors are contributing to the poor performance.

1.2 Statement of the problem

The rapid expansion of knowledge within the last twenty years has seen many changes taking place in the education system. The society has experienced scientific advancement, changing technology and new teaching methodologies that makes teachers trained years ago ineffective in the school environment unless additional support is given through in-service training.

In Kenya science is regarded as one of the subjects that leads towards technical advancement and industrialization. Poor performance in science in KCPE at the national level as Table 1.1 shows has drawn concern among various stakeholders as this may hinder the realization of the national development goals of industrialization by the year 2030.

Although the national grade appears to be lower than that of the division as Table 1.1 shows, the ideal grade should be 50% and above of which the division has not attained and therefore the performance cannot be regarded as good since other divisions in the district have been performing better than Kandara division as seen

in Table 1.2. This is despite the government intervention of introducing and supporting the SMASE INSET programme throughout the country.

Research studies have been carried out to evaluate the SMASSE project and to assess the implementation of ASEI-PDSI approach at secondary level but there are limited studies carried out regarding the implementation of SMASE project at primary school level. This prompted the researcher to investigate the school factors influencing implementation of SMASE project approach in science teaching in public primary schools in Kandara division.

1.3 Purpose of the study

The purpose of the study was to investigate school factors influencing implementation of Strengthening Mathematics and Science Education project approach in science teaching in public primary schools in Kandara division.

1.4 Objectives of the study

The study was guided by the following research objectives:-

- i. To determine the influence of provision and use of teaching and learning resources on implementation of Strengthening Mathematics and Science Education approach in science teaching in public primary schools in Kandara division.

- ii. To establish the influence of teachers attitude on implementation of Strengthening Mathematics and Science Education approach in science teaching in public primary schools in Kandara division.
- iii. To determine ways in which teachers professional qualification influence implementation of Strengthening Mathematics and Science Education approach in science teaching in public primary schools in Kandara division.
- iv. To establish the extent to which teachers workload influence implementation of Strengthening Mathematics and Science Education approach in science teaching in public primary schools in Kandara division.

1.5 Research questions

The following were the research questions for the study:-

- i. To what extent do provision and use of teaching and learning resources influence implementation of Strengthening Mathematics and Science Education approach in science teaching in public primary schools in Kandara division?
- ii. How does teacher's attitude influence implementation of Strengthening Mathematics and Science Education approach in science teaching in public primary schools in Kandara division?
- iii. To what extent does professional qualification influence implementation of Strengthening Mathematics and Science Education approach in science teaching in public primary schools in Kandara division?

- iv. How does teachers' workload influence implementation of Strengthening Mathematics and Science Education approach in science teaching in public primary schools in Kandara division?

1.6 Significance of the study

The findings might benefit the district quality assurance and standard officers who supervise curriculum implementation thus enabling them to advise science teachers on the best ways to implement the SMASE project teaching approach. The finding might also help the ministry of education to reinforce areas that contribute to students' achievements in science like provision of adequate instructional materials and employing adequate teaching staff. The findings might also help science teachers who are the implementers of the curriculum to evaluate their styles of teaching and improve on them.

The findings might also help the school administration that organizes, coordinates and monitors all educational activities in the school including providing resources for curriculum implementation and allocation of teaching load on how to overcome the challenges of implementing the SMASE project approach. The finding might also benefit all educational stakeholders in realizing that the quality of science teachers training is a key factor affecting science education in the country.

1.7 Delimitations of the study

The study limited itself to public primary school. It also dealt with school factors like provision and use of teaching and learning resources, teacher's attitude, teacher's professional qualification and teacher's workload and how they influence implementation of SMASE project approach in public primary schools. Factors such as school infrastructure, discipline, teacher's experience and school evaluation system were not considered in the study. The respondents included head teachers and science teachers that have attended SMASE INSET programme and class 7 pupils.

1.8 Limitations of the study

Strengthening Mathematics and Science Education (SMASE) project is relatively a new project in primary schools since it was started in 2009 and therefore there is limited literature on the extent of its implementation in public primary school. Some teachers have not completed the full cycle of the INSET programme to fully implement the SMASE project. To overcome this challenge the researcher used teachers that have undergone the full cycle of the INSET programme as much as possible.

1.9 Assumptions of the study

All the respondents would be cooperative in providing appropriate responses to the questionnaire. Science teachers who have completed all the cycles of the SMASE INSET are using the ASEI-PDSI approach in their science lessons.

1.10 Definition of significant terms

Attitude refers to learned predispositions to respond positively or negatively to SMASE project.

Learning refers to acquisition of knowledge, skills and attitude towards a subject that may result in better performance.

Learner-centred refers to teaching based on the pace, motivation and participation of learners.

Pedagogy refers to the study of teaching methods.

Performance refers to a measure of students' academic achievement.

Pre-service course refers to the training of prospective teacher prior to initial basic qualification as a teacher.

Programme refers to a set of related measures or activities with a particular long-term aim.

Workload refers to the number of lessons and the class size the teacher handles.

1.11 Organization of the study

The study is organized into five chapters. Chapter one presents background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, limitation of the study, delimitation of the study, basic assumptions, definition of significant terms and organization of the study. Chapter two consists of review of related literature. It includes rationale for INSET, concept of implementation, school based factors influencing implementation of SMASE such as teaching/ learning resources, professional qualification, teachers attitude, and teachers workload, Summary of literature review, theoretical framework and conceptual framework. Chapter three addresses research methodology. It consists of research design, target population, sample size and sampling procedures, research instruments, instrument validity and reliability, data collection procedures and data analysis techniques. Chapter four presents data analysis, interpretation and discussions. Chapter five consists of the summary of the study, conclusions and recommendations based on the study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents the related literature pertaining to factors influencing implementation of SMASE project. It is organized into the following themes, rationale for INSET, concept of implementation, influence of teaching and learning resources, teachers' attitude, teachers' professional qualification and teachers' workload on implementation of SMASE INSET.

2.2 Rationale for INSET

In-service teacher education and training (INSET) refers to a whole range of activities which serving teacher may participate in to improve their personal qualities professional competencies and general understanding of the role schools plays in changing the society. There is a wide worldwide consensus that improving quality of education depends on quality of classroom practices such as good methodology, group discussion and use of teaching aids (Adeyemi, 2008). The performance of Mathematics and Science in secondary schools has attracted a nationwide attention mainly due to dismal performance especially in the final secondary examinations over a period of years. Given that teachers play a significant role in instruction, efforts to improve education have been seen to depend on their beliefs, attitudes and conception of teaching and learning. In order

for teachers to considerably shift from their current practices of teaching which are mainly teacher centred, they require efforts that integrate reform agenda with their professional challenges which include poor attitude towards the subject, poor methodology used, lack of enough finance to buy learning materials and teaching aids. Consequently, In-Service Education and Training (INSET), as part of professional development hold a key to meaningful interventions in the classrooms.

According to Republic of Tanzania (2010) professional development is achieved through a set of planned activities. It is meant to enhance the skills, knowledge and understanding of teachers for effective classroom practices, raise their academic qualification to competently address the educational challenges and compete effectively in the labour market.

Shiundu and Omulando (1992) points out that INSET helps to acquaint the participating teacher with the latest innovations that help them to cope with new demands in the area of specialization, new approaches in methodology in order to enhance teaching and learning. INSETs helps teachers to plan and develop their work thoroughly, develop new strategies for change and current development trends. The demands of a teacher changes considerably during his/her career it does not seem possible to equip the teacher trainee with all the knowledge and skills required for an entire professional life hence, the need for continuous professional growth.

UNESCO (2008) points out that professional development through INSET is a way of equipping the teachers to teach diverse students population and meet their diverse needs. In-service education is a corrective strategy in education aimed at reversing any major deviations from the set goals, aims and objectives (CEMASTE, 2010). Outdated practices are kept at check and professionalism is enhanced. In-service training in Kenya has not been fully embraced and institutionalized. The teacher is taken as dispenser of knowledge and not a guide to learners (MoEST 2005). The SMASE project was initiated to address this issue and make learning child- centered.

The Kenya government, through the Ministry of Education, consulted the Government of Japan for a remedy for this poor performance. After an agreement with the Government of Japan to support INSET for mathematics and science teachers, the JICA dispatched project study and implementation missions and JICA-MoE Technical Cooperation on SMASSE Project was launched in July 1998 as pilot project in nine districts (Kibeet *al*, 2008). In 2003, the project expanded to cover the entire country. With the expansion of the project, the Government of Kenya (GOK) in line with Ministry of Education (MOE) established the Centre for Mathematics, Science and Technology Education in Africa (CEMASTE) as a centre for enhancing dialogue and cooperation among mathematics and science educators in Africa. The issues identified by the baseline study in 1998 form the basis of the four-year SMASE INSET curriculum. The guiding principle of SMASE INSET is ASEI (Activity- based, Student-centred

teaching/learning, Experimental work as opposed to theoretical treatment along with Improvisation of teaching/learning resources when necessary). The principle is implemented based on the Plan, Do, See and Improve (PDSI) approach so that corrective measures are taken in subsequent cycles of activity to avoid major disruptions (SMASSE, 2008). The main aim of INSET project is to shift classroom practices from being ineffective to effective. This is important so that teachers can benefit from professional development by sharing of experiences and continuous exposure to new ideas to keep abreast with new developments in the teaching profession (SMASSE, 2008).

Continuous study can improve teachers' mastery in the subject matter. The Measuring Performance and Evaluation Tool (MPET) 1997-2010 reiterates that, teachers' pedagogical skills and knowledge of content be updated through regular in-service. Simon and Schifter (1991) noted that in-service programmes which adopted constructivist approach to teaching and learning provides opportunities for teachers to engage in problem solving were generally successful in facilitating change not only in teachers' classroom practices but also in their beliefs and attitudes towards the subject and its teaching.

2.3 The concept of implementation of Strengthening Mathematics and Science Education

Implementation is putting new ideas into practice (Fullan, 2001). Implementation involves a transition period in which implementers in the context of the school

(teachers) become increasingly skilful, consistent and committed in their use of an innovation. Implementation as a continuum can range from avoidance of the use of innovation, superficial or partial use to skilled, enthusiastic and consistent use (Fullan, 2001).

The principle is implemented based on the Plan, Do, See and Improve (PDSI) approach so that corrective measures are taken in subsequent cycles of activity to avoid major disruptions (SMASE, 2008). The main aim of SMASE project is to shift classroom practices from being ineffective to effective (Wambui, 2006). This is important so that teachers can benefit from professional development by sharing of experiences and continuous exposure to new ideas to keep abreast with new developments in the teaching profession (SMASE, 2008).

In order to attain the ASEI condition outlined above, it is essential to adopt a cyclic approach known as PDSI which is an acronym for Plan, Do, See, Improve. Teachers are encouraged to take time when planning to reflect on the most appropriate activities that will enhance effective learning using the resources available (Ogolla, 2001). The planning involves preparation of an ASEI lesson plan which should take into consideration students' previous knowledge, number of students, facilities and resources available and lesson evaluation. Doing is shared between a teacher and learners where a teacher's role is facilitation and not the dispenser of knowledge. Teaching should be seen as non-directive and removes teachers from their usual role as information dispenser, confirmation

provider and limit setter (Cantor, 1946). According to Mwirigi (2011), teacher-student interactions should not be authoritarian or impersonal in class. He indicates that this would contribute to negative attitude of the students towards learning, especially in Mathematics. Students need to be active participants in the learning process.

Seeingø encourages a teacher to include a feedback mechanism in their lessons and teaching functions. Lesson evaluation is seen as the key to improvement of lesson delivery. Evaluation therefore should essentially be formative rather than summative. This allows room for remedial work aimed at improving studentsø performance. Improvement should be done by incorporating information obtained from feedback during and after lessons. This is a continuous activity, which ensures that a teacherø skills improve and confidence increase as the instructional programmes are enriched (Ogolla, 2001).

Implementing changes however has proved difficult even with developed countries like America, with many highly skilled, motivated and educated teachers who are also claimed to receive continuous professional development and support in terms of resources, infrastructure and the experienced professional needed to ensure successful results Rondinnelli (1990) as quoted by Fullan (2001). Inadequate trained change facilitators can seriously impact on how information is passed on to the implementerø. For successful implementation, changes have to be introduced to the users effectively (Fullan, 2001). This requires

knowledgeable and experienced change facilitators. Simon and Schifter (1991) noted that in-service programmes which adopted constructivist approach to teaching and learning provides opportunities for teachers to engage in problem solving were generally successful in facilitating change not only in teachers' classroom practices but also in their beliefs and attitudes towards the subject and its teaching.

2.4 Influence of provision and use of teaching and learning resources on implementation of Strengthening Mathematics and Science Education

Teaching and learning resources are essential for effective implementation of any in-service programme. Utilization of teaching and learning resources stimulates student senses as well as motivating them. The science teachers therefore need to be equipped with the improvisation skills required to make use of locally available materials in teaching and learning process. The availability and use of such materials as textbooks, chemicals, apparatus and supplementary reading materials have significant influence on teaching and learning process with a positive effect on school effectiveness (Gakuru, 2005). According to UNESCO (2008) teaching and learning resources enhances understanding of abstract ideas and improves performance.

Wanjohi (2006) observed that use of teaching and learning resources enhance retention of about 80% of what is learnt. He also noted that instructional materials enhances communication between teachers and learners and facilitates child-

centered learning. According to Bishop (1985) for any curriculum to be implemented effectively there must be adequate and suitable textbooks teachers guide and other teaching and learning materials. This is necessary to enable the teachers cope with large and sometimes difficult classes. Teachers support materials are an integral part of teacher's daily work as they support classroom instruction. Instructional materials play an important role in implementation as they clarify to teachers the implications of innovations and how they can be implemented Collopy (2003) as quoted by (Rogan & Grayson, 2003). Ubogu (2004), notes that textbooks enable pupils to follow the teacher's presentation and in understanding of lessons. Rogan and Grayson (2003) claim that lack of resources have often been identified as undermining the effort of even the best teachers and hinder the implementation of the new ideas.

2.5 Influence of teachers attitude on implementation of Strengthening Mathematics and Science Education

Fair bank (2010) study on why some teachers are more adaptive than others found that knowledge alone does not lead to the kind of thoughtful teaching every one strives to maintain. The study revealed that teachers with similar professional knowledge and qualification were found to have differences in their teaching practices depending on how they perceived teaching. They suggested the need to go beyond knowledge in teacher education with the aim of exploring question

about preparing thoughtful teachers. SMASE INSET provides a basis for thoughtful planning for effective teaching using learner- centered methods.

Research findings by Ballone and Czernik (2001) indicate that attitude towards a certain behaviour is a strong determinant of teachers intention to engage in a specified behaviour. They found that personal beliefs concerning the consequences of using investigative methods to teach physical science strongly influence their attitude towards doing so. INSETs should therefore focus on teachers attitude change in order for them to implement reform recommendations. Negative attitude towards an innovation can powerfully inhibit intellect and curiosity and keep teachers from teaching what is well within their power to understand.

According to Keys and Bryan (2001), teachers' beliefs about the nature of science, students learning and the role of the teacher suggested that these beliefs do affect teachers' planning teaching and assessment. A teacher's belief about learning and knowledge strongly impact the classroom climate enabling students to explore articulate and analyze their beliefs on topics. Jones and Mooney (1981) admit that students have traditionally considered mathematics as being one of the most difficult areas of science. One of the reasons that make students shy away from mathematics is as Musyoka (2000) notes, its quantitative nature.

Other reasons as outlined by Mwaura (2007) include socio-cultural factors where difficult tasks are seen as a male domain and also the contribution of the

mathematics teacher in instilling negative attitude. Some students form negative attitudes towards mathematics long before they enroll in secondary school. This is due to the opinions they get from their parents, elder siblings, friends and sometimes teachers in their primary schools. Negative attitudes are displayed through verbal expression such as "I hate Mathematics", "Mathematics is difficult" or can also be expressed through acted tendencies like sleeping during the lesson, yawning in class and looking bored, absentmindedness during the lesson, refusing to participate in the practical activity and obtaining poor results that do not bother the student

The SMASSE report of 1999 also noted that teachers' negative attitudes affected performance. Teachers' attitude as Voss (1981), notes, determine the direction and action the students are likely to take. Teachers' positive attitudes have been shown to attract more interest in their class and according to Sogomo (2001), students' attitudes are a reflection of teachers' attitudes.

A study conducted by Asembo (2013), to establish teachers' attitude towards effective implementation of SMASSE project revealed that positive attitude towards an innovation plays a significant role for it affects teaching and greatly improves the achievement of teaching and learning objectives. However, teachers with negative attitude do not implement INSET recommendations.

2.6 Influence of teachers professional qualification on implementation of Strengthening Mathematics and Science Education

The Ministry of Education(2006),states that teachers qualification show an important but complex relationship to student outcomes.Student learn more from teachers with high academic skills than from teachers with low academic skills. Therefore the effectiveness of any curriculum implementation dependon the quality of teachers that are there to translate the syllabus into practical instructional materials in the classroom (Moseti,2007).As a professional a teacher needs to have a high education and training,having expertise required in the particular field of professionalism(Shiundu&Omulando, 1992).

According to Rogan and Grayson (2003), teacherø content knowledge and training influences teachers change and how fast they change. Empirical study done by Bajah (1991), as quoted by Fullan (2001), indicate that well trained teachers were better able to understand complex spiral structure of their science curriculum,while the spiralling was found to be confusing repetition of topics by undertrained teachers. Training of teachers is a crucial step for successful implementation so that teachers understand what changes are and how they can put them into practice. Teachers can successfully implement required changes if they are given appropriate training that provides necessary knowledge and skills development, which is the aim of SMASE INSET.Training fosters teachersø interest and commitment to continue using the gained expertise. With the knowledge acquired from SMASE INSET, teachers are encouraged to use new

methods to teach different content by doing this lessons become interactive and learners become more involved in their studies.

Bishop (1985) states that educational changes can only succeed when teachers are sufficiently impressed by the validity of the new approach and thoroughly grounded in the techniques for its implementation. In light of the fact SMASE is an innovation that radically challenges the traditional norms, teacher preparedness is an indispensable fact. The SMASE project provides specialized attention to teachers to organize conducive teaching environment, actual teaching and real commitment to duties pertaining to all elements of curriculum implementation.

2.7 Influence of teacher's workload on implementation of Strengthening Mathematics and Science Education

Bray (1986) argue that when teachers load is high they become irritated and confused and this affects teacher's efficiency. The situation has deteriorated with the introduction of free primary education where class size has increased significantly yet the number of teachers remains more or less the same. Learning suffers under such conditions. Smaller class size allows teachers to use more personalized instructional techniques and apply new teaching methods. Teachers with smaller classes report less stress and high morale and turnover rates among them are lower.

Beith (1987) notes that changes in workload are related to performance in that increase in workload is accompanied by decrease in performance .According to a

study by Kibuthu (2011) high workload prevents teachers to prepare and present the lessons as per the guidelines of SMASSE INSET programme. Kibuthu also notes that much workload hinders effective implementation of ASEI-PDSI approach. With manageable workload teachers could probably have enough time to prepare ASEI lessons plans and improvise teaching and learning materials. CEMASTE A (2009) notes that high workload for teachers were the main reason as to why teachers opted to use lecture method. CEMASTE A also noted that pressure from administration to complete the syllabus before the end of each year was also attributed to the use of lecture method.

2.8 Summary of literature review

A study by Asembo (2013) on factors influencing teachers' perception on the effectiveness of SMASSE project in Embakasi revealed that teachers had negative attitude towards the SMASSE project because they felt it had no value. Kibuthu (2011) study on effects of SMASSE in-service programme on physics teachers performance revealed that high teachers workload made teachers opt to use teacher-centered methods instead of learner-centered methods advocated by the SMASSE INSET programme.

It is clear that there are different factors that inter play to influence the implementation of SMASSE project approach and they affect the teaching of science. Since there is limited research that has been carried out to investigate the influence of school factors on implementation of SMASSE project approach at the

primary level in Kandara division, the study was aimed to fill this knowledge gap by investigating how school factors influence implementation of SMASE project approach in science teaching in Kandara division. The current study might also enrich the other studies.

2.9 Theoretical framework

The research study is based on constructivist theory by Bruner 1966. The theory states that learning is an active process in which learners construct new ideas or concepts based upon their current or past knowledge. The learner selects and transforms information, constructs hypothesis and makes meaning from information and experiences while relying on a cognitive structure to do so. Cognitive structure (schema) provides meaning and organization to experiences and allows the individual to go beyond the information given.

The theory assumes that learners bring experience and understanding to the classroom, they do not encounter new information out of context but rather applying what they know to assimilate this information, to accommodate or reframe what they know to match new understandings they have gained. Therefore, the process of knowing is an interactive one. The theory advocates for active participation of learners in the learning process rather than being passive receivers of knowledge. Learners should be involved in physical action, hand-on experience that engages the mind as well as the hands.

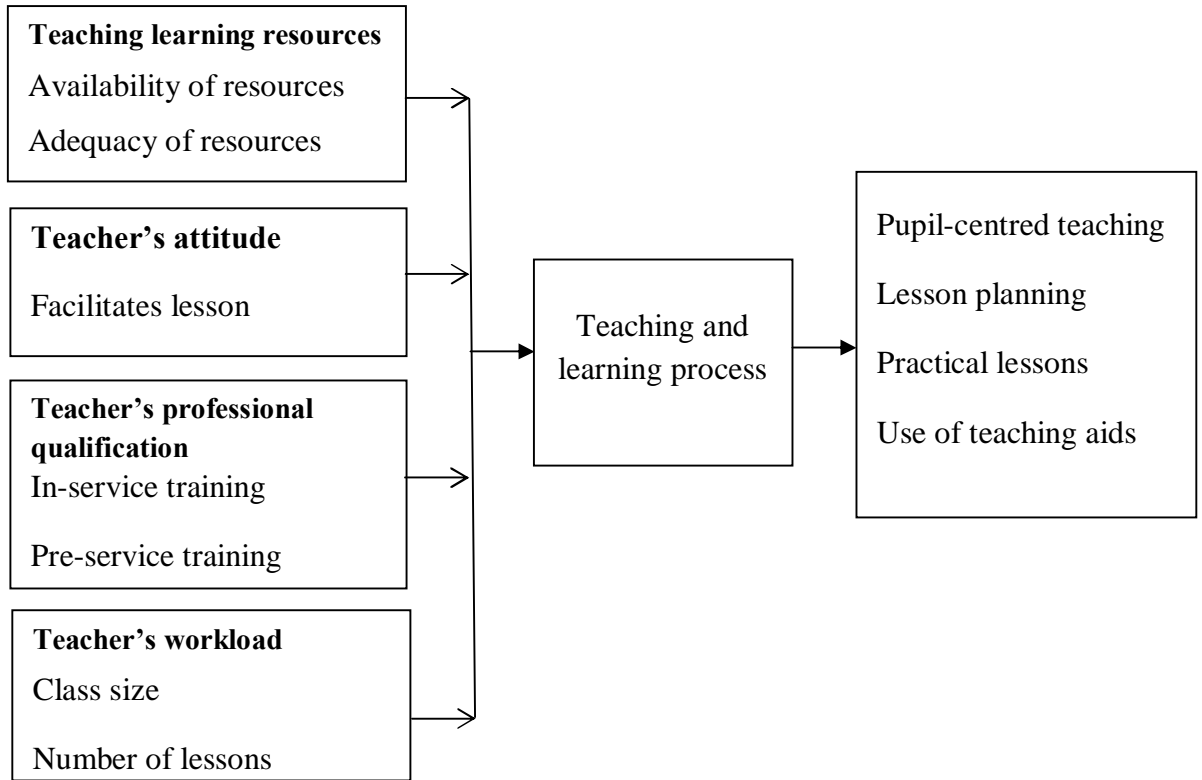
The researcher has adopted the theory because the SMASE INSET programme advocates for learners being active participants in the learning process and the teacher to adopt learners- centered method in teaching and learning of science. The theory also stresses constructing meaning by use of cognitive process. The SMASE project stresses the use of ASEI-PDSI paradigm.

The theory also acknowledges learners prior knowledge on which learners construct new knowledge. The SMASE programme encourages teachers to plan their lessons considering learner's prior knowledge/practical experiences on the topic and build new concepts on it. Through discussion, the teacher should remove any misconception and help learners draw correct scientific concepts.

2.10 Conceptual Framework

Orodho (2004), defines conceptual framework as a model of representation where a researcher conceptualizes or represents relationship between variables in the study and shows the relationship graphically or diagrammatically.

Figure 2.1 Factors influencing implementation of SMASE INSET approaches



The conceptual framework shows the interaction between the variables affecting implementation of SMASE INSET approach. The school factors are independent variables. According to Fullan (1991) model once change is initiated there are intervening factors which affect the implementation. In this case teaching and learning resources, teachers' attitude, teachers' professional qualification and teachers' workload. Implementation of SMASE project approach will therefore depend on the outlined school factors.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology used in the study. It covers the description of the research design, target population, sample size, sampling procedures, research instruments, instrument validity and reliability, procedures of data collection and data analysis techniques.

3.2 Research Design

The study utilized descriptive survey research design. According to Mugenda and Mugenda (2003), a survey is an attempt to collect data from members of a population in order to determine the status of the population with respect to one or more variables. It is a self-report study that requires the collection of quantifiable information from the sample. Descriptive survey is a method of collecting numerical data to answer questions about the status of the phenomena under study. The design allows the researcher to collect data about people's opinions, attitudes, habits or any other educational or social issue (Orodho, 2004).

The design was appropriate for this study since the teachers, head teachers had already undergone the SMASE INSET, and the researcher did not have the opportunity to manipulate the training conditions, objectives or activities. In this study teachers who had undergone SMASE INSET were studied to establish what

influence provision and use of teaching/learning resources has on implementation of SMASE; to establish the attitude of teachers on implementation of SMASE; to determine the influence of teachers' professional qualification on implementation of SMASE and influence of teachers' workload on implementation of SMASE.

3.3 Target Population

The target population for this study was 71 public primary schools in Kandara Division, 160 science teachers who have attended SMASE INSET programme. A population of 3784 class 7 pupils since they have been in school for long and had more science knowledge and could read and respond to the questionnaire easily and 71 headteachers of these primary schools due to the role they play in curriculum implementation.

3.4 Sample Size and Sampling Procedures

Sampling is the process of selecting a number of individuals for a study in such a way that the individuals selected represent the larger group thus representing the characteristics found in the entire group (Orodho, 2003). According to Mugenda and Mugenda (2003) a sample size of 10- 30% of the respondents can represent the target population. A sample of 21 schools was used for the study that is 30% of 71 schools. The headteachers of the sampled schools were automatically selected, 32 teachers that is 20% of 160 science teachers and 378 pupils which is 10% of the total number of class 7 pupils.

Simple random sampling was used to select teachers and pupils from the selected primary schools. Simple random sampling is important in reducing the influence of extraneous variables in a study (Mugenda&Mugenda, 2003).

Table 3.1 Sample frame

Category of respondents	Target population	Sample size
Head teachers	71 21	
Science teachers	160	32
Pupils	3784 378	
Total	4015	431

3.5 Research instruments

Data for the study was collected using an interview guide for head teachers, questionnaires for teachers and pupils. An interview guide is an oral questionnaire that gives immediate feedback and is administered face to face. A questionnaire is a research instrument consisting of a series of questions and other prompts for the purpose of gathering information. Questionnaires were used because it is the most suitable research instrument for descriptive research design (Kombo& Tromp, 2006). Both open ended and closed ended questions were used. According to Mugenda andMugenda (2003) questionnaires allows the respondents to express themselves freely. Questionnaire was also used because it has the ability to collect

a large amount of information in a reasonably quick space of time (Orodho, 2004). Items in the questionnaires were designed based on the objectives of the study. The questionnaires consisted of two sections. Section one sought the respondent background information while section two consisted of items addressing the objectives of the study.

3.6 Instruments validity

Validity is the degree to which results obtained from the analysis of the data actually represent the phenomenon under study (Mugenda & Mugenda, 2003). It has to do with the accuracy of the data collected in representing the variables of the study so as to make accurate and meaningful inferences. This is true in this study since the variables of the study cannot be directly measured but must be inferred from representative measurement. The researcher tested for content validity. Kothari (2003) defines content validity as the extent to which a measuring instrument provides adequate coverage of topic under study. The researcher sought for opinions from the supervisors and other experts to check for validity of the instruments. Best and Khan (2004) supports the use of experts to check for validity of the instruments in research. The instruments were then piloted in a primary school that was not to be involved in the study. The respondents included 2 teachers, 1 Head teacher and 38 pupils. Mugenda and Mugenda (2003) recommends the use of 1% of the total population

for piloting. The results were used to modify the questions that could be ambiguous.

3.7 Instruments reliability

Reliability is a measure of degree to which a research instrument will yield consistent result or data after repeated trials (Mugenda&Mugenda, 2003). To determine the reliability of the instruments, the researcher used test- retest method during piloting. The researcher administered the questionnaires on two different occasions. The response given in the second administration of the questionnaires was correlated with responses of the first administration. The reliability was then calculated using Pearson's product moment correlation coefficient.

$$r = \frac{n \sum xy - (\sum x)(\sum y)}{\sqrt{[n \sum x^2 - (\sum x)^2][n \sum y^2 - (\sum y)^2]}}$$

$$\sqrt{[n \sum x^2 - (\sum x)^2][n \sum y^2 - (\sum y)^2]}$$

r coefficient correlation.

n number of respondents in each test.

x scores in first test.

y scores in second test.

\sum summation sign.

According to Mugenda andMugenda (2003) a coefficient of 0.80 or more implies a high degree of reliability of the data. This study's research questionnaires yielded a correlation coefficient of 0.75 teacher's and 0.78 pupil's questionnaires

respectively which was quite sufficient. The head teachers' interview guide also scored a correlation coefficient of 0.72.

3.8 Data collection procedure

The researcher obtained an introductory letter from the University of Nairobi. A research permit was then obtained from the National Commission for Science Technology and Innovation. The researcher then presented copies of the research permit to the County Commissioner, County director of education and the District Education office in order to obtain the necessary authority to proceed with the study. The researcher then booked an appointment with the sample schools through the head teachers to visit and administer the questionnaires. According to Mugenda and Mugenda (2003) administering the questionnaires personally gives the researcher time to establish rapport, explain the purpose of the study and the meaning of items that may not be clear to the respondents.

3.9 Data Analysis Techniques

To analyze the data obtained from the research study, questionnaires were cross checked to ascertain their accuracy, completeness and uniformity of information. Quantitative data obtained from demographic section and other closed- ended questions were analyzed using descriptive statistics using percentages and frequencies. Bar graphs and pie charts were used to present the data. Qualitative data generated from open- ended questions were organized into themes and

patterns categorized through content analysis based on variables from the objectives. Data was coded and computed using Statistical Package for Social Science.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND DISCUSSIONS

4.1 Introduction

This chapter presents and discusses the findings of the study. The study was to investigate school factors influencing implementation of Strengthening Mathematics and Science Education in science teaching in public primary schools in Kandara division Muranga County, Kenya. It was to answer following research questions; how provision and use of teaching and learning resources, teacher's attitude, professional qualification and teacher's workload influence implementation of Strengthening Mathematics and Science Education approach in science teaching. Data was collected using questionnaires for teachers and pupils. Interview schedules that involved headteachers in the sampled schools were also used. Collected data was compiled into frequencies and percentages, and then presented in tables, graphs and pie charts.

4.2 Questionnaire Return Rate

The study sampled 21 public primary schools thus, headteachers of the sampled schools were automatically selected, 32 teachers and 378 class seven pupils.

Therefore 431 research instruments were administered. Table 4.1 presents the instrument response rate.

Table 4.1 Response rate

Respondents' Category	Sample size	Responses	Response rate
Headteachers	21	17	80.9
Teachers	32	31	96.9
Pupils	378	360	95.2
Total	395	347	94.7

From Table 4.1, the response rate was 80.9 percent, 96.9 percent and 95.2 percent for headteachers, teachers and pupils respectively. The overall response rate was 94.7 percent which was adequate for this study. According to Edward *et al* (2002) a response rate of less than 60 percent is considered inadequate while that of 60 percent to 80 percent is adequate. In addition, if the response rate is over 80 percent, it is considered as excellent for the purpose of a study.

4.3 Demographic Information

This section presents personal characteristics data of the respondents who participated in the study. This information was not to answer any research question but to give an insight of the respondents, which includes; gender and age. Table 4.2 presents data on respondents' gender.

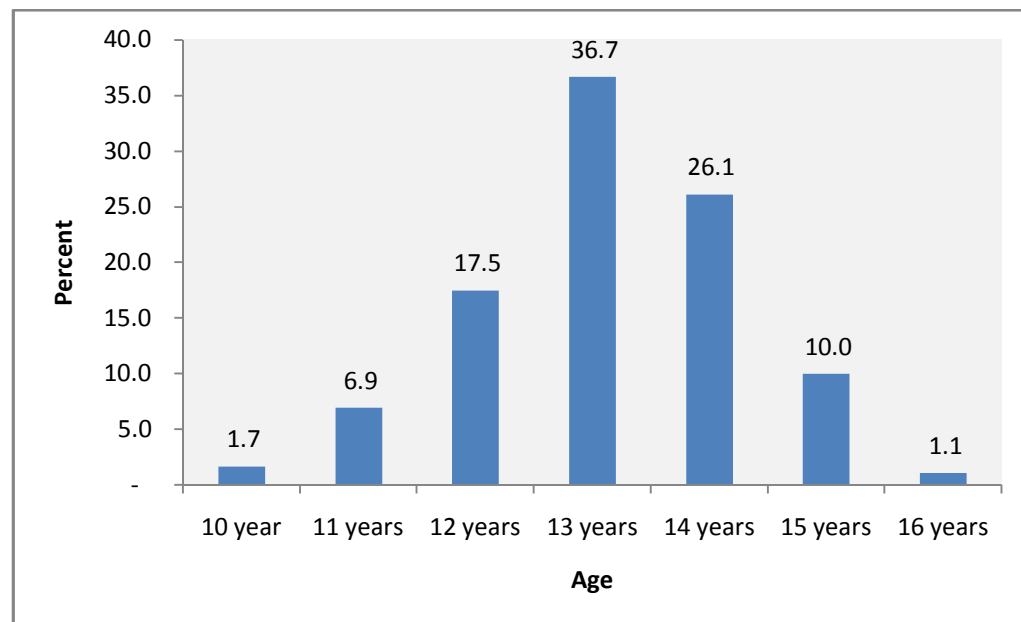
Table 4.2 Respondents' gender distribution

Gender	Teachers		Pupils	
	Frequency	Percent	Frequency	Percent (%)
Male	11	34.4	150	41.7
Female	21	65.6	210	58.3
Total	32	100.0	360	100.0

As indicated in Table 4.2, majority of the pupils (58.3%) were females while the remaining 41.7 percent were males. These findings imply that majority of pupils who participated in the study were female. On the teacher respondents majority of teachers (65.6%) were female with the remaining 34.4% being male. Analysis of the gender of science teacher is important as it may be linked to their perception on science as well as that of their pupils. In most cases, male pupils are attracted to teachers of a certain gender upon which they build their perception and attitude towards the subject and this directly affects their performance on the subject. The opposite could also be true. Among head teachers there were more male teachers than females.

The researcher sought to find the ages of the sampled pupils and presented the findings in Figure 4.1.

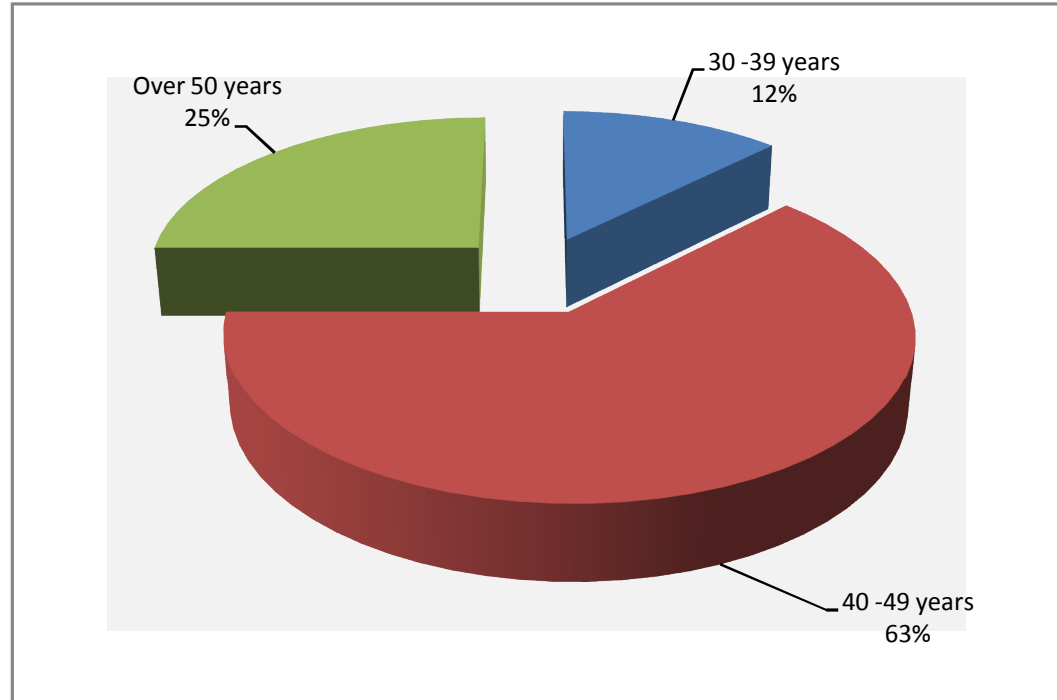
Figure 4.1 Distribution of pupils by their age



As indicated in Figure 4.1, majority of the pupils (62.8%) were aged 13 years and below, while only 1.1 percent of the class seven pupils were 16 years. These findings imply that many pupils in class seven were young. Age of a child may dictate their attitude towards science where it may be assumed that the more the advancement of pupils in age the more the comprehension of science subject and thus eventual effectiveness in implementation of the SMASE teaching in primary school.

The researcher sought to find out the science teachers age distribution and presented the findings in Figure 4.2.

Figure 4.2 Age of science teachers



From the findings, majority (63%) of teachers were found to be aged between 40 ó 49 years with 25% being 50 years and above. the remaining 12% were below 40 years of age. This implies that, an overwhelming majority of teachers in Kandara Division are at least 40 years. The age of teachers would be largely proportional to their teaching experience, a fact that would affect their perception on science teaching. In advanced age teachers are more likely to have a positive attitude towards a subject as opposed to their counterparts in relatively tender age. This would directly affect implementation of the SMASE teaching.

4.4 Influence of the provision and use of teaching and learning resources on implementation of SMASE

Provision and utilization of teaching and learning resources stimulates student senses as well as motivating them thus, science teachers need to be equipped with necessary materials in teaching and learning process. To establish whether teaching and learning resources influence implementation of SMASE (Objective I), the researcher sought to find out whether available teaching and learning resources are adequate and presented the findings in Table 4.3.

Table 4.3 Teachers response on the availability of teaching learning resources

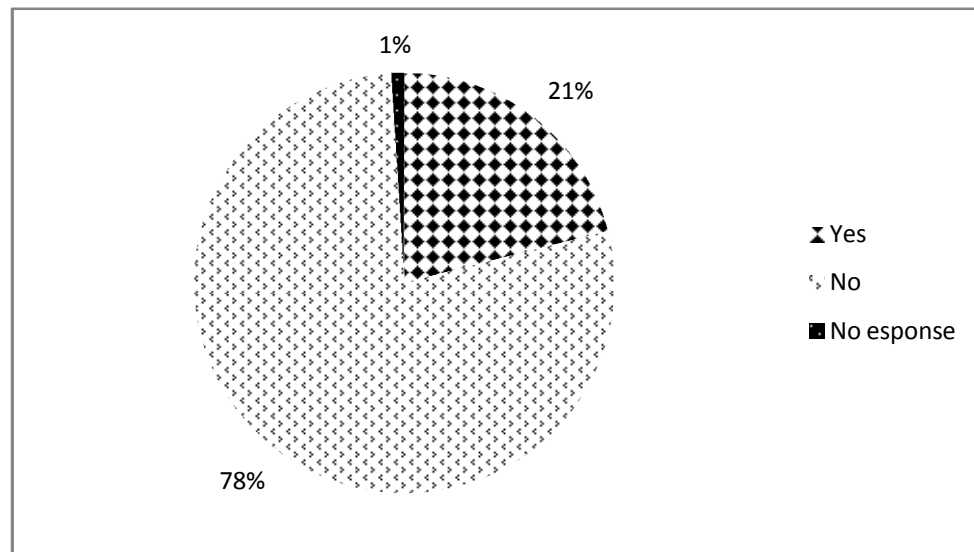
Response	Frequency	Percent (%)
Adequate	6	18.8
Inadequate	15	46.9
Hardly enough	11	34.4
Total	32	100.0

Table 4.3 shows that in most of the public primary schools (46.9%) in Kandara Division, available teaching learning resources were inadequate while 34.4 percent having hardly enough. On the other hand, 18.8 percent have adequate resources to cater for implementation of the SMASE teaching. These findings imply that teaching science lessons need to use of teaching and learning resources to effectively demonstrate in the teaching and learning process. When provided

resources are not adequate the lessons are not fully delivered. These findings contrasted with head teachers interviews that most head teachers indicated that they provide adequate resources for teaching science in their school. This is in line with Bishop (1985) who states that for any curriculum to be implemented effectively there must be adequate and suitable textbooks teachers guide and other teaching and learning materials. As asserted by UNESCO (2008) the availability and use of such materials as textbooks, chemicals, apparatus and supplementary reading materials have significant influence on teaching and learning process with a positive effect on school effectiveness.

Pupils were asked on whether the science teachers use teaching aids when teaching as presented in Figure 4.3

Figure 4.3 Pupils response on whether teachers use teaching aids during science lessons



From the findings, majority of the pupils (78%) indicated that their teachers do not use teaching aids when teaching with only 21% approved the usage. The remaining 1% of the pupils did not respond on the question. From the results it can be implied that teaching aids are important resources in SMASE teaching as this assist pupils in grasping the science concepts with ease, though majority of the lessons are not effectively contextualized due to the absence of teaching aids in class. Head teachers also indicated that most teachers are reluctant to use provided materials. This is in line with UNESCO (2008) that points out that teaching and learning resources enhances understanding of abstract ideas and improves performance.

Pupils were also asked to indicate the frequency of use of the teaching aids by their science teachers when teaching. The results are presented in Table 4.4.

Table 4.4 Pupils responses on the frequency of teachers' use of teaching aids

Response	Frequency	Percent (%)
Always	57	15.8
Sometimes	243	67.5
Rarely	56	15.6
No response	4	1.1
Total	360	100.0

Findings revealed that 67.5% of teachers sometimes use teaching aids while only 15.8% use them always. Therefore it can be established that teachers in Kandara Division do not always use teaching aids when teaching and thus the implementation of SMASE has not been effective. These findings concur with Rogan and Grayson (2003), who claim that lack of resources have often been identified as undermining the effort of even the best teachers and hinder the implementation of the new ideas.

Teachers were asked on how often they do develop teaching learning materials with the knowledge acquired from SMASE training. The results are presented in Table 4.5.

Table 4.5 Teachers responses on the frequency of developing teaching learning materials with the knowledge acquired from SMASE training

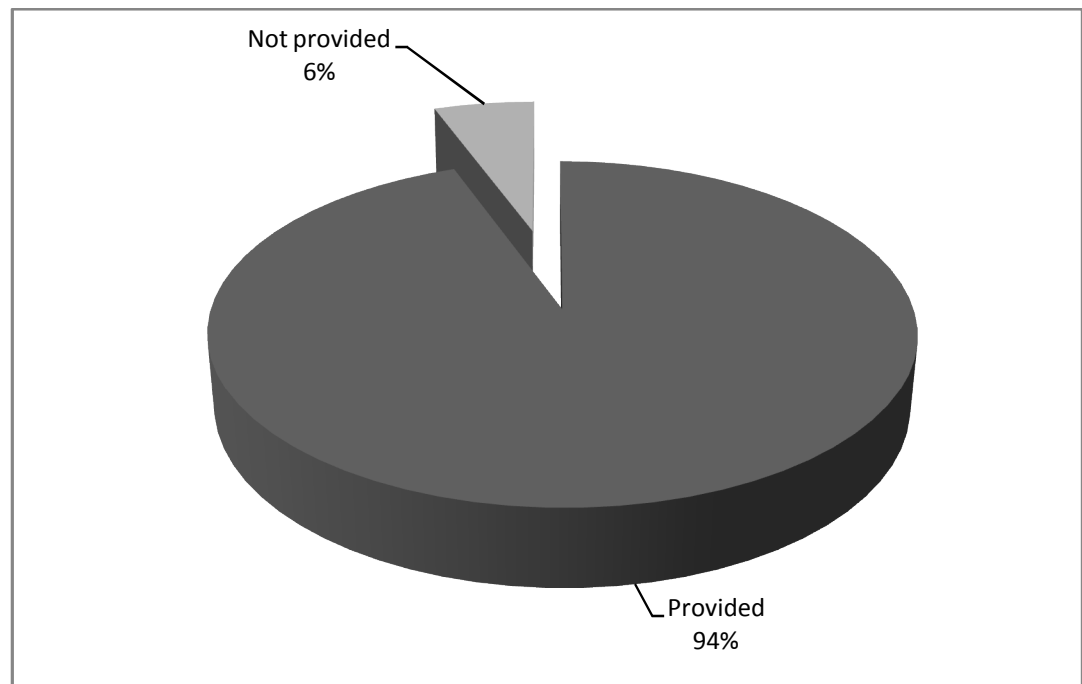
Response	Frequency	Percent (%)
Always	7	21.9
Sometimes	22	68.8
Rarely	3	9.4
Total	32	100.0

From the findings, majority of teachers (68.8%) sometimes develop teaching learning materials with the knowledge acquired from SMASE training with

21.9% developing the materials always. The remaining 9.4% nonetheless rarely develop teaching learning materials with the knowledge acquired from SMASE training. These findings imply that teachers are reluctant to improvise resources into teaching aids that would ease pupils understanding in science teaching. This is in line with CEMASTE A (2010) which recommends improvisation and utilization of teaching learning resources when/where necessary.

Pupils were asked whether their respective schools provide them with science textbooks. Figure 4.4 presents the findings.

Figure 4.4 Pupils responses on provision of science textbooks



On whether the primary schools provided their class 7 pupils with science text books, an overwhelming majority (94%) said yes while the remaining 6% said they are not supplied with the science text books. Head teachers confirmed these findings by indicating that science is a core subject and thus they provide textbooks. These findings imply that schools provide textbooks for core subjects to enable effective learning. The results are congruent with Ubogu (2004) who notes that textbooks enable pupils to follow the teacher's presentation and in understanding of lessons. This is also in line with Gakuru, (2005), who states that the availability and use of such materials as textbooks, chemicals, apparatus and supplementary reading materials have significant influence on teaching and learning process with a positive effect on school effectiveness.

Pupils were requested to indicate the frequency of carrying out experiments in science lessons and their responses were tabulated in Table 4.6.

Table 4.6 Pupils responses on frequency of carrying out experiments in science lessons

Response	Frequency	Percent (%)
Very often	13	3.6
Often	80	22.2
Rarely	196	54.4
Not at all	61	16.8
Total	360	100.0

Concerning the frequency to which students carry out experiments in science lessons majority of the pupils (54.4%) indicated that they rarely carry out the experiments with 22.2% indicating they often do so. This implies that most of the teachers lack resources to carry out experiments during science lessons. Rogan and Grayson (2003) claim that lack of resources have often been identified as undermining the effort of even the best teachers and hinder the implementation of the new ideas.

4.5 Influence of teachers attitude on implementation of SMASE

In a bid to establish the attitude of teachers towards implementation of SMASE (Objective II), the researcher provided the teachers with statements to assess their attitude towards SMASE and requested them to indicate the extent to which they agreed or disagreed with the statements. Their responses are presented in Table 4.7.

Table 4.7 Teachers attitude towards implementation of SMASE teaching

Statements on attitude	Strongly		Not		Strongly
	agree	Agree	Sure	Disagree	disagree
Interaction with other teachers during, INSET adds value to the teacher	75.0	18.8	-	3.1	3.1
The INSET topics are relevant to teaching	71.9	28.1	-	-	-
SMASE INSET has no influence on teaching of science	-	3.1	-	28.1	68.8
The ASEI-PDSI approach helps a teacher focus more on the learning objectives	68.8	28.1	-	-	3.1
Activities help students understand concepts	71.9	21.9	3.1	-	3.1
Activities delays syllabus coverage	15.6	34.4	6.3	15.6	28.1
Ten days duration of INSET is adequate	6.3	37.5	3.1	15.6	37.5

From the findings, teachers unanimously agreed that, interaction with other teachers during, INSET adds value to the respondent as a teacher and that the INSET topics are relevant to the respondents teaching. On the other hand, a vast majority (over 90%) refuted that, SMASE INSET has no influence on teaching science. Teachers were however largely dispersed on their opinion regarding the statement that, activities delays syllabus coverage. Table 4.7 gives the breakdown of the distribution of teachers' opinions. This is in line with Ballone and Czernik (2001), who states that the attitude towards a certain behaviour is a strong determinant of teachers' intention to engage in a specified behaviour. They found that personal beliefs concerning the consequences of using investigative methods to teach physical science strongly influence their attitude towards doing so. INSETs should therefore focus on teachers attitude change in order for them to implement reform recommendations. Negative attitude towards an innovation can powerfully inhibit intellect and curiosity and keep teachers from teaching what is well within their power to understand.

Pupils were asked on whether they enjoyed the science lessons as presented in Table 4.8.

Table 4.8 Pupils' responses on their enjoyment during science lessons

Response	Frequency	Percent
Very much	331	91.9
Not very much	25	6.9
Not at all	4	1.1
Total	360	100.0

From the findings, majority of the pupils (91.9%) indicated that they enjoy science lessons very much with only 1.1% not enjoying at all. These findings imply that pupils have a positive attitude towards science lessons this could have a direct relation with teachers attitude on the same and thus positive attitude from both pupils and teachers could lead to effective implementation of SMASE teaching. These findings were confirmed by head teachers who stated that majority of pupils enjoy demonstrated lessons. These findings concur with SMASSE report of 1999, Voss (1981) and Sogomo (2001), who noted that teachers' negative attitudes affected performance. Teachers' attitude determines the direction and action the students are likely to take. Teachers' positive attitudes have been shown to attract more interest and reflect in their class students' attitudes.

4.6 Influence of teachers professional qualification on implementation of SMASE

Teachers' qualifications show an important but complex relationship to student outcomes (MoE, 2006). To establish whether teacher professional qualification influence implementation of SMASE (Objective III) the researcher sought to find out teachers professional qualification and presented that findings in Table 4.9.

Table 4.9 Teachers' highest professional qualification

Qualification	Frequency	Percent
Bachelor of Education	3	9.4
Diploma	15	46.9
Certificate	13	40.6
Others	1	3.1
Total	32	100.0

As indicated in Table 4.9, 46.9 percent had diploma with 40.6 percent being certificate holders. Only 9.4 percent of the teachers had Bachelor of Education. This implies that majority of public primary schools in Kandara Division had Diploma as their highest level of professional qualification. A low level of professional qualification may hamper effective implementation of SMASE teaching given the fact that teachers have to understand the concept fully before

they impart the same to the pupils. This can only happen if their knowledge, skills and competence are advanced or enhanced.

Quality of teaching is dependent on the professional qualification of the teacher. Woolnough(1994), observes that for such teaching to take place, well qualified and enthusiastic graduate teachers should be employed since they have good mastery and expertise on the subject as well as the necessary pedagogical skills. According to this study the teachers are well qualified for majority has a P1 certificate required qualification to teach in primary school.

Teachers were also asked if professional qualification affects teaching of science and their responses presented in Table 4.10.

Table 4.10 Teachers’ responses on whether their professional qualification affect science teaching

Response	Frequency	Percent
Yes	26	81.3
No	6	18.7
Total	32	100.0

According to the findings, majority of teachers (81.3%) opined that professional qualification affects teaching of science though 18.7 percent felt that professional qualifications has no effects on teaching of sciences. These findings imply that for a teacher to effectively implement SMASE approach prior training is very

essential. This is in line with Ministry of Education (2006) that states that student learn more from teachers with high academic skills than from teachers with low academic skills. Therefore the effectiveness of any curriculum implementation depend on the quality of teachers that are there to translate the syllabus into practical instructional materials in the classroom in addition, Bajah (1991) indicate that well trained teachers were better able to understand complex spiral structure of their science curriculum, while the spiralling was found to be confusing repetition of topics by undertrained teachers.

The researcher sought to find out the number of SMASE INSET cycles science teachers have attended and presented the findings in Table 4.11.

Table 4.11 Teachers responses on the number of SMASE INSET cycles they have attended

Number of cycles	Frequency	Percent (%)
4	17	53
3	6	19
2	4	13
1	5	15
Total	32	100

From the findings on the attendance of SMASE cycle INSET by science teachers 53 percent had attended all the mandatory four SMASE INSET cycles, 19 percent had attend thrice, 13 percent twice and 15 percent had attended once.

The nine teachers who had attended twice or once gave the reason that they were replacing those who were transferred or joined the school based programme to pursue their education, thus they had only limited opportunity to attend all the cycles. Busherand Wise (2001), Mohanty(2002) agree that with effective planning and teaching of in-service courses there is evidence that teachers do change their practices. Most of the teachers had attended the SMASE INSET cycles and had enough basis to implement the programme in their school.

4.7 Influence of teachers workload on implementation of SMASE

Class size allows teachers to use more personalized instructional techniques and apply new teaching methods, therefore to establish the influence of teacher workload on the implementation of SMASE (Objective IV) the researcher sought to find out pupil class enrolment and presented the findings in Table 4.12.

Table 4.12 Number of pupils in the class

Pupils	Frequency	Percent
30 - 39 pupils	100	27.8
40 - 49 pupils	183	50.9
50 - 59 pupils	42	11.7
60 pupils and above	35	9.7
Total	360	100.0

Regarding the number of pupils in their respective classes, majority of the classes (50.9%) had 40 ó 49 pupils with 11.7 percent having 50 ó 59 pupils. This indicates that Class 7 streams have morethan 40 pupils in each stream. This further implies a high teacher-pupil ratio which could be an impediment to effective implementation of SMASE teaching. Figure 4.5presents the number of lessons taught by teachers in a week.

Figure 4.5 Number of lessons taughtby teachers in a week

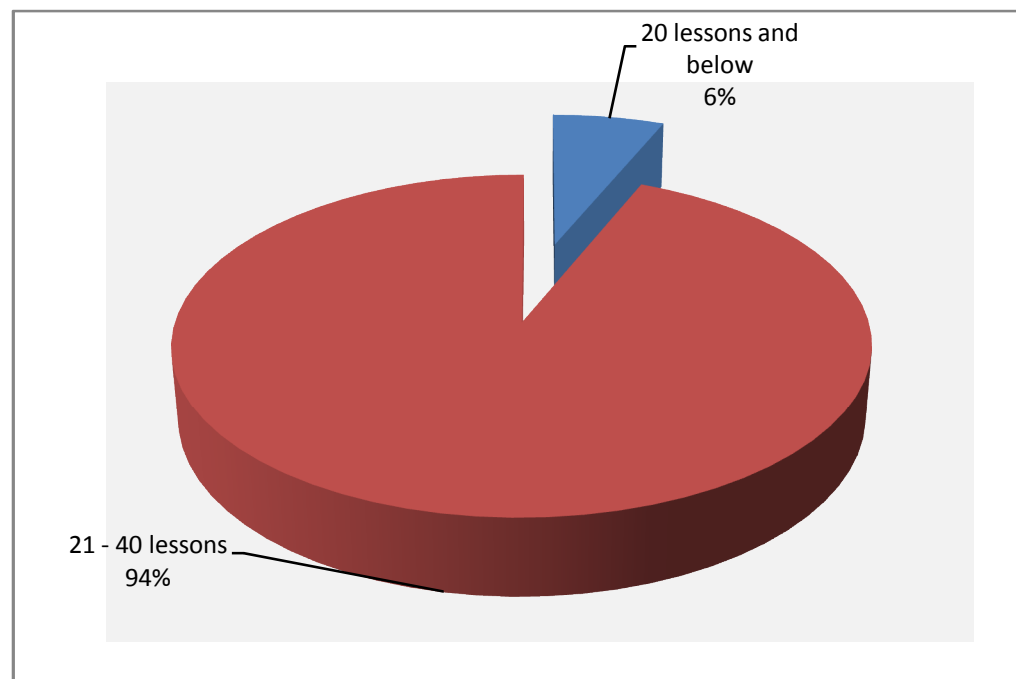


Figure 4.5 reveals that an overwhelming majority (94%) of public primary school teachers in Kandara Division have 20 - 40 lessons with only 6% having less than 20 lessons. This implies that teachers in the divisions may be overloaded with lessons to effectively implement SMASE teachings. To find out whether teachers

are overloaded with teaching workload the researcher sought to find out the number of subjects they teach and presented the finding in Table 4.13.

Table 4.13 Number of subjects taught by science teachers

No. of subjects	Frequency	Percent
3 subjects and below	5	15.6
4 - 5 subjects	7	21.9
6 - 7 subjects	19	59.4
Over 7 subjects	1	3.1
Total	32	100.0

Regarding the number of subjects that the teacher teaches, majority (59.4%) teach between 6 and 7 subjects with 21.9% teaching 4 ó 5 subjects each. Only 3.1% had over 7 subjects to teach while 15.6% had 3 subjects and below. This implies that most public primary school teachers in the division had over 6 subjects to teach. This is in line with Beith (1987) who notes that changes in workload are related to performance in that increase in workload is accompanied by decrease in performance. The findings also concur with Kibuthu (2011) who states that high workload prevents teachers to prepare and present the lessons as per the guidelines of SMASSE INSET programme. With manageable workload teachers could probably have enough time to prepare ASEI lessons plans and improvise teaching and learning materials.

From the findings on the head teachers interview, head teachers stated that science lessons should be double lessons which would provide ample time to conduct practical lesson to ensure that teachers can be able to fully implement new approaches. They further stated that teacher workload as the major hindrance. Lack of enough teaching resources also cited as another challenge in implementing the SMASE programme. The administrators cited teachers' negative attitude toward SMASE programme, transfer of SMASE trained personnel and large number of pupils in class hence making group work impossible. Understaffing in schools was also realized to be a challenge faced.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of the study, findings of the study, conclusions and recommendations. The chapter also presents suggestions for further studies.

5.2 Summary of the Study

The purpose of the study was to investigate school factors influencing implementation of Strengthening Mathematics and Science Education in science teaching in public primary schools in Kandara division. The objectives of the study were to determine the extent to which provision and use of teaching and learning resources, teachers' attitude, teachers' professional qualification and teachers' workload influence implementation of Strengthening Mathematics and Science Education approach in science teaching in public primary schools in Kandara division.

The study utilized descriptive survey research design where the target population of the study was 71 public primary schools, 71 headteachers, 160 science teachers who had attended SMASE INSET programme and 3784 class seven pupils. A sample of 21 (30%) schools was used for the study. The headteachers of the sampled schools were automatically selected, 32 (20%) science teachers and 378 (10%) class 7 pupils. Simple random sampling was used to select teachers

and pupils from the selected primary schools. Data for the study was collected using an interview guide for head teachers, questionnaires for teachers and pupils. The instruments were then piloted in a primary school that was not involved in the final study. To determine the reliability of the instruments, the researcher used test-retest method during piloting which was calculated using Pearson's product moment correlation coefficient. This study yielded a correlation coefficient of 0.75 which was quite sufficient. Collected data was analyzed both qualitatively and quantitatively using percentages and frequencies and presented in tables, bar graphs and pie charts.

5.3 Summary of the study findings

Findings indicated that, majority of the public primary schools (81.2%) in Kandara Division have inadequate teaching learning resources. Majority of the teachers (78%) do not use teaching aids when teaching. Therefore it can be established that class seven teachers in Kandara Division do not always use teaching aids when teaching. In addition, majority of teachers (68.8%) sometimes develop teaching learning materials with the knowledge acquired from SMASE training.

Majority of the primary schools (94%), provide their class 7 pupils with science text books. However, majority of the classes (54.4%) rarely carry out experiments during science lessons.

Teachers unanimously agreed that, interaction with other teachers during, INSET adds value to the teacher and that the INSET topics are relevant to teaching. Therefore teachers were found to positively embrace SMASE programme. In addition, majority (91.9%) of the pupils expressed that they enjoy science lessons very much, which imply that pupils' attitude towards science lessons could have a direct relation with teachers attitude on the same and thus positive attitude from both pupils and teachers could lead to effective implementation of SMASE teaching.

From the findings, 46.9% had diploma with 40.6% being certificate holders. Only 9.4% of the teachers had Bachelor of Education as their highest level of professional qualification. Majority of teachers (81.3%) opined that professional qualification affects teaching of sciences.

Pupils enrolment in public primary schools revealed that majority of the classes (50.9%) had 40 to 49 pupils per class. However, an overwhelming majority (94%) of public primary school teachers in Kandara Division have 20- 40 lessons with only 6% having less than 20 lessons. Regarding the number of subjects that the teacher teaches, majority (59.4%) indicated that they handle between 6 and 7 subjects with 21.9% teaching 4 to 5 lessons each. This was a clear indication that teachers were overloaded with their teaching workload making it impossible to implement SMASE in schools.

5.4 Conclusions

From the study findings the researcher concluded the following based on research objective; provision of teaching and learning resources in schools is very low causing teachers to teach without teaching aids. Therefore teachers do not effectively implement SMASE INSET programme when they do not use resources to conduct demonstrative teaching. Though majority of the pupils in primary schools enjoy science lessons majority of their science teachers have negative attitude towards the SMASE programme which can affect its implementation. Teacher professional qualification is an essential aspect on the teaching and learning process. However teachers fail to attend in-service training which include SMASE thus they are not in a position to fully implement the programme.

Primary school education programme do not call for specialization therefore teachers are forced to handle more than one subject in a single class that is usually overcrowded with pupils and many lessons to prepare for. Therefore science teachers do not take pride in implementation of SMASE programme due to the heavy workload they have to deliver.

5.5 Recommendations

Given the findings and conclusions of this study, the researcher recommends the following:

- i. The government through the Ministry of Education and other stakeholders should adequately finance public primary schools to enable them acquire the necessary teaching and learning resources to enhance effective implementation of the SMASE teaching.
- ii. School administrations and other facilitators should organize seminars and workshops to build-up teachers' confidence amongst themselves and particularly on their attitudes concerning SMASE teaching.
- iii. In order to motivate science teachers SMASE certificates should be awarded and recognized by the Teachers Service Commission for promotion/ upgrading.
- iv. Public primary school administrators should encourage their teachers to enhance professional development through in-service programmes particularly SMASE related courses.

5.6 Suggestions for Further Research

The researcher suggests the following areas for further research:

- i. A study to investigate on the school factors influencing implementation of strengthening mathematics and science education in science teaching should

be extended to public primary schools in other parts of the country other than Kandara;

- ii. A study to investigate on the factors influencing implementation of strengthening mathematics and science education in science teaching in public primary schools should be carried out to cover other areas like social-background based factors as opposed to school based factors.

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APPENDICES

APPENDIX I

LETTER TO HEADTEACHERS

Mwagiru Agnes N.

CEES

P.O Box 92

KIKUYU

The Headteacher

_____ School

P.O Box

KANDARA

Dear Sir/Madam,

RE: PERMISSION TO COLLECT DATA

I am a postgraduate student in the University of Nairobi, pursuing a master's degree in curriculum studies. I am researching on **school factors influencing implementation of SMASE**.

Your school has been selected to participate in the research. You are requested to respond to the questionnaire item as honestly as possible and to the best of your knowledge. This research is purely for academic purposes.

Kindly note that your name and that of your school should not be included in the research tools.

Thank you.

Yours faithfully,

Mwagiru Agnes N.

APPENDIX II

HEAD TEACHERS' INTERVIEW GUIDE

1. Are teaching and learning resources available in your school?
2. Do teachers use the knowledge acquired from SMASE training to improvise and utilize teaching learning materials?
3. What factors hinder effective use of teaching and learning resources in your school?
4. Do teachers willingly attend SMASE training?
5. Do SMASE trained teachers conduct in-service training to other science teachers in the school?
6. Do you feel that pre-service training prepared teachers adequately to teach science?
7. (a) In your opinion do you think professional qualification affect the teaching of science?
(b)Do you think in-service programmes help teachers improve their job performance?
8. What would you comment on the general effectiveness and impact of SMASE to your teachers and pupils?
(b)Are there any challenges that have been reported to you in reference to implementation of SMASE INSET approach?
9. What suggestion would you give in order to improve the implementation of SMASE project?

APPENDIX III

QUESTIONNAIRE FOR SCIENCE TEACHERS

You are kindly requested to fill this questionnaire indicating your honest response by putting a tick against your response or filling blanks next to the items as indicated. Please do not write your name or name of your school anywhere in this questionnaire.

Section I: Background information

1. Please indicate your gender. Male [] Female []
2. Please indicate your age bracket 20-29 years [] 30-39 years []
40-49 years [] Over 50 years []
3. What is your highest professional qualification? MED [] BED []
Diploma [] Certificate []
Other
specify _____ ..

SECTION II:

Teaching learning resources

4. (a) How would you describe the availability of teaching learning resources?
Adequate [] inadequate [] hardly enough [] not sure []
(b) Explain your answer _____ ..
5. How often do you develop teaching learning materials with the knowledge acquired from SMASE training? Always [] sometimes [] rarely []
not at all []

6. What factors hinders effective use of teaching and learning resources in your school?.....
-

ATTITUDE

Please consider the statement written and then tick (ç) to indicate to what extent you agree or disagree

Key: SA ó Strongly Agree (1) A-Agree (2) NS- Not Sure (3)

D ó Disagree (4) SD Strongly Disagree (5)

7. (a) Interaction with other participants during, INSET adds value to me as a teacher SA [] A [] NS [] D [] SD []
- (b) The INSET topics are relevant to my teaching,
SA [] A [] NS [] D [] SD []
- (c) SMASE INSET has no influence on teaching of science,
SA [] A [] D [] SD []
- (d) The ASEI-PDSI approach help a teacher focus more on the learning objectives. SA [] A [] NS [] D [] SD []
- (e) Activities help students to understand difficult concepts,
SA [] A [] NS [] D [] SD []
- (f) Activities delay syllabus coverage,
SA [] A [] NS [] D [] SD []
- (g) Ten days duration of INSET is adequate,
SA [] A [] NS [] D [] SD []

Professional qualification

8. What is your highest professional qualification?

MED [] Diploma[] BED[] Certificate []

9. Do you belief that professional qualification affects teaching of science?

Explain briefly

í í

10. (a) Do you feel that the pre-service training prepared you adequately to teach science course? Yes [] No []

(b)If No what was lacking in the training?.....

11. How many cycles have gone through in SMASE INSET programme?

4[] 3[] 2[] 1[]

12. Do you think in-service training programmes are helpful in improving job performance? Yes [] No []

Explain your answer í ..

13. What challenges are you facing in implementing SMASE project acquired ideas?í .

Workload

14. How many lessons do you teach in a week?.....

15. How many subjects do you teach? í í í í í í í í í í í í í í í í .

16. (a)What are your other responsibilities in the school?

Head teacher [] deputy Headteacher []
senior teacher [] subject panel head []

Others specifyí .

(b) What are your professional responsibilities outside school?

Examiner [] SMASE trainer [] subject panel member []

Others specify í .

17. Which classes do you teach science and how many students do you have in each class?.....

18. In what ways does your workload affect your science teaching?

í í

APPENDIX IV

QUESTIONNAIRE FOR PUPILS

Please answer all the questions by ticking (ç) against your answer after carefully reading through them. Do not write your name or the name of your school.

SECTION A: Background information

1. What is your gender? Male [] Female []
2. How old are you? í í í í í í í í í í í í í í .
3. How many pupils are in your class?.....

SECTION B

4. Do you enjoy science lessons? Very much [] not very much []
not sure [] not at all []
5. (a) Does your science teacher use teaching aids when teaching?
Yes [] No []
(b) If yes, how often? Always [] sometimes [] rarely []
6. (a) Does the school provide you with science textbooks? Yes [] No []
(b) If yes, do you get a copy each or you share? A copy each [] share []
7. How often do you carry out experiments in science lessons? Very often []
often [] rarely [] not at all []
8. (a) Does your science teacher give you homework? Yes [] No []
(b) If yes, is the homework marked? Yes [] No []

9. (a) Does the head teachers collect and check pupils' science notebooks?

Yes []

No []

(b) If yes how often?

Once in a month []

once in a term []

once in a year []

APPENDIX V

AUTHORIZATION LETTER



NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: +254-20-2213471,
2241349, 310571, 2219420
Fax: +254-20-318245, 318249
Email: secretary@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

9th Floor, Utalii House
Uhuru Highway
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No.

Date:

12th June, 2014

NACOSTI/P/14/0401/1838

Agnes Njoki Mwangi
University of Nairobi
P.O.Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *“School factors influencing implementation of Strengthening Mathematics and Science Education in science teaching in public primary schools in Kandara Division, Muranga County,”* I am pleased to inform you that you have been authorized to undertake research in **Muranga County** for a period ending **31st August, 2014.**

You are advised to report to **the County Commissioner and the County Director of Education, Muranga County** before embarking on the research project.

On completion of the research, you are expected to submit **two hard copies and one soft copy in pdf** of the research report/thesis to our office.


DR. M. K. RUGUTT, PhD, HSC.
Ag. SECRETARY/CEO

Copy to:

The County Commissioner
The County Director of Education
Muranga County.

