FACTORS INFLUENCING IMPLEMENTATION OF STRENGTHENING MATHEMATICS AND SCIENCE PROGRAMME IN PUBLIC SECONDRY SCHOOS IN EMUHAYA SUB-COUNTY, KENYA

BY

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ABSTRACT

Strengthening of Mathematics and Science in Secondary School Education (SMASSE) is important for Mathematics and Science Teachers in Kenya in effective and efficient curriculum delivery through Activity Student Experiment and Improvisation (ASEI) of Plan, Do, See and Improve (PDSI) approach. However, since its inception, Emuhaya Sub-County has performed consistently poor in these subjects than other Sub-Counties in Vihiga County from 2012 to 2017. This study purposed to establish factors influencing the implementation of SMASSE in Emuhaya Sub-County. The study objectives were to: establish teacher factors, student factors and quality assurance factors influencing SMASSE implementation in secondary schools. The target population comprised 37 principals, 196 teachers of mathematics and science and 2543form fours. Descriptive survey and correlational research designs were adopted. Saturated sampling technique was used to obtain 33 principals after 4 were used for piloting; simple random sampling was used to obtain 65 (33%) Mathematics and Science teachers and 254 (10%) form fours. Data was collected using questionnaires and document analysis. Validity of the instruments was ascertained through expert opinion and revision. The reliability was ascertained through a pilot study using 4 principals, 19 teacher and 32 students and an index of 0.78 was ascertained through a test-retest method. Data were analyzed using frequency counts, percentages, means, Standard deviation and hypotheses were tested using Pearson's r at 0.05 level of significance. The study findings established that SMASSE implementation was average (M=2.54) among the mathematics and science teachers, about (50.7%) used ASEI-PDSI approach and about a quarter (24.6%) had gone through the four cycles of SMASSE training. There was a significant influence of overall teacher [F (4, 60) =2.401, p =.030], student [F (3, 210) = 71.103, p < .05] and QASO factors, (n=65; r=.334; p<.05) on SMASSE implementation. Teacher factors accounted for 13.8%, students' factors accounted for 50.4% and QASO factors accounted for 9.7% change in the implementation of SMASSE. The study concluded that SMASSE was implemented by some teachers; all teacher factors except qualification and student factors increase chances of effective SMASSE implementation. For QASO factors, it was concluded that constant coordination, monitoring/supervision is important in curriculum implementation. The study recommended that a further study be done on challenges and their solutions in SMASSE implementation in secondary schools. These study findings may inform educational planners and policy makers on how to improve on SMASSE implementation.

CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

The strengthening of Mathematics and Science in Secondary Schools Education (SMASSE) is an In-service Education and Training (INSET) that was made compulsory to all serving Mathematics and Science teachers in Kenya in 2004 organized at Sub-County level. SMASSE programme was started in July 1994 as a joint venture between the government of Kenya (G.O.K) through the Ministry of Education Science and Technology (MOEST) and the government of Japan (G.O.J) through Japan International Cooperation Agency (JICA), (Republic of Kenya, 1998). It was an intervention to address poor performance in Mathematics and Science subjects in the Kenya Certificate of Secondary Education (KCSE) examinations. The overall goal was to upgrade ability of secondary school students in Mathematics and Science through In-Service training of teachers of these subjects to improve their teaching practices (Republic of Kenya, 1998).

SMASSE came in hand with the following objectives; to upgrade the capabilities of youths in Mathematics and sciences through In-service education and training, capacity building of teachers in Mathematics and Science through INSET and to enhance teaching and learning capacity of teachers and students respectively. A study done by Sifuna and Kaime (2007) in Primary and Secondary Schools in Kenya found out that teachers perceived the SMASSE INSET programme as having been effective in exposing them to a student-centered approach, but this was not reflected in their classroom deliveries. Similarly in studies done by Macharia (2008) who looked at the use of ASEI-PDSI approach by mathematics teachers in Murang'a district and reported that over 80% of teachers in his study applied the SEI-PDSI approach in their classroom practice although the instructional materials used by teachers who underwent the training and

those who didn't differed. In a study by Odawa, Okwara, Murundu and Bantu (2014), in Emuhaya District revealed that HODs reported that ASEI-PDSI approach was practiced yet this aspect was not evident in the lessons observed in classrooms.

A study carried out by Henderson (2007) in Latin America focused on teaching methods and importance of innovation. The study focused on INSETS of all subjects. The research revealed that teacher training in effective curriculum implementation is related to positive outcomes for students. Many studies in Africa have continued to show the importance of in- service teacher training. Okono (2011) from Nigeria reports gains in scores on the nature of scientific knowledge scale which he attributes to an in- service program. Onocha and Okpala (2009) in another study in Nigeria report that experienced integrated science teachers resort to monologue in their classes than do their counterparts still undergoing teacher training.

Macdonald and Regan (2008) in their studies in South Africa observed positive changes in teacher classroom delivery and students performance during the Science Educational Project (SEP) in Ciskei, Transkei, Soweto and Durban in South Africa. A study on the effect of the INSET program in Mathematics and Science on classroom interaction was carried out by Sifuna and Kaime (2007) in four districts established that teacher reported INSET programme exposed teachers on student centred approach. In another study by Khadija (2009) on the impact of INSET course on teachers reported that they implemented what they learnt in the INSET.

Odawa (2013) carried out a study on assessment of the impact of strengthening of Mathematics and Science education in secondary education programme on teaching and learning of Biology in Emuhaya Sub-County. His findings revealed that teachers perceived SMASSE as an important programme. The results revealed that its impact on their classroom practice was minimal due to

its structure and understaffing and further suggested for further research on factors that hinder effective implementation of SMASSE programme in Emuhaya Sub-County. This study hence wanted to establish if the poor performance in mathematics and science subjects in Emuhaya Sub-County is as a result of school factors influencing the implementation of SMASSE.

The above studies by Sifuna and Kaime (2007) investigated the influence of INSET on teacher delivery that enhances teaching and learning. Further, the study of Odawa (2013) focused on senior Mathematics and Biology teachers, however, the in-service training was not only attended by senior teachers but also junior teachers. However, the current study sought to establish how teacher factors influence the implementation of SMASSE programme in Emsuhaya Sub-County. The present study will improve on studies by Odawa (2013) by involving all teachers in the Sub-County who have attended SMASSE so as to avoid bias.

Siringi (2010) also reported that the performance in Mathematics and Science at KCSE had been poor as students had failed to embrace the concepts in Math and Science curriculum. The third international Mathematics and Science study (TIMSS) in Australia showed that students background variables influence in achievement in Mathematics. Classroom and school variables also contributed to performance substantially (Lamb & Fullerton, 2000). These findings imply that several factors contribute to students' performance in Mathematics and Science than have been identified.

Sessional Paper No.1 of 2005(Republic of Kenya, 2005) states that Secondary education has been characterized by poor performance in National Examination especially in Mathematics and Science subjects, and teacher and student characteristics are important in explaining the poor performance. The above report by The Sessional Paper No.1 of 2005(Republic of Kenya, 2005)

mentioned that the poor performance in KCSE in mathematics and sciences could be explained by student and teacher factors. This study wanted therefore to look at how the student factors (motivation, attitude and entry behavior) affect the performance in mathematics and science subjects in Emuhaya Sub-County.

There are possible opportunities to provide quality assurance in public institutions with minimal fiscal implications. This can be done effectively through internal quality assurance and standards in which the principal takes the leading role (Odawa, 2013). The Dakar conference on Education held in the year 2000 observed that quality education especially in Sub Saharan Africa needed to improve through effective internal supervision. In Kenya approximately 20,000 Mathematics and Science teachers have been trained (Tabu, 2012). The trained teachers are expected to implement the INSET in the classroom. Principals were also inducted to familiarize themselves with objectives and teaching approaches of ASEI-PDSI. Therefore the above studies (Tabu, 2012; The Dakar conference, 2000) did not examine the contribution of the principal to quality curriculum content, a gap which this study seeks to fill.

The implementation of SMASSE programme was geared towards a turnaround in the performance of students in Mathematics and Science. Yet the scenario in Emuhaya Sub-County seems contrary. Instead of improving, the performance has remained below average, and most subjects' mean score was operating on a downward trend in the past three years. Table 1.1 shows the students' performance in KCSE in Mathematics and Science in Emuhaya Sub-County and other Sub-Counties in Vihiga County and neighboring Sub Counties before and after implementation of SMASSE.

Table 1.1: Students' Performance in KCSE in Mathematics and Science (2012-2017)

Sub Counties	Subject	2012	2013	2014	2015	2016	2017
Butere	Mathematics	3.24	3.58	3.26	3.73	3.95	3.90
	Biology	5.04	5.04	4.74	4.62	5.80	6.00
	Chemistry	3.82	4.19	3.50	4.02	4.09	5.26
	Physics	4.24	4.24	2.48	3.31	3.52	4.70
Vihiga	Mathematics	3.22	3.05	3.48	3.31	3.52	3.62
	Biology	4.49	4.62	5.03	4.26	4.94	5.31
	Chemistry	4.92	5.19	4.92	5.00	5.30	5.60
	Physics	3.85	3.95	4.01	4.50	5.00	5.01
Sabatia	Mathematics	3.02	2.70	2.91	3.47	3.43	3.80
	Biology	3.11	3.80	3.80	4.46	4.54	4.47
	Chemistry	3.19	3.24	3.31	4.04	3.91	4.91
	Physics	4.70	3.86	4.90	5.19	5.33	5.08
Emuhaya	Mathematics	3.11	3.00	3.01	3.67	3.17	3.04
	Biology	3.57	3.20	3.61	4.50	4.22	4.08
	Chemistry	4.31	3.90	4.64	4.30	3.46	3.35
	Physics	4.58	4.10	4.88	4.50	4.30	5.23
Hamisi	Mathematics	4.58	4.63	4.88	4.50	4.30	2.81
	Biology	3.98	4.16	4.27	4.37	4.39	4.21
	Chemistry	3.02	3.40	3.57	3.74	3.89	3.88
	Physics	3.58	4.39	4.46	4.91	5.00	4.41

Source: Vihiga and Kakamega County Education Office (2017)

In Emuhaya Sub-County the performance of Mathematics was on a downward trend from 2015 to 2017. Similarly Biology was recording a declining trend from 2015 to 2017, while Chemistry was experiencing persistence in fluctuation in performance. Physics was the only subject that was recording a consistency in improvement from 2015 to 2017. The trend in performance in Mathematics, Chemistry and Biology in Emuhaya Sub-County was seen to be contrary to the performance in other Sub-Counties (Sabatia, Hamisi and Vihiga) within Vihiga County that was experiencing gradual upward trend.

In Emuhaya Sub-County compared to the rest of Sub- Counties within Vihiga County and neighboring Sub-County (Butere) recorded mean scores in Mathematics, Chemistry and Physics

in the year 2016 and 2017 that were below the mean scores that were realized even before the implementation of SMASSE programme in 2004. In comparison with other sub counties in (Hamisi, Sabatia and Vihiga) within Vihiga County, Emuhaya was consistently recording a drop in Mathematics, Chemistry and Biology from 2015 to 2017. This decline therefore calls for a close investigation into the extent of implementation of SMASSE in teaching science and mathematics in secondary schools of Emuhaya Sub-County as well as the teacher based factors, student based factors and QASO based factors that influence the implementation of SMASSE programme in Emuhaya Sub-County.

1.2 Statement of the Problem

SMASSE INSET aimed at improving the poor performance that had been witnessed in Mathematics and Science subjects in KCSE. An evaluation by JICA revealed that there is an improved students' capability through the implementation of SMASSE INSET particularly Mathematics and Biology. However in Emuhaya Sub-County, in the year 2009 to 2012 KCSE examination, 5 years after the implementation of SMASSE in 2004, Mathematics, Biology, Chemistry and Physics registered a mean of 3.111, 3.57, 4.311 and 4.586 respectively. Similarly in 2017, Emuhaya recorded a mean of 3.04 and a mean of 3.35 in Mathematics and Chemistry respectively that was even below the subjects' mean registered in the Sub- County before the implementation of SMASSE. This raises much doubt on the impact the implementation of SMASSE INSET has had on the teaching and learning of mathematics and science despite the huge expenditure on SMASSE INSET. One study found out that teachers perceived SMASSE as an important programme though its impact on their classroom practice was minimal due to its structure and understaffing and further suggested for further research on factors that hindered its effective implementation.Therefore there was therefore need to study the teacher factors influencing implementation of SMASSE INSET in Emuhaya Sub-County. It was also reported in

another study that there was poor performance in Mathematics and Science at KCSE because students had failed to embrace the concepts in Math and Science curriculum and in the Dakar conference on Education held in the year 2000 observed that quality education especially in Sub Saharan Africa needed to improve through effective internal supervision. This study hence aimed at finding out the student and QASO factors (supervision of SMASSE implementation) that influence the implementation of SMASSE in Emuhaya Sub-County. The aim of this study was to establish if the poor performance in mathematics and science subjects in Emuhaya is as a result of implementation of SMASSE.

1.3 Purpose of the Study

The purpose of this study was to establish factors influencing implementation of SMASSE programme in secondary schools in Emuhaya Sub-County.

1.4 Objectives of the Study

Objectives of the study were to;

i. Establish the influence of teacher based factors on the implementation of SMASSE programme in secondary schools in Emuhaya Sub-County.
ii. Establish the influence of student based factors on the implementation of SMASSE programme in the secondary schools in Emuhaya Sub-County.
iii. Examine the influence of quality assurance factors on the implementation of SMASSE programme in secondary schools in Emuhaya Sub-County.

1.5 Research Hypothesis

The study was guided by the following research hypothesis:-

i. There is no statistical significant influence of teacher based factors on the implementation of SMASSE programme in secondary schools in Emuhaya Sub-County.

ii. There is no statistical significant influence of student based factors on the implementation of SMASSE programme in the secondary schools in Emuhaya Sub-County.

iii. There is no statistical significant influence of Quality Assurance Standard Officer (QASO) factors on the implementation of SMASSE programme in secondary schools in Emuhaya Sub-County.

1.6 Scope of the Study

This study focused on investigation of the factors influencing the implementation of SMASSE programme in secondary schools in Emuhaya Sub-County. The study only focused on public secondary schools within Emuhaya Sub-County. The study involved principals, teachers of mathematics and science and form four students from whom the researcher sought information about: the extent of implementation of the skills learnt in SMASSE, the influence of teacher based, student based and quality assurance factors on the implementation of SMASSE programme, in teaching and learning in mathematics and science lessons in secondary schools of Emuhaya sub-county.

1.7 Limitations of the Study

1. A few of the questionnaires received from the respondents had been filled whereby the responses were inflating on one side of the likert scale; some respondents seemed to have filled the questionnaires for the sake of completing the process. The researcher used a document analysis guide to get more information that could have been unfairly presented on the questionnaire.

2. Due to time and financial constraints, the researcher focused on a small population and this made it impossible to generalize the study findings to other Sub-Counties in Kenya.

3. Some teachers who had undergone SMASSE training had been transferred, and others on study leave hence some data was not available within the schools. This was solved by following the ones who were transferred within the county.

1.8 Assumptions of the Study

i) All respondents are conversant with SMASSE program.

ii) That achievement in KCSE is a reflection of overall performance during the secondary school period.

iii) That SMASSE program have more influence on mathematics and Sciences achievement than the other school based INSETS.

iv) That the KCSE mathematics and science grades and mean scores are reflection effectiveness of teaching as a result of SMASSE training/programme(s).

1.9 Significance of the Study

The study was significant because it might provide information that could be used by Ministry of Education policy makers to identify factors hindering implementation of SMASSE that may enhance achievement in sciences and Mathematics subjects in secondary school in Kenya. The study was also significant because from it students could understand how their attitude, motivation and entry behavior affected the implementation of SMASSE and teachers could understand how their teaching experience, teaching methods, attitude, motivation and qualification influences their implementation of SMASSE in classroom delivery.

1.10 Conceptual Framework

The study was conceptualized on how various factors interrelate to affect the implementation of SMASSE programme in secondary schools in Emuhaya sub-county, Vihiga County Kenya as shown in the Figure 1.1. on page 10

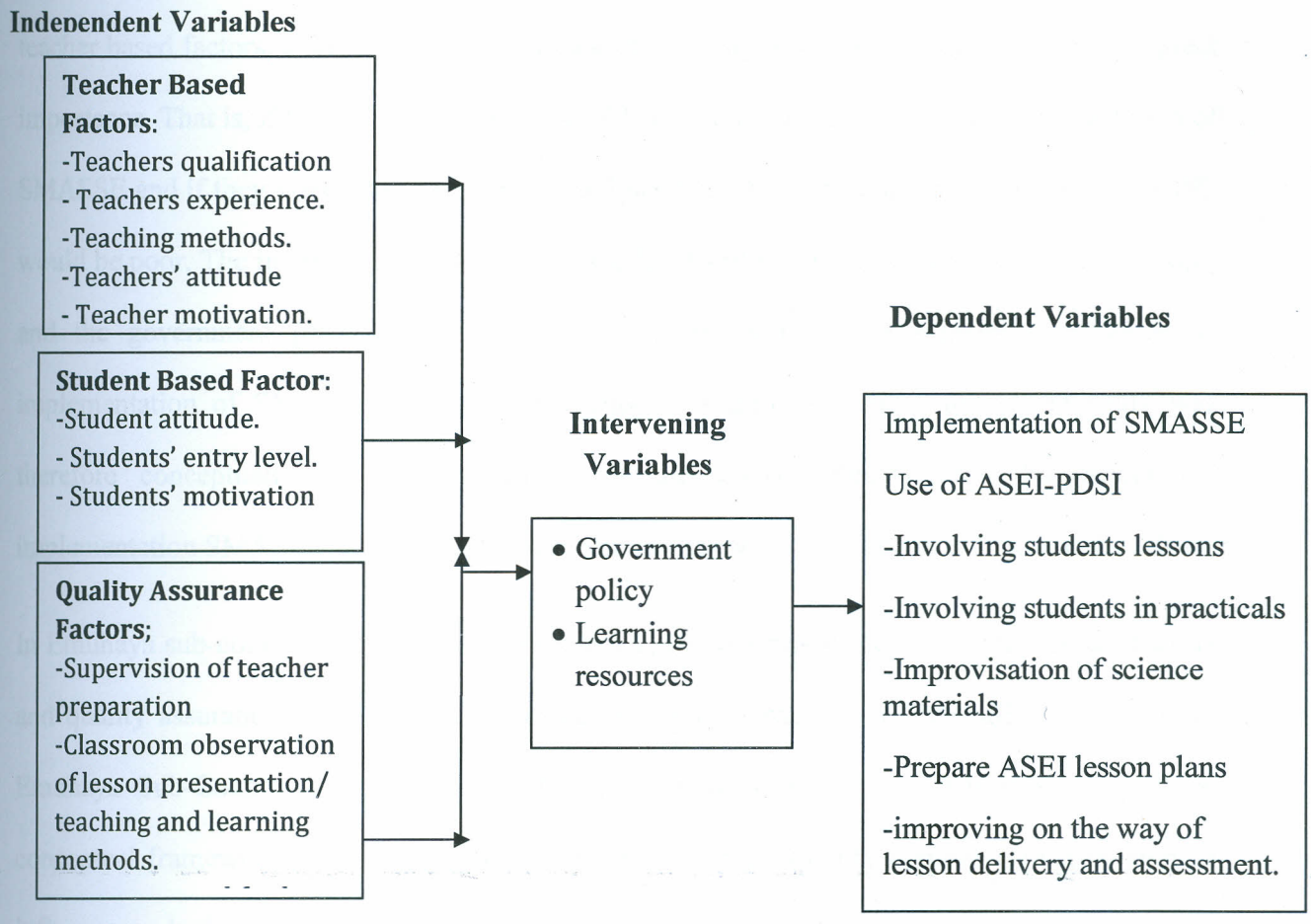

Figure 1.1: Conceptual Framework on Factors Influencing Implementation of SMASSE Programme in Secondary School in Emuhaya Sub-County.

Source: ***Adopted from Bas Swaen (2015)***

A conceptual frame work is a hypothesized model identifying the variables under study and their relationship that is independent and dependent (Ahida 2010). The conceptual framework is adopted from Bas Swaen (2015) who looked at the relationship between dependent and independent variables in a research. In this study the independent variables under investigation were; - teacher based factors, student based factors and quality assurance based factors while the dependent variables were implementation of the SMASSE programme. An independent variable is the cause of the change while a dependent variable is the effect or the outcome of change (Chambers &Skinner, 2003). In this case for effective implementation of SMASSE program,

teacher based factors, students based factors and the quality assurance based factors are of great importance. That is, if they improved, there would also be improvement in the implementation of SMASSE and if they were poor, the same would happen where the implementation of SMASSE would be poor. The intervening variables on the other hand included learning resources/facilities and the government policy for the required qualification of the principals to supervise implementation of SMASSE in Secondary schools in Emuhaya sub-county. The study was therefore conceptualized on the interplay of the above cited factors that affect the implementation SMASSE of programme in secondary schools in Emuhaya Sub- County.

In Emuhaya sub-county as shown in the Figure 1.1, teacher based factors, student based factors and quality assurance based factors influence the implementation of SMASSE programme in Emuhaya Sub-County. It is the interrelationship between the factors that is crucial in the conceptual framework. For instance, in Emuhaya sub-county quality assurance factors have an influence on both student based factors and teacher based factors. Teacher based factors on the other hand have an influence on both student based factors and Quality Assurance factors. All these variables are interrelated and in turn influence the implementation of SMASSE programme in secondary school (Tabu, 2012). This association is reflected in figure 1.1. The above conceptual frame work takes into account factors that may not be quantified and indirectly influence the implementation of SMASSE programme (intervening variables).

1.11 Operational Definition of Terms

Academic Achievement – Means measure of knowledge and cognitive abilities as depicted in the grade a learner earns in mathematics and science.

Academic Qualifications – refers to the highest level of schooling of teachers in the field of education.

Attitude – Refers to the beliefs or opinions teachers and students have toward mathematics and science.

Basic Education –refers to the minimum package of education that would be appropriate for the nation to provide for its citizen who comprise pre-school, primary and secondary education which should be made accessible to every eligible citizen.

Curriculum – refers to a set of all the programmed educational activities in a secondary school.

Enrolment –refers to the total number of children registered for learning in a secondary school in a given year.

Implementation –Means enactment of SMASSE programme (curriculum).

Influence – refers to the cause of implementation of SMASSE programme.

Professional Qualification–Means the highest level of job/work training of teachers in the field for education after schooling.

Socio- Economic Factors- Means the level of Parent education and occupation.

Teacher: Child Ratio –refers to the total number of children assigned to one teacher in a class.

Trained Teacher – Means a teacher who obtains a certificate in education after specific time of professional training and is directly engaged in instructing a group of students.

Quality Assurance and Standards Officer – Is one who ensures establishment and maintenance of education standards in learning institutions.

Quality Assurance Factor –refers to the principals as an internal Quality Assurance and Standards.

Students Based Factor – Means the students' attitude, background, entry and motivation.

Teacher Based Factors –refers to teacher Qualification, experience, teaching method, attitude and motivation.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter presents literature review for the study organized basing on objectives on sub-themes. The themes include; teacher based factor, student based factor and Quality Assurance based factor.

2.2 Teacher Based Factors

Teacher based factors include: teachers' qualifications, teaching experience, teaching methods, teachers' attitude and teachers' motivation.

2.2.1 Teachers Qualification

In any school/institution in any country (Cox & Carpenter, 2009; Sobel Naad Maletsky 2008) presented this view, teachers must know their staff; must have knowledge, intelligence and professional skills. In a research done in Gongola State, in Nigeria, Banu (2008), examined attitudes towards sciences held by secondary school students in relation to their tutors using a descriptive survey design. The research findings revealed that generally, male students had a more positive attitude towards science especially mathematics irrespective of the teacher as compared to the female students. He therefore concluded that the quality of teachers and development of more relevant curriculum might improve students' attitude towards mathematics and science subjects. Alsubaie, (2016) found out that the training of teachers is among the most important aspects of curriculum development and implementation in any education system.

Republic of Kenya (2006b) recommended that public schools should be staffed by teachers who had trained education courses and who demonstrate the appropriate personal characteristics for working with pupils and students. The amount training should vary according to the level of professional responsibility of the position. The Ministry of Education and Teachers Service

Commission's (TSC) Guide Lines on recruitment by school Board of Management stipulates that among other qualifications, science based teachers should have done seven units at the undergraduate level to handle the subject effectively, (Teachers Service Recruitment 2010 Guidelines). Ministry of Education Statistics (2012) indicates that nationally about 65% science and mathematics teachers are not trained. A report on SMASSE programme situation analysis September, 2010, the following Districts had much higher proportion of untrained science and mathematics teachers; Bomet 87%, Mt. Elgon 84%, Marsabit 84% Meru 83%Nyandarua 83% Laikipia 82% and Vihiga 81%. By the year 2009 Emuhaya sub-county had 65% of untrained teachers (DPC Emuhaya 2010).

Shaji (2007) notes that professional qualification needs to promote change in attitude, beliefs and confidence in the learning environment in order to change teachers thinking about implementation of SMASSE programme in secondary schools. Murundu (2011) established two factors that influence science teachers' attitude towards teaching of science curriculum. They were: attendance of science teaching methods courses and the number of in-service science workshops. However, a study by Gitonga (2011) revealed that there was no sufficient relationship between attitude held by primary teachers and professional qualification.

Professional qualification of teachers in both primary and secondary is crucial a determinant of the teachers' confidence in the utilization of the teaching and learning environment which influences implementation of primary curriculum (Mukuna, 2008). Training helps the teacher understand learning environment that is suitable for effective implementation of SMASSE programme in secondary schools. The teacher understands how to interpret the objectives and use the right experiences suitable for the science learning environment. Training makes it

possible for teachers to evaluate their learning environment, then learners and themselves (Ong'ang'a, 2004).

The above studies by Mukuna, (2008) looked at teacher qualification as a factor in curriculum implementation in primary schools while Banu (2008) focused on teacher qualification as a factor in science curriculum implementation in secondary schools. The current study differs from the two studies because it focused on teacher qualification as a factor in the implementation of SMASSE (both mathematics and science subjects) in secondary schools in Emuhaya Sub-County.

2.2.2 Teaching Experience

There is an assumption that students taught by more experienced teachers perform better because their teachers have mastered the content and have over time acquired classroom management skills to deal with different types of classroom problems (Slavin & Madden (2006). According to Little (2007) teachers who have gone through INSETs acquire the skills to use for effective teaching strategies, and how to develop and examine new conceptions of teaching and learning. In a qualitative case study by Fricke, (2008) to establish the effect of a mentoring programme on secondary school mathematics teachers, it was found that the program made the teachers to greatly improve in terms of content knowledge and that their confidence levels had grown.

According to Opolot-Okurut et al. (2008) there is poor performance of pupils in mathematics in national examinations in the Ugandan republic. Opolot-Okurut investigated factors hindering leaner's opportunities to learn mathematics in primary schools. The findings revealed that 83% of the factors that hinder mathematics' learning are teacher related factors, among them being: poor teaching methods, lack of teaching experience, teachers' weak academic background, poor teacher attitudes towards mathematics, and lack of a continuous professional development.

Teachers who are expected to participate in the development of students material and curriculum implementation lacks systematic knowledge particularly with regards to stimulation of students cognitive growth due to lack of experience of teaching primary pupils for a longer period of time (Obuchere, 2011).

According to Shaji (2007) in his study "Attitude of ECDE teachers towards science curriculum in Kakamega Municipality Kenya" found out that teaching experience in ECDE was a factor that influences attitudes of teachers towards implementation of science curriculum as teachers with teaching experience of six years and above had a positive attitude towards science curriculum.

The above researchers conducted their studies on the effects of teaching experience towards teacher's attitude on implementation of science curriculum in ECDE centre, primary and secondary while the current study sought to find out the influence of teaching experience on implementation of SMASSE teaching approach solely in secondary schools in Emuhaya sub-county, Vihiga County, Kenya.

2.2.3 Teaching Methods

Obuchere (2011) denotes that important techniques at the science curriculum of primary level are observation, isolation and control of variables. Research studies with high school students undergraduate students (Bulunuz, in press 2012; Jarrett & Burnley, 2010) indicates that engagement with interesting hands-on science activities in a playful environment not only promotes students' learning science, but also helps them to recognize the value of ma-king science exploratory, fun, interesting and motivational. Good teaching is found in environments where students are actively engaged, enjoy what they are learning in the classroom, participate in real world experiences, and are asked to make connections to their own experiences (Copple & Bredekamp, 2009). In a study by Tarim, (2009), cooperative learning in small groups enhanced

scholar's mathematics problem-solving abilities. In this approach, teachers guide students as they work together by providing materials and explaining when they are in need of assistance. According to Shumba, (2008), sciences are practical subjects which should be taught by discovery or inquiry methods. Njenga and Kabiru (2005) posited that children use their sense to explore the environment, manipulate objects and discover the nature of things so that they can work and relate. They discover how things smell, taste, feel and how they look like. They experiment with different things making discoveries and this increases their knowledge and concepts. They learn by hands on experiences with real materials and meaningful activities. When they explore and experiment, they discover new things and ways of doing things.

Republic of Kenya (2008 (a) and 2008 (b)) recommended thematic learning approaches as the only proven effective method which can be used by teachers in the lower primary facilitation of learning in primary school. Teaching-learning process should be generally participatory or child centered in nature. Shaji (2007) carried out a study on attitude of Preschool teachers towards science curriculum in Kakamega District, Kenya. She had a large population of 230 teachers. To add on questionnaires, she used observation checklist to collect data. She found out that, teachers strongly agreed that integrated approaches were ideal during teaching of science in Prechools. The current study on the other hand had smaller population of 30 principals, 30 H.O.Ds and used questionnaire to collect data. It examined teaching methods as a factor influencing implementation of SMASSE programme in secondary schools in Emuhaya Sub-County unlike Shaji (2007) who looked teaching methods in preschools and the Republic of Kenya (2008 (a) and 2008 (b)) which focused on lower primary. This study filled the gap and provided a rationale for re-training and professional re-orientation service for serving

mathematics and science teachers for educational planning and ensure cost effectiveness in education system.

2.2.4 Teachers' Attitude

Fairbank et al. (2010) did a study to find out why some teachers are more adaptive than others in implementing innovations. In the study, teachers with similar professional knowledge and qualifications were found to have differences in their teaching practices. They found out that attitude was the reason behind some teachers being more adaptive than others. Abdulkafi (2004) explored the attitude of high school teachers in teaching a foreign language (EFL) in Syria Information and Communication Technology (ICT). His findings suggest that teachers have positive attitude towards ICT in education hence its performance. Inyega (2002) evaluated the attitude change of chemistry teachers using two sets of questionnaires, the Pre-INSET and the Post-INSET. It was evident from the results that professional development programs for chemistry teachers could be beneficial by changing teachers' attitudes positively towards the teaching and learning objective.

A number of research studies have shown that teachers with negative attitudes toward science spend less time teaching it and also use instructive approach rather than approaches that give the student chance to participate and explore (Fulp, 2002; Goodrum, Hackling, and Rennie, 2001; Varelas, Plotnick, Wink, Fan, & Harris, 2008). Edomwonyo-otu and Avaa (2011) found out that teachers' attitude reflects on the way they teach and this ultimately has adverse effects on students' performance. According to Olatunde, (2009), attitude of students can be influenced by the attitude of the teacher and his method of teaching. On the contrary, Obadara (2008) found no significant relationship between teachers' attitude to teaching and students' academic.

A study by FEMSA (2001) revealed that both the female and male teachers, albeit often sub-consciously. A positive attitude is therefore necessary for teaching efficiency and wastage reduction, and called for research in this area.

Attitude towards mathematics and science is seen as the pattern of beliefs and emotions associated with science. The attitude is said to be positive if there is a positive emotional deposition towards the subjects and negative if the emotional deposition towards the subject is negative (Daskalogianni and Simpson, 2000). Ones belief about the subject influences his attitude towards it (Turner-Bisset, 2001). If teachers read enthusiastically and confidently, then an attitude towards implementing SMASSE programme is influenced. It is therefore, important for professional developers to become knowledgeable about beliefs and attitudes that participants hold and their current practices because they influence curriculum decisions (Handal, Bobis and Grimson, 2001). Teachers also exhibit attitude towards students whereby liking and enthusiasm to teach specific students may be shown. More enthusiasm in preparation and presentation of lessons is shown when teachers are affectionate towards students than when they are apathetic or indifferent towards the students. This attitude toward students could be formed due to the characteristics exhibited by a student or a group of students such as a low socio-economic status, poor discipline, physical appearance that teachers personally find acceptable or unacceptable attractive or repulsive (Dada and Alant, 2002). The above literature reveals that indeed teachers' attitude is an obstacle to effective teaching. Koech (2001) in his study did not show the impact of attitude when it comes to imparting new competencies that students need in a rapidly changing and dynamic world. The present study aimed at establishing the attitude of mathematics and science teachers towards implementation of SMASSE programme in secondary school in Emuhaya sub-county.

Shaji (2007) notes that professional development needs to promote changes in attitude, beliefs and confidence in the learning environment in order to change teachers thinking (attitude) towards implementation of SMASSE programme in secondary school. Karen (2002) conducted a study to determine effects of science workshop on teachers' attitude towards science curriculum. The finding indicated that participation in the workshop increased teachers understanding of science career and gained greater confidence in the learning environment while supervising research projects. They also expanded teachers' instructional techniques and showed more confidence in using inquiry based instructional practice.

The above studies (Fulp, 2002; Goodrum, Hackling, and Rennie, 2001; Varelas, Plotnick, Wink, Fan, & Harris, 2008) differ from the current as they looked at teacher attitude as a factor in teaching sciences alone while the current study examined teachers' attitude as a factor that influence the implementation of SMASSE programme in teaching sciences and mathematics in secondary school in Emuhaya sub-county.

2.2.5 Teacher Motivation

Bassett and Blatch ford, (2012) found out that the major barriers of use of innovations by teachers were inadequate motivation, lack of strong leadership together with inadequate cooperation by teachers etc. According to Yidrim, (2007), where there is no teacher motivation, they may decide not to adopt a certain innovation in their teaching. In a study on the factor that influence teachers' perception towards the implementation of strengthening mathematics and science in secondary education (SMASSE programme) in Bungoma County, Kenya by Wamalwa, (2017), it was concluded that teacher motivation is a driving force behind their participation in the SMASSE in-service training. If teachers are not motivated, they will not participate in the in-service training; implying that implementation of SMASSE tenets are at risk.

According to him, the motivational factors were adequate allowances, certificates of participation, provision of adequate security, quality meals and adequate training materials during in-service training.

With regards to Kithinji (2007), as cited in Twoli, et al., (2007), teacher's attitude and motivation are vital in the teaching and learning process. Cheruiyot (2015) carried out an Assessment of the Challenges facing the Implementation of SMASSE Project Activities in Bomet District, Kenya. There was 100% response that low morale among teachers was a challenge. In a study by Chepkwony (2011) on challenges facing the implementation of SMASSE project in Kericho district, Kericho county, Kenya, the teachers listed that low morale was a challenge. The report by the World Bank, (2004) stated that shortage of teachers, inadequate and poor facilities; limited instructional materials and low teachers' morale due to low remuneration and poor terms of service affect SMASSE implementation.

The study by Kithinji (2007), as cited in Twoli, et al., (2007), looked at teacher's motivation as a factor in the general teaching and learning process whereas the current study looked at teacher's motivation as a factor in the teaching and learning processes specifically in mathematics and science subjects.

2.3 Student Based Factors

The student based factors include student's entry level, student attitude and student motivation.

2.3.1 Students' Entry Level

Mastery of basic skills and concepts has always been recognized as an essential in learning of mathematics and science. Much of mathematics and science learning is hierarchical in nature. Prerequisite need to be acquired before the more advanced and high order skills can be learned.

A study with secondary school students also showed that those with better academic performance from primary school exhibited more positive attitudes towards math than those with low performance (Mato and De La Torre, 2010). Georgiou et al. (2007) showed that high achievement in mathematics from preschool could serve to predict a positive attitude towards math, but such an attitude could not predict stronger achievement. Factors from home environment and society including educational background, parental expectations and occupation of the parent" (Mata et al, 2012) influence student achievement in science subjects. The University of Southern Maine (USM) is a public university in Northern New England. To determine if poor performance in entry level mathematics course is a problem in USM, as it seems nationwide, the USM department of mathematics and statistics reviewed pass rates for all semesters of 2011 in the three entry level mathematics courses that it offers. It found a 20.7% failure rate for these courses compared to a 9.6% failure rate for all 100 courses across the university for the same semester (Gupta & Caron, 2006). This confirms that poor performance in entry level mathematics courses determines future performance in mathematics related courses.

In Kenya, at the beginning of every year, after the release of KCPE examination results, school heads go for selection of form ones. It is normally interesting that this selection is done in a stratified manner that is national school heads select their students first, followed by extra county, County and lastly Sub-County schools. Therefore the "top layer" of the candidates who normally join form one are taken to national schools. The students registered in a school are an important input component and it is argued that higher achievers at lower levels have got innate ability to perform well in the succeeding levels.

Nderitu (2007) acknowledged that the performance and enrolment in a subject may be defined by the learners' entry behaviour and previous exposure to the content of that subject. The author

further said that the quality of grades in the KCPE science paper is likely to a certain extent influence the performance of physics, chemistry and biology. The author therefore concluded that good academic performance had a positive effect on the future pupil's achievements. However it has been noticed that sometimes students with higher mean grades at lower levels do not perform well at higher levels. Entry level brings about the strata of schools. This study investigated the influence of students' entry level at KCPE in mathematics and science as a factor influencing the implementation of SMASSE programme in Emuhaya Sub-County.

2.3.2 Students Attitude

Students' attitude towards mathematics and science, and learning and their implications for mathematics and science instructions have long been a common interest among mathematics educators. Attitude towards mathematics has been considered an important factor in influencing participation in mathematics and science. Weidman & Humphrey (2002) state that investigation into students' mathematics attitude and perceptive not only informs teachers, parents and administrators about student needs, but also serves as a catalyst for reform in mathematics education.

A research by Zan and Martino (2007) on attitudes points out that student attitude plays a crucial role in learning and achievement in mathematics hence determines their success in the subject. Mensah et al (2013) found out that in many cases, students have been found to approach Mathematics as procedural and rule-oriented which prevents them from experiencing the richness of Mathematics and the many approaches that could be used to develop competence in the subject. In a study by Mata et al, (2012) on the relationship between student attitude and achievement in mathematics showed that the more positive the attitude, the higher the level of achievement in the student. However, there is research evidence showing that students' high

performance in Mathematics is not necessarily positively associated with their attitudes about mathematics and mathematics learning. Results of third international mathematics and science study (TIMSS) revealed that while Japanese students out performed students from many other countries in mathematics, they displayed relatively negative attitudes towards mathematics (Mallis, 2000).

Studies have shown that factors such as motivation and attitude have impacted on students' achievement (Cote & Levine, 2000; Singh, Granville & Dika, 2000). Tymn (2001) investigated 21000 students attitude towards mathematics and suggested that the most important factors were the teachers and students' academic level while age, gender and language were weakly associated with attitudes. Webster & Fisher (2000) study revealed that rural and urban students attitude in maths and career aspiration positively affected their performance. Altermal & Colleages (2002) found that students' attitude changes could be predicted and influenced by type of classmates. The students' attitude towards an academic subject is a crucial factor in learning and achievement in that subject. Whether a student views himself as a strong or weak person in a specific subject may be an important in his or her academic achievement. Papanastasiou (2002) shared that there is a positive relation between mathematics and science achievement. According to Schreiber (2002) those who have a positive attitude towards mathematics have a better performance in the subject.

The reported gender difference in attitude towards mathematics and science influenced some researchers to study some affective variables as mediators of gender differences in mathematics achievement (Casey *et al.,* 2001). However, little consensus existed among researchers regarding the influence of affective variables on gender and mathematics achievement. Some studies reported statistically significant effects of effective variables on the learning of mathematics

(Casey *et al*, 2001; Ho *et al* 2001) while others indicated no relationship between attitude variables and mathematics achievement (Papanastasious, 2000). Even among those studies that found a significant relationship, there was still a controversy regarding the educational implications of the results.

A research was done in Gongola State, in Nigeria by Banu (2008) who examined attitudes towards sciences held by secondary school students in relation to their tutors. A descriptive survey design was employed and the research findings revealed that male students in general held a more positive attitude towards science especially mathematics irrespective of the teacher as compared to the female students. Similarly, Shumba (2008) surveyed the attitudes of students of form two and form four towards science subjects in Zimbabwe. In his study, form two students reported a significantly positive and favourable predisposition towards science subjects than the form fours. Olatunde, (2009) found out that those students who do well in a subject generally have more positive attitudes towards that subject and those who have more positive attitudes towards a subject tend to perform better in the subject. According to Bassey, Umoren and Udida (2008), students' academic performance in chemistry is a function of their attitude

In Kenya, Ali and Awan (2013) conducted a study to examine the relationship of attitude of secondary school students towards Science with the achievement in the subjects of Physics, Chemistry, Biology and Mathematics. The results indicated a significantly positive relationship between student attitude and the achievement of Science students at secondary level. SAMASSE (2003) conducted a study in Kenya and found out that teachers who had negative attitude towards teaching of science were reluctant to perform experiments. The study indicated that teacher attitude had strong influence on student's attitude and that the student attitude towards science had bearing on the achievements.

The aforementioned studies by Shumba, (2008) looked at student attitude towards sciences solely and Mata et al, (2012) looked at student attitude towards mathematics achievement solely; however the current study focused on student attitude towards sciences and mathematics as a factor that influences SMASSE implementation in secondary schools in Emuhaya Sub-County.

2.3.3 Student's Motivation

Affective factors that are emphasized in the science education literature are attitude, self-efficacy, anxiety and motivation (Ekici, 2005; Glynn, & Koballa, 2006; Mallow, 2006; Osborne, Simon & Collins, 2003; Uzuntiryaki & Capa Aydin, 2008; Yumasak, Sungur, & Cakiroglu, 2007). According to Osborne, Simon & Collins, (2003) motivation is the affective factor that is given more concern than the others in science learning.

There has been a considerable impact on students' achievement in science because of them being motivated (Pintrich & Schunk, 2002). Cavas, (2011) also found out that the students' motivation towards science learning has considerable impact on students' scientific attitude and achievement. Kohn (2001) carried out a study in the United States of America to find out the characteristics of motivated ECD children and pupils. He recommended that parents and teachers should build the confidence of children by giving them unstructured play and activities to support the development of motivation which enhance foundation for optional education growth.

The studies reviewed prior (Ekici, 2005; Glynn, & Koballa, 2006; Mallow, 2006; Osborne, Simon & Collins, 2003; Uzuntiryaki & Capa Aydin, 2008; Yumasak, Sungur, & Cakiroglu, 2007) focused on student motivation as a factor in science learning. However the current study sought to find out student motivation as a factor in learning both sciences and mathematics subjects in the implementation of SMASSE programme in secondary schools in Emuhaya sub-county.

2.4 Quality Assurance and Standards

This includes: resources and facilities, supervision of teachers' profession lesson preparation, observation of teaching and learning methods/lesson presentation.

2.4.1 Resources and Facilities

The Sessional Paper No.1 of 2005 on Policy Framework for Education, Training and Research (Republic of Kenya, 2005) observes that Quality Assurance and Standards Officers in-charge of science curriculum lack enough funding and essential facilities to enable them coordinate and supervise science subjects in secondary schools effectively in the country. Quality Assurance and Standards Directorate (2006) points out that science inspectors and field officers require: transport facilities, adequate stationary, adequate office transport facilities, funding to enhance proper monitoring and supervision of science subjects in secondary schools.

Tsungui (2006) conducted a study on primary learning environment in 20 primaries in 13 Midwestern in primary schools in U.S.A. He found out that primary institutions had a few quality learning materials in the learning environment but most of the learning materials were missing. This hindered most of the science activities in primary schools. The study showed that a half of the primary schools had science areas. The activities that the primary teachers engaged in were mostly un-related to science activities 86.8%, 4.5% of the activities were related to formal sciencing and 8.8% of the activities were related to informal sciencing. The study has great implication of science curriculum in primary schools. However, the study involved a small size (n=20).

Becker and Riel (2001) revealed that positive factors which encourage teachers' use of innovations to include school support from school heads, resource available for staff development and smaller class sizes. In view of Shumba, (2008), Sciences are practical subjects,

which should be taught by discovery or inquiry methods; however, the author acknowledges that teachers may lack enthusiasm of making mathematics subject enjoyable to others due to lack of instruments for practicals and experimental techniques. At the classroom level, the climate is made conducive in a number of ways. The secondary classroom are expected to be spacious and attractive (Shaji, 2007).

Migwi (2012) conducted a study in Gatanga district on impact of SMASSE on teaching and learning of Chemistry and the study findings revealed that school principal support enhanced implementation of SMASSE skills by the teachers. Similarly, Charles (2012) averred that the principal is instrumental in ensuring that SMASSE project succeeds in school. The school principal is expected to encourage and motivate teachers to practice SMASSE at school level. According to SMASSE Project (2005) mathematics requires involvement of both theoretical and practical work so that it is easily understood by the students. Each student is supposed to have a mathematics textbook because of the nature of the subject, which requires continuous assessment. Mutunga (2006) states that the availability of textbooks is likely to be reflected in the student's performance in Mathematics.

Albirin (2006) avowed that the availability of classrooms that are spacious and accommodative to all physics students is good for learning. The author continued and said that some space within the classroom is vital for some physics practical demonstrations and activities, connection to power supply for the classroom, as well as availability of natural light may be important when a teacher is tackling some topics in physics. In addition to that, an equipped laboratory is an important facility when it comes to the teaching and learning of physics at secondary school level in Kenya. Chepkwony (2011) conducted a study on the Challenges Facing the Implementation of SMASSE Project in Kericho District, Kericho County, Kenya. From the

findings, the main challenge faced by the principals was shortage of teachers in mathematics and science subjects.

The studies reviewed (Albirin, 2006; Mutunga, 2006) looked at quality of resources and facilities as a factor influencing the teaching of a single science subject. The current study was therefore done in Emuhaya Sub-County but not for a single science only.

2.4.2 Supervision on Teacher Preparation

Teachers play a crucial role in the preparation for secondary curriculum implementation (Mukuna, 2008). They address questions such as: Who will staff the SMASSE programme? How will the SMASSE classroom look like? What is the best way to group SMASSE students? Are all students present in the secondary schools? What are they going to learn and at what time? How much content will the secondary students learn in a single lesson or in a week? What objectives to be achieved in a single lesson? How does each and every science student perform in class?

According to CEMASTEA, (2010), a part from schemes of work and lesson plans, school heads should ensure that teachers carefully prepare by planning the lesson and trying out the teaching and learning activities as required by PDSI approach to teaching. The first part of PDSI is planning of the lesson and instruction outlining lesson activities based on ASEI principles (CEMASTEA, 2010). The second part of PDSI is "Do". The teacher carries the planned lesson activities as intended. The third part of PDSI is "See". Teachers evaluate teaching and learning process during and after the lesson objectives and planned activities. The last part of PDSI is "Improve". The teacher reflects on the performance, evaluation reports and effectiveness in achieving the lesson objectives. The teacher integrates good practices and feedback in subsequent lessons (Mwigwi, 2012). Ochanda (2010), in his study on mathematics teachers in

Emuhaya District reported that supervision of teachers' level of preparedness before lesson delivery was very low.

The current wanted to add to the existing knowledge discovered by Ochanda (2010) on supervision of teachers' level of preparedness.

2.4.3 QASO Supervision of Teacher lesson Presentation/teaching and Learning methods and Teacher Preparedness

According to Sushila (2004), the head-teacher is the leader in a school, the pivot around which many aspects of the school revolve, and the person in charge of every detail of the running of the school, be it academic or administrative. One of the roles of the head teacher as an instructional supervisor is to supply learning-teaching materials. The Teacher's Service Commission (TSC) has bestowed school head teachers with the mandate to supervise all that goes on in the school (Code of Regulation for TSC, 2014). According to SMASSE Project (2000), the specific roles of head teachers in the SMASEE programme include: utilizing scarce resources at their disposal more rationally towards academic activities for the benefit of the learners; mobilize all available resources, both human and physical, for enhancement of teaching and learning activities; conduct regular school-based supervision of teaching and learning activities; and organize regular seminars and workshops for mathematics and science teachers through science congress.

According to Waititu & Orado, (2009), the ASEI movement and PDSI approach should ensure that there is learner participation and the variation of stimuli by the teacher for effective learning. In view of Wambui, (2005), the ASEI principle is based on the fact that students do not simply copy the science world; rather, they construct their own meaning of it while in the report of SMASSE Project (2002) ASEI movement is thought to enable learners develop an inquiry mind, develop the skills of making accurate observations, drawing conclusions and holding discussions

to enhance learning and development of skills. Important techniques at secondary level are observation, isolation and control of variables which are student centred method (Shaji, 2007).

In her study, Wambui (2006) found that school head teachers had a significant effect on teachers' teaching practices. School head teachers as supervisors play an important role within the SMASE project, they ensure that the mathematics teachers attend the SMASE training, they sensitize and stress the importance of the INSET, provide the necessary support that the teachers need to implement the strategies and new approaches used during the ASEI-PDSI lessons, they also monitor and evaluate the classroom activities of the teachers who have attended the SMASE training (Wafubwa, 2014). The school head should also provide the necessary support and understanding especially to teachers with emotional needs as well as those who are new in the profession (CEMASTEA, 2012).

Benedict (2013) reveals that a majority of aspects of supervision are rarely practiced by school heads leading to inadequate use of ASEI-PDSI in mathematics lessons in Nyamaiya Division, Nyamira County. A study by Ngetuny (2013) in Koibatek Sub-County on the implementation of ASEI-PDSI in the teaching of mathematics in secondary schools revealed that more than half of the schools in his study area lacked a monitoring mechanism to check whether what is expected by SMASE in the teaching and learning of mathematics is actually done. Itolondo (2008) mentioned that observation of teachers during instruction, which is an aspect of supervision, was done in very few schools in his study area hence inadequate use of ASEI-PDSI. In a critical investigation into the nature and quality of INSET programmes for further education and training of mathematics teachers Mensah (2008) found out that monitoring and supervision of teachers after the INSET attendance was not being done effectively as principals and HODs rarely visited teachers in class nor did external specialists.

The current study aimed at adding to the existing knowledge as found out by Benedict and Ngetuny (2013) though with a special focus on secondary schools in Emuhaya Sub-County.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter outlines the procedure and methods the researcher employed in order to obtain data needed for the study. It comprises the research design; area of study, the study population, the sampling techniques, research instruments, and data collection procedure methods of data analysis and presentation.

3.2 Research Design

The study used both descriptive survey and correlational designs. This was considered sufficiently robust and appropriate for this study since it involves asking a group of people questions about their perception towards a particular issue at hand (Frankel & Wallen, 2011). Descriptive survey was used, the study sought to find out opinions, attitudes, knowledge and perception of science and mathematics teachers, principals and form four students to establish factors influencing the implementation of SMASSE in public secondary schools in Emuhaya sub-county. It allows for quick data collection in a relatively short time at comparatively cheap cost and aims at describing the nature of existing conditions and determining the relationship that exists between independent and dependent variables (Orodho, 2011). Correlation design on the other hand enabled the researcher to assess the degree of relationship that existed between the teacher, students and quality assurance based factor that influence the implementation of SMASSE in secondary schools in Emuhaya (Aldrich, 1995).

3.3 Area of Study

The study was conducted in Emuhaya Sub-county in Vihiga County. Emuhaya Sub-county is one of the four Sub-counties in Vihiga County. Appendix E is a map of Kenya showing the

position of Emuhaya Sub-county. The area is located between latitude 0°5'S and $0^0$15'N and Longitude 34^0 30'E and 35°0'E. It boarders Khwisero Sub-County to the North, Vihiga Sub-County to the East, Kisumu West Sub-County to the South and Gem Sub-County to the West. The Sub-County is densely populated and it is divided into four administrative divisions; Luanda, Elukongo, Esiembero and Ekwanda. According to the 2009 National Census Report, the Sub-County had a population of 162, 712 (Republic of Kenya, 2011). It covers a total area of 172km², this translates into 935 persons per square kilometers making it one of the highly populated areas in Kenya and thus impacting negatively on the available resources.

The Sub-County also experiences high poverty levels, which stand at 56.7% of the total population (Republic of Kenya, 2002). Furthermore 53.3% of the households in the Sub-County live below the poverty level.

Agriculture plays an important role in producing employment to the rural communities in the Sub-County (Republic of Kenya, 2002). Out of a total of 38 secondary schools in the Sub-County, there are 37 public and only 1 private secondary schools (Sub-County Education office, 2017). The Sub-County in the recent past recorded improved enrolment in public secondary schools especially after the inception of subsidized secondary education unlike in private secondary schools where education is still not subsidized (Sub-County Education Office, Emuhaya 2015).

The Sub-county was chosen as an area of study due to following reasons; First, the performance of Mathematics and Science has been poor. All subjects recorded an average mean score of about 4.00 out of a possible 12 points in the last three years in KCSE examinations. The second reason for choosing Emuhaya Sub-county was that no empirical study had been carried out on

factors influencing the implementation of SMASSE in the Sub-County. The study was carried out in 33 public secondary schools in Emuhaya Sub-County, Kenya.

3.4 Study Population

The target population comprised of 37 principals, 196 Mathematics and Science teachers, and 2543 form four students of 2018 (Sub- County Education office, Emuhaya 2017).

3.5 Sample Size and Sampling Techniques

As Chambers and Skinner (2011) note that the primary issue on choosing a sample size is to ensure that the sample size is sufficient to act as a representation of the population from which it is drawn. Saturated sampling technique was used to select 33 principals representing 89.189 after using 10% study population in the pilot study. Saturated sampling is a non-probability sampling procedure in which all members of the target population are selected because they are too few to make a sample out of them (Gall, Borg and Gall, 2011).

Simple random sampling technique was used to select a sample size of 65 form four teachers of Mathematics and Science (33% of the study population) as a third of the study population is the convenient sample size of the survey study (Mugenda & Mugenda, 2011). Simple random sampling was used because it is a technique in which every member has an equal chance of being selected (Bartlett *et al,* 2011). Simple random sampling was also used to select 254 students of form four in the year 2015 (10% of the study population), as 10% of the target population is large enough so long as it allows for reliable data analysis by cross tabulation (Kirlinger, 2009). The sample frame is shown in Table 3.1.

Table 3.1: Sample Frame

Category of Respondents	Population N	Sample (n)	Percentage %
Principals	37	33	89.19
Maths & Sci. Teachers	196	65	33.67
Form Four Students	2543	254	10

The population was stratified into Boys, Girls and mixed Secondary schools. The study used proportionate allocation to sample depending on different population size. The sample frame (schools stratified by type) is given in Table 3.2.

Table 3.2: Sample Frame

School Type	No. of school (N)	Sample (n)	Students	Sample (n)	Percentage %
Boys	4	2	463	47	10
Girls	5	2	606	61	10
Mixed	29	10	1449	145	10

3.6 Research Instruments

3.6.1 Questionnaire

A questionnaire is a written document with questions that should be responded to in writing.

3.6.1.1 Principals' Questionnaire

This instrument was administered to Principal. It contained both closed and open ended items to solicit views and ideas from Principal on SMASSE training in relation to teacher and student attitude, extent of practice of ASEI-PDSI in classroom, teacher effectiveness in employing the approach in teaching and learning. It was used to collect general information on educational resources available in the school, measures instituted in the use of ASEI-PDSI, the capacity to supervise the implementation of ASEI-PDSI and performance in KCSE in sciences.

3.6.1.2 Teachers' Questionnaire (TQ)

This tool was used to collect information on teacher experience, teacher attitude towards teaching sciences, teacher profession and academic qualification, in-service training, methods of teaching used in science subjects, availability of teaching and learning resources and improvisation apparatus. The questionnaire had two formats; one involving answering questions and the second was a Likert scale to measure attitude towards science with special reference to objectives, content and methodology (ASEI-PDSI).

3.6.1.3. Student Questionnaire (SQ)

This solicited the following data from students; their demographic characteristics, their attitude towards science subjects, and entry behavior levels.

3.6.2: Document analysis guide

The professional documents of the science and mathematics teachers and the students' exercise books were analyzed in this study.

3.7 Validity and Reliability of Research Instruments

3.7.1 Validity of Research Instruments

Validity refers to the degree to which results obtained from analysis of data actually represents the phenomenon under study. The validity of research instruments was done through expert opinion's revision (Mugenda & Mugenda, 2003). The validity of research instruments was ascertained by presenting them to three experts from the department of Educational Management for scrutiny and verification. They made their judgment on the instruments independently and made recommendations on their face validity. Improvements were then made based on their recommendation before instruments were finally used in the field.

3.7.2 Reliability of Research Instrument

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials (Mugenda and Mugenda, 2011). In this study, reliability was determined by the test retest method for the internal consistency of the instrument. A pilot study was therefore conducted using 10% of the study population that is 4 principals, 19 teachers and 32 students. The scores from the two tests were correlated using Person's Moment Correlation. Reliability coefficients of 0.74, 0.79 and 0.76 were obtained for the principal, teacher and student questionnaire respectively which were reliable, because according to Frankel and Wallen (2011), an alpha value of 0.7 and above is considered suitable to make group inferences that are accurate enough.

3.8 Data Collection Procedures

The researcher first sought permission from Maseno University Ethics Committee through the school of graduate studies, Maseno University. In stage one the researcher sent notification letters to the SCDE, Principals of sampled schools in Emuhaya Sub-County. In stage two, the researcher visited each sampled schools to distribute questionnaires to the Principals, Science and Mathematics teachers and the form four students to fill. Students in each sampled school were put in one room where questionnaires were administered to them. The third visitation involved collection of filled questionnaires from Principals and science and Mathematics teachers.

3.9 Data Analysis Procedure

Quantitative data collected from closed – ended questions were analyzed using both descriptive and inferential statistics. Descriptive statistics involved statistic such as means, standard deviations and frequencies with their percentages. The inferential statistics used were Pearson Product Moment Correlation, Scatter plot and regression analysis to investigate the relationship

of the variables to help make inferences and draw conclusions. All test of significance were computed at α=0.05. After analysis, the quantitative data was presented in form of frequency tables, bar graphs and pie-charts to give an overview of the respondents' views. For the qualitative data, a thematic analysis approach was used. The basic analysis of the data concerning use of ASEI-PDSI, teacher attitude towards SMASSE programme were done in terms of measures gained in the attitude scale (rating scale). The memorial scores were assigned 5 response options given to each item in the rating scale. Mean scores were then computed for each respondent and each contributes. The statistical package for social science (SPSS) version 22 was used to analyses the data.

The Pearson correlation coefficient, R, shows the strength and direction of a relationship in statistics.

Key for the Pearson correlation coefficient

R values of 1 indicate a perfect relationship, R values >0.50 indicates a strong correlation, R values >0.30 and < .50 indicate moderate correlation while, R values < 0.30 indicate a weak correlation, (Bonett, 2008).

Key for correlation significance

P values < .05 indicate correlation is significant and > .05 indicates correlation is insignificant, (Anderson et. al, 2000).

Interpretation of mean

Mean shows the distribution of the responses from the study participants in relation to the rating scale (Spicy, 2008). For example in a rating scale of 4 where 1 represents strongly agree, 2 represents agree, 3 represents disagree and 4 represents strongly disagree, if the mean is 3.1 shows that most of the respondents disagreed with the idea, 3.7 shows that most of the

respondents disagreed and strongly disagreed, 4.0 or 4.shows that most respondents strongly disagreed.

Qualitative data was summarized into emerging themes and presented objectively

3.10 Ethical Consideration

The ethical consideration considered three principles, namely; respect of person, beneficence and justice and confidentiality. The researcher treated all participants as autonomous persons, their opinion and choices would not be influenced in any way by refraining from abstracting their actions. The participants were well informed of the purpose of the study and explanations on both benefits and risks provided to ensure they were not denied the freedom to act on those considered judgment, or to withhold information necessary to make a considered judgment.

Confidentiality was considered in that the researcher ensured that their information was treated with privacy and only for the purpose of the study. Data collected was corded and had no names of the participants to protect their identity. Raw data from the field was kept under lock and key where only the investigators accessed. Justice in sampling the study involved student participation by gender in public secondary schools. To ensure fairness, proportionate random sampling was used to ensure equal opportunities for both girls and boys. A consent form was issued to students in the selected schools, who then presented their parents or guardians for signing and approval to participate.

CHAPTER FOUR

FINDINGS, INTERPRETATION AND DISCUSSION

1.1 Introduction

This chapter presents the findings and interpretation of the study. The chapter has been sub-divided into sections and subsections. The demographic information of the respondents has been presented first. The demographic information include type of the school, highest qualification, teaching experience, teaching subjects and years of experience of the teacher respondents, and gender, type of the school and subject of the student respondents. After the demographic findings of the study have been discussed the research findings were presented on the basis of the study objectives, but first to: Investigate the extent of implementation of the skills learnt in SMASSE in teaching and learning in mathematics and science lessons in secondary schools of Emuhaya sub-county, establish the influence of teacher based factors on the implementation of SMASSE programme in secondary schools in Emuhaya Sub-County, establish the influence of student based factors on the implementation of SMASSE programme in the secondary schools in Emuhaya Sub-County and examine the influence of quality assurance factors on the implementation of SMASSE programme in secondary schools in Emuhaya Sub-County.

4.2 Questionnaire Response Rate

Table 4.1, which shows the summary of return rate of questionnaires from the respondents, reveals that the questionnaires were adequate for the study.

Table 4.1: Questionnaire Return Rate

Respondents	Questionnaires administered	Questionnaires returned	Return rate (%)
Students	254	214	84.3
Teachers	65	65	100.0
Principals (QASO)	33	32	90.9
Total	**352**	**311**	**88.4**

Table 4.1 shows that in overall, 88.4% of all the questionnaires were returned for analysis; which was considered quite satisfactory. Out of 254 questionnaires administered to the students, 214 of them were returned for data analysis, which translates to 84.3% response rate. On the same note, 100.0% and 90.9% the teacher and principal respondents' questionnaires were returned, respectively. According to Oso and Onen (2009) the acceptable response rate for a survey questionnaire administered personally by the researcher is achieved when the questionnaire return rate is 80% and above. This was achieved because the instruments in this study were personally administered by the researcher to the respondents.

4.3 Demographic Information of Respondents

4.3.1 Teachers Respondents Demographic Characteristics

The teacher respondents' demographic characteristics included; type of schools where the teachers were teaching, professional qualifications, experience and subjects of specialization.

From Table 4.2 it is evident that 44(67.7%) of the teachers who took part in the study were from mixed secondary schools and the rest were from either boys or girls secondary schools. Although teachers from mixed schools were, presentation from other type of schools confirm that all the types of the schools were presented in the study, an indication that there was no bias in capturing

the views of the teachers, implying that the results can easily be generalized to all the types of schools. Similarly, to investigate professional qualifications of the teachers who participated in the study. This was necessary because knowledge of professional qualifications of the teacher respondents was considered an important component of the teacher factor in the implementation of SMASSE programme

Table 4.2: **Teacher Respondents' Bio-Data (n=65)**

Item	F	(%)	Cumulative %
Type of School			
Boys school	12	18.5	18.5
Girls school	9	13.8	32.3
Mixed school	44	67.7	100.0
Total	**65**	**100.0**	
Professional Qualification			
Untrained	3	4.6	4.6
Diploma	6	9.2	13.8
B/Education	53	81.6	95.4
Masters	3	4.6	100.0
Total	**65**	**100.0**	
Experience			
1-3 Years	31	47.7	8.2
4-6 Years	19	29.2	36.8
7-9 Year	5	7.7	87.8
10 and above years	10	15.4	100.0
Total	**65**	**100.0**	

Source: Survey data (2016)

It emerged from the exploratory data analysis that, 56 (86.2%), of the teachers had at least bachelor's degree in education, implying that they had sufficient qualification to implement SMASSE approach. Similarly, as regards their experience in teaching, 31 (47.7%) of the teachers had experience of 1-3 years, more than one out of every five, 15 (23.1%), of them had over seven years of experience as science and mathematics teachers. This suggests that many of the teachers had adequate experience in teaching of science and mathematics which is requisite requirement for effective implementation of SMASSE programme in schools.

4.3.2 Students Respondents Demographics

The demographic characteristics of the students who took part in the survey were summarized, as in Table 4.3.

Table 4.3 Students Respondents' Bio-Data (n=214)

Item	Frequency	(%)	Cumulative %
Gender			
Boys	105	49.1	49.1
Girls	109	50.9	100.0
Total	214	100.0	
School Type			
Boys school	21	9.8	18.5
Girls school	29	13.6	32.3
Mixed school	164	67.7	100.0
Total	214	100.0	
Entry Behaviour (KCPE Marks)			
Above 350	15	7.0	7.0
300 – 349	76	35.5	42.5
250 – 299	90	42.1	84.6
Below 250	33	15.4	100.0
Total	214	100.0	

Source: Survey data (2018)

Table 4.3 shows that both gender were almost equally represented in the study, with girls being slightly more 109 (50.9%) than boys. Similarly, although of the study revealed that students from mixed secondary schools formed 164 (67.7%) of the respondents, the other two types of schools were equally represented in the survey. Regarding the students entry behaviour to secondary schools, the students were asked to indicate their KCPE marks. From the analysis of their KCPE marks, highest proportion 90 (42.1%) of the students had attained 250 – 299 marks, only 15 (7.0%) of them scored 350 and above. This implies that a significant majority of the students proceeded to public secondary schools in Emuhaya Sub-County with fairly low KCPE scores.

4.4 Extent of Implementation of SMASSE Programme

SMASSE is grounded on the premise that learners learn better when they are involved in doing through discussions, improvisation, use of experiments and other activities, with emphasis on the learners as the central focus of learning. The researcher first sought the views of teachers which were collected using a five-point scale (4=Always, 3=Mostly, 2=Sometimes, 1=Rarely, 0=Never), where "Never" implies complete lack of evidence of use of the indicator and "Always" implies evidence all the times of use of the indicator. The findings are presented and discussed below. To interpret the level of implementation of SMASSE, the means were collapsed into three ordinal categories; Low (1.00-2.33), Moderate (2.34-3.66) and High (3.67-5.00). Table 4.4 shows the summary of teachers' response on implementation of SMASSE on page 48.

Table 4.4: Teachers' View on Implementation of SMASSE Programme (n=65)

Item	Always	Mostly	Stms	Rarely	Never	Mean
My lessons are activity-focused and always give practical work during teaching and learning.	9 (13.8%)	24 (36.9%)	19 (29.2%)	8 (12.3%)	5 (7.7%)	2.54
I give my learners appropriate tasks for discussion and I effectively encourage them to relate them to their prior experiences.	20 (30.8%)	10 (15.4%)	13 (20.0%)	13 (20.0%)	9 (13.8%)	2.34
I inspire students to give their own hypotheses/predictions and to give their own results/ observations in experiments.	24 (36.9%)	12 (18.5%)	8 (12.3%)	13 (20.0%)	8 (12.3%)	2.28
I encourage students to evaluate my lessons at the end.	17 (26.2%)	8 (12.3%	7 (10.8%)	14 (21.6%)	19 (29.2%))	2.54
I use improvised materials available in the students' immediate environment in teaching and learning.	7 (10.8%)	19 (29.2%)	18 (27.7%)	6 (9.2%)	15 (23.1%)	2.03
I incorporate previous knowledge, skills and everyday experience on what I want the students to learn.	12 (18.5%)	17 (26.2%)	21 (20.0%)	11 (21.5%)	4 (24.6%)	2.00
I conduct my lessons by taking into account the individual differences in student abilities and always attentive to the needs of the students of both low and high academic ability.	16 (24.6%)	17 (26.2%)	14 (21.5%)	13 (20.0%)	5 (7.7%)	2.37
I check accuracy, correctness and depth of content through question and answer technique, and encourage learners to view content in relation to what they come across in the society.	36 (55.4%)	12 (18.5%)	5 (7.7%)	10 (15.4%)	2 (3.1%)	2.91
Average score of implementation of SMASSE approaches according the teachers						**2.54**

It was revealed that lessons were activity focused with a mean of 2.54 and similarly students were encouraged to evaluate teachers lesson recorded a mean of 2.54 implies that they mostly implement the SMASSE programme. The rest of items had a mean between 2.00-2.37 implies that teachers sometimes implement the SMASSE programme. The only area where teachers evaluated learners on taught content through question and answer technique recorded 1.91 implying the technique was not implemented. About a half (mean=2.54) of mathematics and science teachers who took part in the survey indicated that their lessons were activity-focused and mostly gave practical work during teaching and learning a sign of implementation of SMASSE approach, some of them said they only did this sometimes but a small proportion of the teachers consented that they hardly or had never used practical work during teaching and learning mathematics. It was established that use of improvised materials available in the students' immediate environment in teaching and learning was moderate (mean=2.03) among the teachers. This was revealed by the sharp division among the teachers on this matter, while some accepted that they had never improvised any teaching and learning aids from the environment, others said that they mostly improvised their teaching and learning aid. Similarly, some teachers confirmed (mean=2.34) that they always give their students appropriate tasks for discussion and they effectively encourage them to relate them to their prior experiences. In addition, just about one out of every four of the teachers alluded (mean=2.00) that they mostly incorporate previous knowledge, skills and everyday experience on what they want their students to learn.

Similarly, the study found that only few (mean=2.28) of the teachers always inspire students to give their own hypotheses/predictions and to give their own results/ observations in experiments. On the same vein, just about a quarter of the teachers agreed that they mostly conduct their lessons by taking into account the individual differences in student abilities and always attentive

to the needs of the students of both low and high academic abilities. However, the finding of the study show that majority (mean=2.91) of the teachers who took part in the survey indicated that they check accuracy, correctness and depth of content through question and answer techniques, and encourage learners to view content in relation to what they come across in the society. On the contrary, although some of the sampled teachers always encourage (mean=2.54) students to evaluate their lessons at the end, others said they rarely did this, while some of the teachers who were sampled for the survey confirmed that they had never involved their students in evaluating them at the end of their lesson.

With an overall mean of 2.25, it was implied that according to teachers in majority of the schools in Emuhaya Sub-County, SMASSE was implemented sometimes and not always as it should be. The researcher went further to seek the students' respondents that were as well collected using a five point scale (4=Always, 3=mostly, 2=sometimes, 1=rarely and O=Never), Where "Never" implies lack of evidence of the use of the indicator and "Always", implies evidence all the times of the use of the indicator. The findings were presented and discussed on page 51.

Table 4.5: Students Views on Implementation of SMASSE Programme (n=214)

Item	Always	Mostly	Stms	Rarely	Never	Mean
Our mathematics and science lessons are activity-focused and always give practical work during teaching and learning.	63 (29.4%)	70 (32.7%)	25 (11.7%)	34 (15.9%)	22 (10.3%)	2.55
The teachers give us appropriate tasks for discussions encourage us to relate them to our prior experiences.	71 (33.2%)	55 (25.7%)	41 (19.2%)	26 (12.1%)	21 (9.8%)	2.60
My teachers encourage us to evaluate his/her lessons at the end.	61 (28.5%)	40 (18.7%)	35 (16.4%)	48 (22.4%)	30 (14.0%)	2.25
The teachers use improvised materials available in our immediate environment in teaching and learning.	64 (29.9%)	49 (22.9%)	43 (20.1%)	34 (15.9%)	24 (11.2%)	2.44
The teachers incorporate previous knowledge, skills and everyday experience on what they want us to learn.	75 (35.0%)	44 (20.6%)	27 (12.6%)	44 (20.6%)	24 (11.2%)	2.48
My teachers conduct lessons by taking into account the individual differences in student abilities and are always attentive to the needs of the students of both low and high academic ability.	56 (26.2%)	53 (24.8%)	37 (17.3%)	36 (16.8%)	32 (15.0%)	2.30
My teacher helps us correct the work we have done during the lesson	73(34.1%)	41(19.2%)	38(17.8%)	47(21.9%)	15(7.0%)	2.42
My teacher gives us work during the lesson which he/she checks and marks during the lesson	54(25.2%)	57(26.6%)	35(16.4%)	29(13.6%)	39(18.2%)	2.38
Average score of implementation of SMASSE approaches according the students						**2.44**

From the views of the students (Table 4.5), the study showed that the opinion that their mathematics and science teachers moderately (average score=2.44) used SMASSE techniques in

teaching and learning. For instance, 133 (62.1%) of students who took part in the survey agreed (mean = 2.55) that their mathematics and science lessons were activity-focused and always give practical work during teaching and learning. In addition, about half, of the student respondents confirmed that their teachers use improvised materials available in their immediate environment in teaching and learning.

However, the students held a conviction that teachers do not conduct lessons by taking into account the individual differences in student abilities and are never attentive to the needs of the students of both low and high academic ability. This point of view was held by 68 (31.8%) of the students who participated in the study, translating a mean response of 2.30. Similarly, only some (mean=2.60) of the students held a perception that the teachers give them appropriate tasks for discussions and encourage them to relate point of discussion to their prior experiences.

It was established by the study findings that significant proportion of the students were in agreement (mean= 2.48) that their teachers incorporate previous knowledge, skills and everyday experience on what they want them to learn, an indication of application of SMASSE ideas. In the same vein, although some of the student respondents did not believe that their teachers gave them the opportunity to evaluate them at the end the teachers lessons, a considerable proportion others said that their teachers encourage them to evaluate their lessons at the end. This indicates a mixed opinion of the student on the teachers' effort to implement SMASSE teaching and learning approaches, translating to a mean response of 2.25. Lastly, some students said that their teachers always helped them correct the work they had done during lessons (mean=2.42); however slightly a smaller number of the students said this was rarely done. Similarly, 57(26.6%) and 54(25.2%) students said their teachers mostly and always gave them work which they checked and marked during lessons, translating to a mean response rate of 2.38.

In conclusion with regards to students, it was revealed that implementation of SMASSE had a mean of 2.44; an implication that SMASSE was partly implemented or rather it was sometimes implemented.

Various documents including teachers and students were also analyzed. These documents included teachers' professional documents, students' exercise books and learning materials. The results were as follows: From the 65 teachers who participated in the study, the researcher sampled and reviewed their professional teaching documents, 33 had no schemes of work, 47 had no ASEI-PDSI lesson plans but 63 of them had up to date filled records of work covered. All the 65 teachers had progress record for pupils. The researcher also went round the 33 schools that were sampled as part of the study to see if they had teaching and learning materials and these were the findings: Only 17 schools had equipped laboratories and few schools had improvised teaching materials; 12 schools had 5-litre Jerri cans as aspirators and 19 schools had sodium hydroxide pellets to be used in place of anhydrous calcium chloride.

Finally, the researcher went round the 33 schools that participated in the study in order to look at the students' exercise books; 6-7 form four students in each school were considered and this is what transpired: All the 214 students had science notes; the researcher also discovered that they frequently wrote assignment and did science quizzes as well as having science diagrams but most of them lacked recorded work from observed experiments. It was therefore noted from the document analysis that the implementation of SMASSE in teaching was not fully embraced in most public secondary schools of Emuhaya Sub-County.

These findings from the principals, teachers and students as well as the document analysis reflected the state of the student outcome in mathematics and science subjects in the Sub-County.

The study findings were different from those of Khadija (2009) on the impact of INSET course on teachers which reported that they implemented what they learnt in the INSET. However, they were similar to those by Odawa (2013) who carried out a study on assessment of the impact of strengthening of Mathematics and Science education in secondary education programme on teaching and learning of Biology in Emuhaya Sub-County and his findings revealed that teachers perceived SMASSE as an important programme. However, its impact on their classroom practice was minimal due to its structure and understaffing. For that reason, Odawa (2013) suggested for further research on factors that hinder effective implementation of SMASSE programme in Emuhaya Sub-County. From this, the researcher was prompted to look at the factors that could be affecting the implementation of SMASSE in this Sub-County.

4.5 Influence of Teacher Based Factors Influencing Implementation of SMASSE Programme in Secondary Schools in Emuhaya Sub-County

The first objective of the study was to establish the influence of teacher based factors on the implementation of SMASSE programme in secondary schools in Emuhaya Sub-County. This objective was explored by use of a Likert scaled questionnaire which was used to collect the views of both the students and teachers. The respondents were presented with questionnaire having items whose constructs were related to teacher factors presumed to have bearing on implementation of SMASSE programme in secondary schools. The views were sought with regard to the degree of agreement of the teacher factor. The characteristics explored were; Training on SMASSE INSET and teaching methods, Teacher Attitudes and Teacher Motivation. Other teacher factors investigated were their professional qualification and level of experience. The findings are presented and discussed in percentage frequencies.

4.5.1 Training on SMASSE Programme and Teaching Method

The study sought to establish the number of science and mathematics teachers who had gone through SMASSE training programme. The finding was summarized as in pie chart in Figure 4.1.

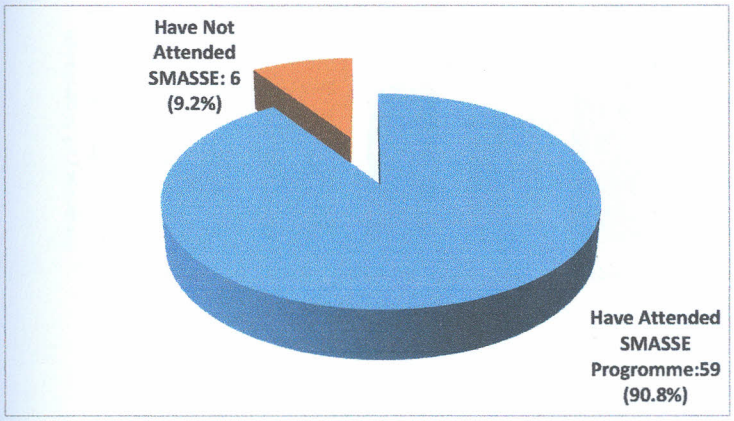

Figure 4.1: Attendance of SMASSE Training Programme

Figure 4.1 reveals that significant of the science and mathematics teachers in secondary schools in Emuhaya Sub-County had gone through SMASSE programme, as reflected by 59 teachers which translates to 90.8% of all the teachers who took part in the survey. It emerged that many of the teachers who had not gone through SMASSE programme pointed out the issue being involved in many school programmes such as sports which, they said, clashed with SMASSE training times, others said they had not been given opportunity by their principals to attend the SMASSE training sessions and a few others attributed their failure to attend the trainings to their lack of interest in the programme.

On the number of cycles of SMASSE training programmes attended by the teachers, the findings of the study show that majority 41 (63.1%) of the teachers had attended the INSETs more than

one cycle. Those who had attended the programme four times formed about 16 (24.6%) of the science and mathematics teachers in Emuhaya sub-county. However, those who attended the training session in one cycle were only 18 (27.7%) of the teachers who took part in the survey, as indicated in Figure 4.2.

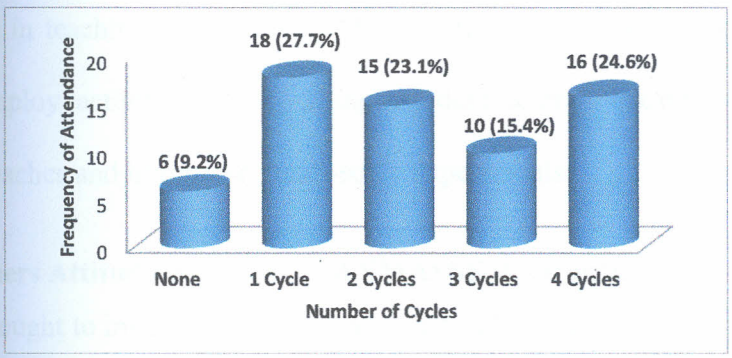

Figure 4.2: Number of Cycles of SMASSE Training Attended by Teachers

It emerged that a significant majority of the science and mathematics teachers in Emuhaya sub-county agreed that SMASSE INSET was relevant and appropriate to the use of experiment teaching and learning of science and mathematics, as reflected by 51 (78.7%) of the teachers who took part in the survey. Those who believed that SMASSE INSET was relevant said it involved the learners, incites their curiosity and motivates them to participate in the teaching and learning process.

On the teaching method, almost all, 61 (93.8%), the science and mathematics teachers who were sampled for the study alluded that they used Child Centred Approach of teaching during their science and mathematics lessons. This is in line with the objectives of the SMASSE INSET programme, which inculcate a positive attitude in the teachers teaching mathematics and science subjects; to encourage teachers to change from the teacher-centred (didactic) approach of

teaching to the child-centred approach (heuristic approach); and to encourage teachers to improvise teaching resources and materials from cheap and locally available materials. Equally, more than four out of every five, 53 (81.3%), of the teacher respondents said they do practice ASEI-PDSI in teaching and learning Mathematics and Science subjects. This implies that the teachers employ activity-based teaching, student-centred learning, experiment and research-based approaches and improvise small-scale experiments.

4.5.2 Teachers Attitudes on the Use of SMASSE Approach

The study sought to investigate the teachers' attitudes towards use of SMASSE approaches. This was necessary because in the SMASSE INSET, the theme of cycle one is attitude change, in which focus is on development of positive attitude as a pre-requisite for quality teaching and learning of mathematics and science. The respondents were presented with Likert-scaled itemed questionnaire whose constructs were related to attitudes in teaching of mathematics and science. Their views were computed in percentage frequencies, as shown in Table 4.6 on page 61.

Table 4.6: **Views of the Respondents on Teachers' Attitude (n=65)**

Items	SA	A	MA	D	SD	Mean	Std.
SMASSE programme has greatly improved my lesson delivery.	9 (13.8%)	28 (43.1%)	12 (18.5%)	11 (16.9%)	5 (7.7%)	3.38	1.15
SMASSE programme has negative impact on development of learners in my subject(s) areas.	9 (13.8%)	18 (27.7%)	16 (24.6%)	13 (20.0%)	9 (13.8%)	3.08	1.26
Teachers are over worked and cannot work well in class using SMASSE teaching approach.	22 (33.8%)	18 (27.7%)	4 (6.2%)	12 (18.5%)	9 (13.8%)	3.49	1.46
SMASSE teaching approach is not interesting to the teachers.	14 (21.5%)	10 (15.4%)	9 (13.8%)	16 (24.6%)	16 (24.6%)	2.85	1.49
The implementation of SMASSE programme is tedious.	9 (13.8%)	12 (18.5%)	25 (38.5%)	6 (9.2%)	13 (20.0%)	2.97	1.28
Preparation of teaching and learning of Science and Mathematics as per SMASSE approach is not easy and should be discouraged.	11 (16.9%)	20 (30.8%)	19 (29.2%)	9 (13.8%)	6 (9.2%)	3.32	1.18
SMASSE training given to teachers is not adequate to aid a teacher in effective classroom delivery.	8 (12.3%)	12 (18.5%)	15 (23.1%)	20 (30.8%)	10 (15.4%)	2.82	1.25
Average Teacher Attitudes Towards the Use of SMASSE						**3.18**	**0.80**

Key: SA-Strongly Agree, A-Agree, MA-Moderately agree, D-Disagree, SD -Strongly Disagree.

The findings of the study show that teachers exhibited varied but moderate (mean=3.18; standard deviation=.80) attitude towards use of SMASSE programme in teaching science and mathematics. For example, whereas more than half of the teachers who were sampled for the survey stated that they normally follow SMASSE approach strictly in teaching and learning of science and mathematics in their lessons, some of them indicated that they never use SMASSE approach in teaching their lessons and the others revealed that they were not sure whether they use it or not, translating to mean teacher attitude of 3.38.

The teachers who used SMASSE programme in their teaching and learning sessions confirmed that its use has greatly improved their lesson delivery, as was indicated by many of the teachers who took part in the survey. In fact more than a third of the teacher respondents refuted the belief by some of their colleagues that SMASSE programme has no significant positive impact on development of learners in their subject(s) areas. This implied that many of the teachers had positive moderate attitudes (mean=3.18; standard deviation=0.8) towards SMASSE programme.

The teachers who held negative attitudes towards the use of SMASSE in teaching and learning science and mathematics insisted that teachers are over worked and cannot deliver well in class using SMASSE teaching and learning approach. This point of view was held by about one out of every three teachers who were sampled for the study who alluded that teachers are over loaded and use of SMASSE in their teaching and learning is not worth it. Similarly, although nearly a half of the teachers who participated in the study contended that SMASSE teaching approach is interesting to the teachers and learners, some of them were of the general feeling that use of SMASSE in teaching and learning is boring to the teachers and others added that the implementation of SMASSE programme is tedious, as reflected by a mean teachers attitude of 2.97.

It emerged from the findings of the study that some of the teachers who took part in the survey held that preparation of teaching and learning of science and mathematics as per SMASSE approach is not easy and consumes a lot of teachers' time. However, the teachers were sharply divided in opinion (mean=2.85) on whether SMASSE training given to teachers is adequate or not. Whereas, some of the teachers who took part in the survey insisted that the training is not adequate to enable teachers to be effective, on the other hand some of them said that the training given to the teachers is adequate enough to aid effective classroom teaching. This finding

supports the tenets for which the SMASSE programme was initiated of equipping teachers with new skills for teaching mathematics and sciences and assisting them to develop improvised teaching and learning materials, all geared toward improving performance and giving learners a positive attitude to the subjects. (Cote & Leine, 2000, Singh, Granville 2000) their studies agree that motivation attitude have strong impact on learning a new teaching method and hence positive students' achievement similarly, Handal, Bobis and Grimson (2001) agree with this findings that attitude of teachers influence curriculum implementation. Teachers attitude have a strong bearing on teaching and learning and Karen (2002) agrees with this findings that as her study on the effects of science workshop on teacher's attitude towards science. The finding indicated that participation in the workshop increased teacher's attitude on the new teaching methodology. Workshop enhances teacher's methodology.

4.5.3 Teacher Motivation

The study investigated the level of teachers' motivation towards use of SMASSE of programme in schools. This was done by presenting the teacher respondents with Likert scaled items whose constructs were based on indicators of teacher motivation. Their views were summarized in percentage and frequencies as shown in Table 4.7 on page 61.

Table 4.7: Views of the Respondents on Teachers' Motivation (n=65)

Items	SA	A	MA	D	SD	Mean	Std.
The certificate acquired by teachers after SMASSE training assist them in teacher promotion.	21 (32.3%)	18 (27.7%)	6 (9.2%)	11 (16.9%)	9 (13.8%)	3.48	1.44
It is quite motivating to teach Science and Mathematics by using SMASSE approach.	19 (29.2%)	13 (20.0%)	11 (16.9%)	12 (18.5%)	10 (15.4%)	3.29	1.44
Using SMASSE Approach in teaching and learning does not assist students in performing well in Mathematics and Science in KCSE.	18 (27.7%)	14 (21.5%)	16 (24.6%)	10 (15.4%)	7 (10.8%)	3.40	1.32
Students' progress well in my teaching subject as a result of the use of SMASSE approach.	19 (29.2%)	14 (21.5%)	12 (18.5%)	14 (21.5%)	6 (9.2%)	3.40	1.35
SMASSE Approach does not assist my students to understand concepts in my subject area.	15 (23.1%)	21 (32.3%)	9 (13.8%)	12 (18.5%)	8 (12.3%)	3.35	1.34
Average Score for Teachers Motivation in the Use of SMASSE Approach						**3.38**	**1.11**

Key: SA-Strongly Agree, A-Agree, MA-Moderately agree, D-Disagree, SD -Strongly Disagree.

On the teachers' motivation, the findings of the study established that whereas a significant proportion of teachers exhibited evidence of being adequately motivated (mean=3.38; standard deviation=1.11) some of them showed low level motivation in the use of SMASSE approach. This was revealed by a sharp division in opinions, of the teachers' respondents who took part in the survey, on the item whether they were feeling motivated enough as teachers of science and mathematics using SMASSE approach, where although some of the teachers alluded that they were quite motivated, others said they were not motivated by the use of SMASSE approach at all, which reflect a mean of 3.48 (SD=1.44) in the teacher motivation scale. Similarly, although

many of the teachers believed that the certificate they acquire after SMASSE training assist them in teacher promotion, another group did not believe that SMASSE certificate can assist them get any promotion.

On the contrary, it was evident from the findings of the study that although many of the mathematics and science teachers generally believed that use of SMASSE approach assist their students to understand concepts in their subject areas some of the teachers who took part in the survey held a belief that using SMASSE approach in teaching and learning assist students in performing well in Mathematics and Science in KCSE, translating to mean teacher motivation of 3.35 with a standard deviation of 1.34.

4.5.4 Hypothesis Testing- Objective 1

$H_0 1$: There is no statistically significant influence of teacher based factors on the implementation of SMASSE program in the secondary schools.

To establish whether there was any statistical significant influence of teacher Motivation and Attitudes on the implementation of SMASSE programme in the secondary schools, bivariate Pearson's Product-Moment Coefficient of Correlation analysis to investigate relationship between teacher motivation and attitude with SMASSE implementation. Therefore, the mean of SMASSE implementation was correlated with the mean of teacher factors, (teacher attitude and teacher motivation). The SPSS output Table 4.8 shows the correlation results on page 63.

Table 4.8: Correlation between Teacher Factor (Motivation and Attitude) and Implementation of SMASSE Programme

		Teacher Attitude	Teacher Motivation
Implementation of SMASSE	Pearson Correlation	.332**	.344**
	Sig. (2-tailed)	.007	.005
	N	65	65

**. Correlation is significant at the 0.01 level (2-tailed).

The output indicates a statistically significant, though fairly weak, positive relationship between implementation of SMASSE in public secondary schools and the two variables, Teacher Attitude (n=65, r =.332; p ==.007) and Teacher Motivation (n= 65, r =.344; p = 0.005). Increases in teacher motivation and teacher attitude were correlated with increases the level of implementation of SMASSE programme. Therefore, for high levels of implementation of SMASSE to be experienced, there should be high teacher motivation as well as positive teacher attitude.

However, to estimate the level of influence of teacher factors (teacher motivation and teacher attitude) on implementation SMASSE, multiple regression analysis was done and the results of the model were as shown in Table 4.9.

Table 4.9: Model Summary on Regression Analysis of Influence Teacher Factors (Motivation and Attitude) on Implementation of SMASSE

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.366[a]	.134	.106	.68371

a. Predictors: (Constant), Teacher Motivation, Teacher Attitude

The model shows that Teachers Factors (motivation and attitude) accounted for 13.4% as signified by coefficient of .134 (R Square) of the variation in the implementation of SMASSE programme. This was fairly large effect on the dependent variable. However, to determine

whether teacher motivation and attitude were significant predictors of implementation of SMASSE, Analysis of Variance (ANOVA) was computed as Table 4.10.

Table 4.10: ANOVA –Influence of Teacher Factors (Motivation and Attitude) on Implementation of SMASSE

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	4.475	2	2.238	4.787	.012[b]
	Residual	28.982	62	.467		
	Total	33.457	64			

a. Dependent Variable: Implementation of SMASSE

b. Predictors: (Constant), Teacher Motivation, Teacher Attitude

From Table 4.10, it is evident that the two variable were a significant predicator of Implementation of SMASSE programme [F (2, 62) = 4.787, p = .012, $R^2_{Adjusted}$ = .134]. Further, the study sought to find out the magnitude of influence of aspects of teacher factors (motivation and attitude) on implementation of SMASSE programme. The results indicated the unique contribution of the independent variable (teacher motivation and teacher attitude) on the dependent variable (SMASSE implementation).

Table 4.11: Unique contribution of teacher factors: Teacher Motivation and Attitude on Implementation of SMASSE Programme

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.025	.406		4.988	.000
	Teacher Attitude	.197	.186	.177	1.056	.015
	Teacher Motivation	.141	.108	.218	1.297	.200

a. Dependent Variable: Implementation of SMASSE

Regression Equation $Y=a + bx_1 + cx_2 + \varepsilon$

From Table 4.11 it is evident that the two aspects of teacher factor contributed differently in influencing implementation of SMASSE programme. Teacher motivation had the highest influence on the implementation of SMASSE programme, having largest beta coefficient of .218, implying that it made the strongest unique contribution in explaining the dependent variable.

The regression equation;

$$Y = 2.025 + .197x_1 + .141x_2 + \varepsilon$$

X_1 is teacher attitude

X_2 is teacher motivation

An increase of 1 unit in teacher attitude improves implementation of SMASSE by 0.197 units. Similarly, an increase of 1 unit in teacher motivation increase performance by 0.141, implying that an increase in "teacher motivation" by one unit leads to a .141 units increase in predicted SMASSE programme implementation with the other variables being held constant.

4.5.5 Influence of Teacher Experience and Teacher Qualification on Implementation of SMASSE

Analysis variance was performed to establish whether teacher experience and qualification significantly influence implementation of SMASSE in secondary schools, whose results are shown in Table 4.12.

Table 4.12: Analysis Variance on Experience and Qualification

Teacher Factor	Df	F	p-value
Experience	(3, 61)	7.867	.000
Professional qualification	(3, 61)	.383	.766 (ns)

The findings of the study revealed that although experience of the teacher had significant influence ($p=.000 < .05$) on Implementation of SMASSE, teacher qualification had no statistical influence on implementation of SMASSE ($p=.766$). This implies that even though the teachers' experience influenced their level of implementation of SMASSE in teaching, their level of professional qualification had no influence at all.

4.5.6 Overall Influence of Teacher Factor on Implementation of SMASSE

To investigate the overall influence of teacher factor on implantation of SMASSE, the null hypothesis was tested. This was done by the use of regression analysis whose model summary is shown in Table 4.13.

Table 4.13: Model Summary on Regression Analysis of Teachers' Factor on Implementation of SMASSE

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.371[a]	.138	.080	.69332	2.181

a. Predictors: (Constant), Experience, Teacher Motivation, Qualification, Teacher Attitude
b. Dependent Variable: Implementation of SMASSE

From the model, it is evident that 13.8% (R^2=.138) of the variation in implementation of SMASSE in secondary schools in Emuhaya sub-county was explained by teacher factors (teacher experience, teacher motivation, teacher qualification and attitude). Other factors such as students' entry behaviour, teacher subject load, availability and adequacy of teaching and resources and teacher training, among others could account for the other percentage in the variation of implementation of SMASSE in secondary schools. However, to determine whether teacher factor was a significant predictor of implementation of SMASSE, Analysis of Variance (ANOVA) was computed as shown in Table 4.14.

Table 4.14: ANOVA–Influence of Teacher Factor on Implementation of SMASSE

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.616	4	1.154	2.401	.030[b]
	Residual	28.841	60	.481		
	Total	33.457	64			

a. Dependent Variable: Implementation of SMASSE
b. Predictors: (Constant), Experience, Teacher Motivation, Qualification, Teacher Attitude

From the ANOVA results, the finding of the study reveals that, despite the moderate effect, teachers' factor is statistically significant predictor of implementation of SMASSE, F (4, 60) = 2.401, p = .030. This means that the regression model is a good fit of the data, indicating that knowledge on teacher factors could be used to predict of the level of implementation of SMASSE in secondary schools. Given that a significant p-value was established, the null hypothesis that there is no statistically significant influence of teacher based factors on the implementation of SMASSE programme in the secondary schools was discarded. It was therefore concluded that teacher based factor (teacher motivation, attitude and level of experience) significantly influence the implementation of SMASSE programme in the secondary schools in Emuhaya sub-county. With positive attitude, high motivation and experience among the teachers, there is improvement in SMASSE implementation in the secondary schools in Emuhaya Sub-County.

These study findings are in line with those of Shaji (2007) who in his study "Attitude of ECDE teachers towards science curriculum in Kakamega Municipality Kenya" found out that teaching experience in ECDE was a factor that influences attitudes of teachers towards implementation of science curriculum as teachers with teaching experience of six years and above had a positive attitude towards science curriculum.

4.6 The Influence of Student Based Factors on the Implementation of SMASSE Programme in the Secondary Schools in Emuhaya Sub-County

The third objective of the study was to investigate the influence of student based factors on the implementation of SMASSE programme in secondary schools in Emuhaya Sub-County. This objective was addressed by; first exploring the views of the respondents on the influence of student based factors and second by conducting statistical test to investigate whether there was

any statistical influence of student based factors on the implementation of SMASSE programme in teaching and learning of mathematics and science. The teachers' and students' opinions on students factors influencing implementation of SMASSE programme approaches in teaching and learning science and mathematics were explored by use of a five-point Likert scale on the degree agreement (1=strongly disagree, 2=disagree, 3=moderately agree, 4= agree, and 5=strongly agree) to statements on students characteristics. Approaches of SMASSE are anchored on learner-centred approaches which are emancipated by promotion of group activities and involvement of the learner through practice and experimentation. Hence, students who do not favour use of these methods impede implementation of SMASSE programme in teaching of mathematics.

4.6.1 Views of the Students' Respondents on Students' Related Factors

Students were asked to rate their views on their characteristics in regard to teaching and learning science and mathematics. Their responses are presented in Table 4.15.

Table 4.15: Views of the Students' Respondents on Students' Related Factors

Items	SA	A	MA	D	SD	Mean
The science and mathematics learning is not applicable to daily life outside the school.	91 (42.5%)	56 (26.2%)	25 (11.7%)	23 (10.7%)	19 (8.9%)	2.18
Science and mathematics subjects are easy to learn compared to other subjects.	63 (29.4%)	70 (32.7%)	25 (11.7%)	34 (15.9%)	22 (10.3%)	2.98
I do not like the teaching of mathematics and Science	75 (35.0%)	68 (31.8%)	25 (11.7%)	28 (13.1%)	18 (8.4%)	1.86
Students in our class enjoy Science and Mathematics lessons.	61 (28.5%)	40 (18.7%)	35 (16.4%)	48 (22.4%)	30 (14.0%)	2.64
For students to pass Mathematics and Science, they should develop a positive attitude towards the	64 (29.9%)	49 (22.9%)	43 (20.1%)	34 (15.9%)	24 (11.2%)	3.21
I do not like working in a group to solve Mathematics and Science problems because later lazy students even earn more marks for	94 (43.9%)	26 (12.1%)	17 (7.9%)	58 (27.1%)	19 (8.9%)	2.68
Students in my class enjoy carrying out practical lesson.	105 (49.1%)	51 (23.8%)	27 (12.6%)	13 (6.1%)	18 (8.4%)	2.14
Students in my class don't enjoy Mathematics and Science lessons	77 (36.0%)	61 (28.5%)	37 (17.3%)	21 (9.8%)	18 (8.4%)	3.34
Average score by students on their own view of their characteristics						**2.57**

Key: SA-Strongly Agree, A-Agree, MA-Moderately agree, D-Disagree, SD -Strongly Disagree.

Table 4.15 reveals that students had a moderate agreement (average score=2.57) on the student factors influencing implementation of SMASSE programme in teaching and learning of science and mathematics. The findings of the study show that, generally, of the students (SA and A) have

moderate attitudes (average score =2.64) towards learning of science and mathematics, which impede implementation of SMASSE approaches in the teaching and learning in these subjects. For example, nearly two thirds of the students who took part in the study confirmed that they do not enjoy mathematics and science lessons at all. Some of them strongly added that they do not like the teaching of mathematics and science, an indication that they do not favour the methodology applied in teaching and learning the subjects. They argue that the science and mathematics learning is not applicable to daily life outside the school, as was held by many of the students (SA and A) respondents.

The findings of the study established that although some students had low opinion in teaching and learning of science and mathematics subjects, others had positive attitudes towards the two subjects. This was indicated by the fact that 63 (29.4%) of the students who took part in the survey were of strong opinion that science and mathematics are easy to learn compared to other subjects and in fact 101 (47.2%) of students (SA and A) said they enjoy science and mathematics lessons. The findings of the study show that those students who held opinion that science and mathematics are easy to learn compared to other subjects (average score =2.98) equally believe that for students to pass mathematics and science; they should develop a positive attitude towards the subjects. This view was held by majority of the student respondents who believe that good performance in mathematics and science is positively correlated to the attitude of the student towards the subject.

It was revealed by the findings of the study that although some students do not like the approaches of SMASSE employed by the teachers, of them favour (average score =3.21) the SMASSE methodologies. For instance, although more than one out of every two of students sampled for the study indicated that they do not like working in a group to solve mathematics

and science problems because it gives opportunity for the lazy students to earn more marks for nothing, another 77 (36.0%) of them said they like group work since it provides every member of the group with an opportunity to benefit from the contribution of other members. Equally, 105 (49.1%) of the students indicated that they enjoy carrying out practical lessons during mathematics and science lessons.

Webster and Fisher (2000) study agree with this findings as their study revealed that the students attitude in mathematics in carrier aspiration positively affect learning. The student attitude towards learning has a positive connection with his/her achievement.

4.6.2 Views of the Teachers' Respondents on Students' Related Factors

The views of the teachers on the students related factors influencing the implementation of SMASSE programme in the teaching and learning of science and mathematics were summarized as in Table 4.16 on page 75.

Table 4.16: **Views of the Teachers' Respondents on Students' Related Factors**

Items	SA	A	MA	D	SD	Mean
Most of the students are closed and are not willing to share with each other during group work.	14 (21.5%)	10 (15.4%)	9 (13.8%)	16 (24.6%)	16 (24.6%)	2.85
Most students have low interest and curiosity to learn mathematics and science.	9 (13.8%)	12 (18.5%)	25 (38.5%)	6 (9.2%)	13 (20.0%)	2.97
Despite my effort to involve my learners during the lessons, they are not interested.	22 (33.8%)	18 (27.7%)	5 (7.7%)	13 (20.0%)	7 (10.8%)	3.54
Most of the students are not keen to do follow up activities and practice.	15 (23.1%)	13 (20.0%)	8 (12.3%)	17 (26.2%)	12 (18.5%)	3.03
Most learners do not honestly give their own observations/results in	19 (29.2%)	13 (20.0%)	11 (16.9%)	12 (18.5%)	10 (15.4%)	3.29
Some students attach performance in Mathematics and Science to gender.	18 (27.7%)	14 (21.5%)	16 (24.6%)	10 (15.4%)	7 (10.8%)	3.40
Students in my class enjoy carrying out practical lesson.	19 (29.2%)	14 (21.5%)	12 (18.5%)	14 (21.5%)	6 (9.2%)	3.40
Average score by teachers on their view of students' characteristics						**3.25**

Key: SA-Strongly Agree, A-Agree, MA-Moderately agree, D-Disagree, SD -Strongly Disagree.

From Table 4.16, it is evident that teachers rated student factors as of above average score (average score =3.25) in influencing implementation of SMASSE programme in secondary schools in Emuhaya sub-county, with the item with the lowest score being at 2.85 and highest score being at a mean of 3.54. The findings of the study show that 21 (32.3%) of the students who took part in the survey have low interest and curiosity to learn mathematics and science. It was revealed that despite the effort made by the science and mathematics teachers to involve the learners during the lessons, most of the learners are not interested in the subjects, as confirmed

by 40 (61.5%) of the teachers who participated in the study. This is a great draw back to the implementation of SMASSE programme.

Similarly, it emerged that discussion groups initiated by the teachers are sometimes not effective given that significant proportion of the students are not free and are not willing to share with each other during group work, as alluded by 24 (36.9%) of the teachers who took part in the survey. Although about a half 33 (50.7%) of the teachers sampled for the survey held a general feeling (mean=3.40) that students in their class enjoy carrying out practical lessons, 32 (36.9%) others observed that most learners do not honestly give their own observations/opinions in experiments or in discussion groups. On the same note, 28 (43.1%) of the teachers who participated in the study indicated that most of the students are not keen to do follow up activities and practice. Lastly, it came out that some students attach performance in mathematics and science to gender, as indicated by 32 (49.2%) of the teachers who took part in the study.

4.6.3 Hypothesis Testing- Objective 2

To address hypothesis two, the study investigated whether there was any statistical significant influence of student based factors on the implementation of SMASSE programme in the secondary schools in Emuhaya sub-county. Student factors explored were motivation, attitude and entry behavior.

4.6.4 Influence of Students' Motivation and Attitude on Implementation of SMASSE

A bivariate Pearson's Product-Moment Coefficient of Correlation analysis was performed to establish the relation between the scores of the student motivation and attitude, and implementation of SMASSE. On the other hand, Analysis of Variance was used to establish the influence of student entry behaviour. The SPSS output Table 4.17 shows the correlation results.

Table 4.17: **Correlation between Student Factors (Motivation and Attitude) and Implementation of SMASSE Programme**

		Student Motivation	Student Attitude
Implementation of SMASSE	Pearson Correlation	.359**	.365**
	Sig. (2-tailed)	.003	.003
	N	65	65

**. Correlation is significant at the 0.01 level (2-tailed).

The finding of the study shows that there was a statistically significant positive relationship between implementation of SMASSE in public secondary schools and the two variables, student motivation ($r = .359$; $p = 0.003$) and student attitude ($r = .365$; $p = 0.003$). Hence, it was concluded that there is significant positive relationship of both student motivation and student attitude on the implementation of SMASSE programme, with high levels of implementation of the programme associated with student teacher motivation and positive student attitude towards mathematics subjects.

However, to estimate their level of influence on implementation of SMASSE, a coefficient of determination was computed. This was done using of regression analysis and the results were as shown in Table 4.18.

Table 4.18: **Model Summary on Regression Analysis of Influence Student Motivation and Attitude on Implementation of SMASSE**

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.368[a]	.136	.108	.68292

a. Predictors: (Constant), Student Attitude, Student Motivation

The model shows that student motivation and attitudes accounted for 13.6% (R Square=.136) of the variation in the implementation of SMASSE programme. This was a relatively small effect

by two independent variables on the dependent variable. The other variable not included in the regression accounted for the rest of variation. On the other hand, to determine whether the two variables were significant predictor of implementation of SMASSE, Analysis of Variance (ANOVA) was computed as Table 4.19.

Table 4.19: ANOVA –Influence of Student Motivation and Attitudes on Implementation of SMASSE

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.542	2	2.271	4.869	.011[b]
	Residual	28.916	62	.466		
	Total	33.457	64			

a. Dependent Variable: Implementation of SMASSE

b. Predictors: (Constant), Student Attitude, Student Motivation

From Table 4.19, it is evident that Student motivation and attitudes were a significant predicator of Implementation of SMASSE programme [$F(2, 62) = 4.869$, $p = .011$, $R^2 = .136$]. This means that Student motivation and attitude are significant predicators of implementation of SMASSE programme in secondary schools. In addition, the researcher sought to find the separate magnitude of influence for student motivation and attitude on implementation of SMASSE programme through the standardized coefficient values as shown in Table 4.20.

Table 4.20: Unique contribution of Student's factors: Student Motivation and Attitude on Implementation of SMASSE Programme.

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.086	.345		6.053	.000
	Student Motivation	.104	.242	.142	.429	.005
	Student Attitude	.204	.289	.233	.706	.046

a. Dependent Variable: Implementation of SMASSE

From Table 4.20 it is evident that the two aspects of student factors contributed differently in influencing implementation of SMASSE programme. Student attitude had the highest influence on the implementation of SMASSE programme, having largest beta coefficient of 233, implying that it made the strongest unique contribution in explaining the dependent variable.

The regression equation,

$$Y = 2.086 + .104x_1 + .204x_2 + \varepsilon$$

X_1 is student motivation

X_2 is student attitude

An increase of 1 unit in student attitude improves implementation of SMASSE by 0.204 units. Similarly, an increase of 1 unit in student motivation increase performance by 0.104, implying that an increase in "student motivation" by one unit leads to a 0.104 units increase in predicted SMASSE programme, with the other variable held constant.

Webster and Fisher (2000) study agree with these findings, as their study revealed that attitude in mathematics and carrier aspiration positively affects learning. The study findings also agree with those of Zan and Martino, (2007) who pointed out that student attitude plays a crucial role in learning and achievement in mathematics hence determines their success in the subject. In a study by Mata et al, (2012) on the relationship between student attitude and achievement in mathematics, it was also showed that the more positive the attitude, the higher the level of achievement in the student. Studies by Pintrich & Schunk, (2002) and Cavas, (2011) discovered that there is a considerable impact on students' achievement in science because of them being motivated.

Influence of Students' Entry Behaviour on Implementation of SMASSE

Analysis of Variance (ANOVA) was conducted to establish whether students' entry behaviour had significant influence on implementation of SMASSE in secondary schools, whose results are shown in Table 4.21.

Table 4.21: Analysis Variance on Students Entry Behaviour Implementation of SMASSE

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	5.165	3	1.722	1.936	.125
Within Groups	186.712	210	.889		
Total	191.877	213			

The findings of the study revealed that student entry behaviour had no statistical influence on implementation of SMASSE [F (3, 210) = 1.936, p = .125 (ns). This implies that student entry mark to secondary school had no influence on the level of implementation of SMASSE in secondary school.

Overall Influence of Student Factor on Implementation of SMASSE

To investigate the overall influence of student factor on implementation of SMASSE, the null hypothesis was tested using of regression analysis whose model summary is shown in Table 4.22.

Table 4.22: Model Summary on Regression Analysis of Student Factor on Implementation of SMASSE

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.710[a]	.504	.497	.67326

a. Predictors: (Constant), Student Entry Behaviour, Student Motivation, Student Attitude

is evident that 50.4% (R^2=.504) of the variation in implementation of SMASSE in secondary schools in Emuhaya sub-county was explained by student factors. However, to determine whether student factors were significant predictor of implementation of SMASSE, Analysis of Variance (ANOVA) was computed as shown in Table 4.23.

Table 4.23: ANOVA–Influence of Student Factor on Implementation of SMASSE

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	96.689	3	32.230	71.103	.000[b]
	Residual	95.188	210	.453		
	Total	191.877	213			

a. Dependent Variable: Implementation of SMASSE
b. Predictors: (Constant), Student Entry Behaviour, Student Motivation, Student Attitude

From the ANOVA results, the finding of the study reveals that student factors are statistically significant predictor of implementation of SMASSE, F (3, 210) = 71.103, $p < .05$. This means that the regression model is a good fit of the data, indicating that knowledge on student factors could be used to predict of the level of implementation of SMASSE in secondary schools. Given that a significant p-value was established, the null hypothesis that there is no statistically significant influence of student based factors on the implementation of SMASSE programme in the secondary schools was rejected. It was therefore concluded that student based factors significantly influence the implementation of SMASSE programme in the secondary schools in Emuhaya sub-county, with positive attitude and high motivation among the students associated with improvement in SMASSE implementation. However, student entry behavior had no significant contribution to implementation of SMASSE in teaching and learning science and mathematics.

4.7: Influence of Quality Assurance Factors on Implementation of SMASSE programme in secondary schools in Emuhaya Sub-County

The fourth objective of the study was to examine the influence of Quality Assurance and Standard related factors on the implementation of SMASSE programme in secondary schools in Emuhaya Sub-County. They were presented with a questionnaire whose items were related to facts/perceptions linked to role of QAS in implementation of SMASSE programme. They were Likert-scaled item type statements, in which respondents choose from 5-point score; strongly Agree (SA), Agree (A), moderately (U), Disagree (D) and Strongly Disagree (D). The Principals'respondents scored on each statement based on their perception on the statement in regard the role of QAS in implementation of SMASSE programme. Their views were summarized in frequency percentages as in Table 4.24 on page 84.

Table 4.24: Views of the Principals on the Influence QASO on SMASSE

Supervision Practice	SA	A	MA	D	SD	Mean
QASOs are adequately knowledgeable in the use of SMASSE programme.	2 (6.3%)	11 (34.4%)	8 (25.0%)	8 (25.0%)	3 (9.3%)	3.35
QASO always check on the provision of the `support materials to teachers by the principals.	3 (9.3%)	4 (12.5%)	6 (18.8%)	13 (40.6%)	6 (18.8%)	3.32
QASO ensures teachers prepare ASE-PDI lessons.	12 (37.5%	13 (40.6	2 (6.3%)	1 (3.1%)	4 (12.5	3.37
QASO occasionally observe teachers deliver lessons using ASE-PDI approach.	5 (15.6%)	13 (40.6%)	3 (9.3%)	8 (25.0%)	3 (9.3%)	3.38
QASO share experience with teachers after lesson observation.	3 (9.3%)	3 (9.3%)	6 (18.8%	12 (37.5%	8 (25.0	3.37
QASO advice teachers on better ways of handling their lessons.	9 (28.1%	9 (28.1	5 (15.6%	6 (18.8%	3 (9.3%)	3.37
QASO Encourage teachers to use SMASSE approach in teaching mathematics and science.	9 (28.1%)	9 (28.1%)	6 (18.8%)	5 (15.6%)	3 (9.3%)	3.34
Average score of Influence by Quality Assurance Standard Officer						**3.36**

Key: SA-Strongly Agree, A-Agree, MA-Moderately agree, D-Disagree, SD -Strongly Disagree.

The findings of this study show that principals generally agreed that the Quality Assurance and Standards Officers had influence (mean =3.36) in the implementation of SMASSE programme. For the effective implementation of SMASSE approaches in teaching and learning science and mathematics, Quality Assurance Officers are expected to do constant coordination, monitoring/supervision and make follow-up of the approach in curriculum implementation.

The study showed that QASOs was very supportive and instrumental in the implementation of SMASSE in schools in Emuhaya Sub-County. For instance, 13 (40.6%) of the head teachers agreed and 12(37.5%) of them strongly agreed (mean=3.37) that QASO ensures teachers prepare SE-PDI lessons, which is the central focus in the application of SMASSE. Further, 13 (40.6%)

of the principals accepted that QASO occasionally observe teachers deliver lessons using ASE-PDI approach, however 12(37.5%) disagreed and 8(25.0%) strongly disagreed that QASOs share experience with teachers after lesson observation. Furthermore, 9(28.1%) of the head teachers who took part in the survey agreed and strongly agreed that QASO advice teachers on better ways of handling their lessons, while the same proportion also confirmed that QASO encourage teachers to use SMASSE approach in teaching mathematics and science.

On the other hand, of 13 (40.6%) of the head teachers who participated in the survey rejected the assertion that QASO always check on the provision of the support materials to teachers by the principals. Similarly, there was a sharp division on whether or not the QASO was adequately knowledgeable in the use of SMASSE programme; while 11 (34.4%) of the head teachers agreed that the QASO was indeed highly knowledgeable and has understanding of SMASSE approaches, some 8 (25.0%) others held a contrary opinion and another 8(25.0%) of the sampled teachers remained noncommittal on the matter. This brings aspersion on the preparedness of the QASO in regards to their supervisory role in the implementation of SMASSE approaches in teaching and learning science and mathematics in secondary schools.

4.7.1 Hypothesis Testing- Objective3

To investigate whether there was any statistically significant influence of QASO based factors on the implementation of SMASSE programme in the secondary schools in Emuhaya sub-county, a bivariate Pearson's Product-Moment Coefficient of Correlation between the scores of the two variables was computed. The SPSS output Table 4.25 on page 86 shows the correlation results.

Table 4.25: Correlation between QASO Factor and Implementation of SMASSE Programme

		QASO Factors	Implementation of SMASSE
QASO Factors	Pearson Correlation	1	.334**
	Sig. (2-tailed)		.007
	N	65	65

**. Correlation is significant at the 0.01 level (2-tailed).

The finding of the study shows that there was a statistically significant (n=65; r =.334; p =0.007), though weak, positive correlation between QASO based factors and the implementation of SMASSE in public secondary schools, with a favourable QASO factors resulting into an increase in the implementation of SMASSE programme. This relationship was further explored by use of a scatter plot shown in Figure 4.3.

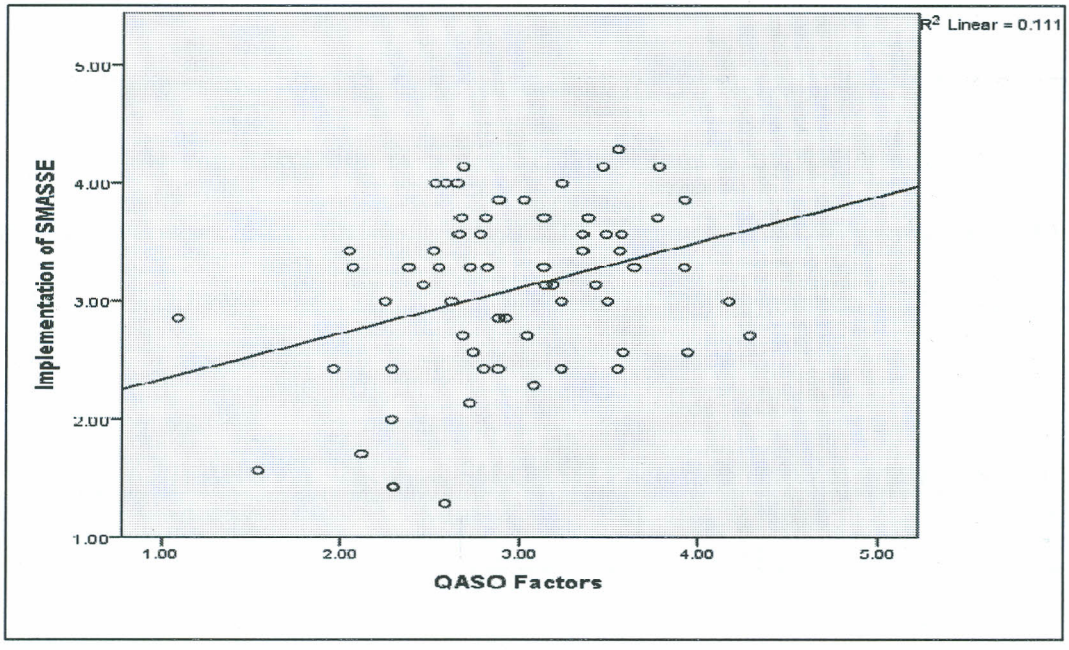

Figure 4.3: Scatter plot graph: QASO Factors and Implementation of SMASSE

A scatterplot summarizes the results (Figure 4.5). It shows that there are evidence of positive correlation between QASO factor and implementation of SMASSE programme. The dots seem

to be rising from lower left to upper right, indicating a positive correlation between the variables. In addition, the line of best fit further shows that there was some correlation between the two variables. However, to estimate the level of influence of QASO factor on implementation SMASSE, a coefficient of determination was computed. This was done using of regression analysis as shown in Table 4.26.

Table 4.26: Model Summary on Regression Analysis of Influence QASO Factors on Implementation of SMASSE

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.334[a]	.111	.097	.68700

a. Predictors: (Constant), QASO Factors

The model shows that QASO factor accounted for 9.7% (Adjusted R Square=.097) of the variation in the implementation of SMASSE programme. This was a fairly small effect on the dependent variable. Nevertheless, Analysis of Variance (ANOVA) was used to determine whether student factor was a significant predictor of implementation of SMASSE, as in Table 4.27.

Table 4.27: ANOVA –Influence of QASO Factor on Implementation of SMASSE

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.724	1	3.724	7.890	.007[b]
	Residual	29.734	63	.472		
	Total	33.457	64			

a. Dependent Variable: Implementation of SMASSE
b. Predictors: (Constant), QASO Factors

From Table 4.27, it is evident that QASO Factor was a significant predicator of Implementation of SMASSE programme [F (1, 63) = 7.890, p=.007, $R^2_{Adjusted}$ = .097]. This means that QASO Factor is a significant predicator, although it accounted for a small amount of the variance (9.7%) in the implementation of SMASSE programme in secondary schools in Emuhaya sub-county. Further, the magnitude of influence QASO factor on implementation of SMASSE programme was determined through the standardized coefficient values as shown in Table 4.28.

Table 4.28: Unique contribution of QASO Factor on Implementation of SMASSE Programme

Model		Unstandardized Coefficients		Standardized Coefficients	T	Sig.
		B	Std. Error	Beta		
1	(Constant)	1.955	.415		4.715	.000
	QASO Factors	.387	.138	.334	2.809	.007

a. Dependent Variable: Implementation of SMASSE

It is evident from Table 4.28 that if the QASO factor was improved by one unit then perceived scores in level of implementation of SMASSE programme would increase by .334 units. It is also evident that increasing QASO factor by one unit would results into an improvement of implementation of SMASSE programme by .387 units.

Some studies concur with this findings that experienced head teachers and Education Officials is more important in curriculum implementation and supervision in schools. For instance, The Dakar conference on Education held in the year 2000 observed that quality education especially in Sub Saharan Africa needed to improve through effective internal supervision and (Odawa, 2013) noted that there are possible opportunities to provide quality assurance in public institutions through internal quality assurance and standards in which the principal takes the leading role.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

In this chapter, the findings of the study are summarized. Subsequently, conclusions are made in view of the findings and recommendations proposed following the conclusions pegged on the objectives.

5.2 Summary of Research Findings

5.2.1 Findings on the Extent of Implementation of SMASSE Programme

The findings of the study showed that implementation SMASSE programme was done mostly (mean=2.54) among the teachers in Emuhaya Sub-County. About a half (mean=2.54) of the mathematics and science teachers had their lessons being activity-focused and gave practical work during teaching and learning, which was a moderate sign of implementation of SMASSE approach. It was established that some teachers always gave their students appropriate tasks for discussion and effectively encourage them to relate them to their prior experiences; incorporate students' previous knowledge, skills and everyday experience on learning and inspire students to fully participate in experiments while taking into account students' individual differences. In addition, the results of the study reveal that, use of improvised materials available in the students' immediate environment in teaching and learning was moderate (mean=2.03) among the teachers.

5.2.2 Influence of Teacher Based Factors on the Implementation of SMASSE Programme

The findings of the study established a significant relationship [$F(4, 60) = 2.401$, $p = .030$] between overall teacher factor and the implementation of SMASSE in public secondary schools. Teacher factor accounted for 13.8% of variation in implementation of SMASSE in schools.

Teacher motivation had a higher (beta coefficient of .218) influence compared to teacher attitude on the implementation of SMASSE programme. The findings of the study established that teachers had moderate (mean=3.18; standard deviation =1.15) positive attitude towards use of SMASSE programme in teaching science and mathematics; many of them used Child Centred Approach of teaching by practicing ASEI-PDSI which involve employment of activity-based teaching, student-centred learning, experiment and research-based approaches. In addition, the findings of the study established that although a significant majority of the science and mathematics teachers in secondary schools in Emuhaya Sub-County had gone through SMASSE training programme, only about a quarter 16 (24.6%) of them had gone through all the four cycles of SMASSE training programme, as required.

5.2.3 Influence of student based factors on the implementation of SMASSE programme

The findings of the study show that of the students had moderate attitudes (mean score =2.64; standard deviation =0.73) towards learning of science and mathematics; 138 (64.5%) of the students do not enjoy mathematics and science lessons at all because they have low interest and curiosity to learn the subjects. However, there was a statistically significant, $F(3, 210) = 71.103$, $p < .05$, relationship between student based factors and the implementation of SMASSE, with student factors accounting for 50.4% of the variability in the implementation of SMASSE. Student attitude had the greater influence on the implementation of SMASSE programme than their motivation. However, student entry behaviour had no significant influence on the implementation of SMASSE programme.

5.2.4 Influence of Quality Assurance Factors on the Implementation of SMASSE programme

The findings of the study established that Quality Assurance Standard factor had substantial influence (mean =3.36) in the implementation of SMASSE programme. It ensured constant

coordination, monitoring/supervision and follow-ups in regard to teachers' preparation of ASE-PDI lessons; observation of teachers during lessons and share experience with teachers after lesson observation, advice and encourage teachers on better ways of handling their lessons. However, the findings of the study revealed that people in charge of QAS were adequately knowledgeable in the use of SMASSE programme.

Nonetheless, the study established that there was a statistically significant ($n=65$; $r=.334$; $p < 0.05$) positive correlation between QAS based factors and the implementation of SMASSE. It accounted for 9.7% of the variation in the implementation of SMASSE programme. Increasing QASO factor by one unit would results into an improvement of implementation of SMASSE programme by .387 units.

5.3 Conclusions

Based on the study findings the following conclusions were made.

5.3.1 Extent of Implementation of SMASSE Programme

It was concluded that only a half of the mathematics and science teachers had their lessons being activity-focused and gave practical work during teaching and learning, which was a sign of implementation of SMASSE approach. Similarly, whereas some teachers always strive to give their students appropriate tasks for discussion, a few of them effectively encourage the students to relate the classroom tasks to their prior experiences. However, for effective teaching and learning, teachers should incorporate students' previous knowledge, skills and everyday experience on the process and at the same time inspire them to fully participate in experiments. SMASSE approach puts emphasis on use of improvised materials available in the students' immediate environment while taking into account students' individual differences in abilities. This is in line with the approaches SMASSE with prepares the teachers to be able to check

accuracy, correctness and depth of content through question and answer techniques, and encourages learners to view content in relation to what they come across in the society.

5.3.2 Influence of Teacher Based Factors on the Implementation of SMASSE Programme

Although most of the teachers had gone through SMASSE training programme, only a small proportion of them had gone through all the four cycles of SMASSE training programme, as required. Effectiveness in implementation SMASSE approaches require the teachers to attend all the four cycles of SMASSE INSET because each of them has specific themes to focus on. Adequate training prepares the teacher for activity-oriented teaching and learning with emphasis on creating and providing opportunities for learners to actively engage in the teaching and learning process. The actualization of the ASEI-PDSI approach and its enhancement and sustenance in schools is key aspect of the teacher factor in implementation of SMASSE programme. Teachers should be able to monitor and evaluate their skills to ensure quality teaching and learning.

The positive relationship between overall teacher factor and the implementation of SMASSE in public secondary schools imply that high levels of implementation of the programme are associated with favourable teacher factors. This means that more favourable teacher factors (motivation and attitude) results to more effective implementation of SMASSE programme. Although teacher motivation had a higher influence on the implementation of SMASSE programme compared to teacher attitude, the teachers need to change their attitude because positive attitude is a pre-requisite requirement for quality teaching and learning of mathematics and science.

5.3.3 Influence of Student Based Factors on the Implementation of SMASSE Programme

Students' attitudes significantly contribute to their academic achievement. This means that for students to allow effective implementation of SMASSE they must improve in their attitudes towards learning of science and mathematics. Lack of interest and curiosity among the students results in to low enjoyment in the mathematics and science lessons.

Given that the finding of the study shows that there was a statistically significant positive relationship between students based factors and the implementation of SMASSE, it was concluded more favourable student factors increase chances of effective implementation of the programme in schools.

5.3.4 Influence of Quality Assurance Factors on the Implementation of SMASSE programme

From the findings of the study, it was concluded that quality assurance activities is quite vital for successful implementation of SMASSE programme. Given that effective implementation of SMASSE approaches in teaching and learning science and mathematics is significantly influenced by Quality Assurance, it was concluded that constant coordination, monitoring/supervision is important in curriculum implementation. It ensures teachers prepare ASE-PDI lessons, deliver lessons using ASE-PDI approach and advice teachers on better ways of handling their lessons using SMASSE approaches. On the same note, it was concluded from the findings of the study that effective QAS activities requires relevant and sufficient knowledge in the use of SMASSE programme.

5.4 Recommendations

In view of the above conclusions, the following suggestions have been made:

5.4.1 Recommendations for Improvement

1. Given that the study revealed that some components of the ASEI-PDSI approach were not adequately practiced, the study recommends that the Ministry of Education should organize INSETs for the science and mathematics teachers on the specific areas of the ASEI-PDSI approach which were not adequately implemented.
2. It was recommended that the ministry of education and school principals should take up the initiative of ensuring that all the science and mathematics teachers attend all the levels of SMASSE trainings.
3. It was recommended that all the secondary school Quality Assurance and Standards Officer should be trained on SMASSE so as to equip them with appropriate understanding for effective monitoring and supervision of implementation of SMASSE programme.
4. It was recommended that students be encouraged through mentorship and guidance programmes to develop interest in science and mathematics subjects.

5.4.2 Suggestions for Further Research

i. First, since this study focused on the influence of students, teachers and QASO on implementation of SMASSE in secondary schools, further studies could be conducted to investigate the level of preparedness of secondary school principals with regard to supervision and monitoring of implementation of the ASEI-PDSI approach in classrooms.

ii. Secondly, given that this study was limited in scope to the few selected secondary schools in Emuhaya Sub-County, it is recommended that a similar study could be conducted in other sub-counties for comparison purposes.

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