INFLUENCE OF STRENGTHENING MATHEMATICS AND SCIENCE EDUCATION ON PUPILS SCIENCE PERFORMANCE IN PUBLIC PRIMARY SCHOOLS IN SAMIA SUB-COUNTY, KENYA

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DECLARATION

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

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DEDICATION

This research project is dedicated to Almighty God, who has granted me the good

health and mental strength to undertake and accomplish this project within the

prescribed period of time.

ACKNOWLEDGEMENTS

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LIST OF ABBREVIATIONS AND ACRONYMS

ASEI   Activity, Student, Experiment and Improvisation

CEMASTEA Centre for Mathematics Science and Technology in Africa

INSET   In-service Education and Training

JICA   Japan International Cooperation Agency

KCPE   Kenya Certificate of Primary Education

KNEC   Kenya National Examination Council

MoE   Ministry of Education

NICASA   National Institute on Student Achievement Curriculum and

Assessment

PDSI   Plan Do See Improve

SESEMA   Secondary Science and Mathematics project (Uganda)

SMASE   Strengthening Mathematics and Science Education

SMASSE   Strengthening Mathematics and Science in Secondary school

SPRED   Strengthening Primary Education Project

SPSS   Statistical Package for Social Sciences

TIMSS   Third International Mathematics and Science Study Report

UNESCO   United Nation Educational Scientific and Cultural Organization

WECSA   Western Eastern Central and Southern Africa

ABSTRACT

The purpose of the study was to investigate the influence of strengthening mathematics and science education on pupils' science performance in public primary schools in Samia Sub County, Kenya. The in-service training in Strengthening Mathematics and Science Education (SMASE) has had little improvement in the performance of science. The objectives of the study were to establish the influence of teachers' use of improvised teaching and learning resources, teachers' attitude, teachers' lesson planning and use of learner centred approaches. The study was based on constructivist theory which says learning is an active process. The study adopted descriptive survey research design. The study targeted 63 public primary schools, 63standard eight science teachers and 1901 standard eight pupils. Study sample consisted of 18 head teachers, 18 standard eight science teachers and 190 standard eight pupils. Simple random sampling was used to select public primary schools and purposive sampling was employed on standard eight science teachers and pupils. Data were collected using interview guides for head teachers and questionnaires for science teachers and pupils. Piloting was conducted in two schools using two head teachers, two standard eight science teachers and 20 standard eight pupils to check the validity of the instruments. The obtained data were computed for reliability using Pearson's Product Moment Correlation and correlation coefficient was 0.82 for teachers and 0.94 for pupils. Data were presented in form of tables and figures. The study findings revealed that 50 percent of the teachers studied improvise teaching and learning resources. Findings on teachers' attitude revealed that 77.8 percent of teachers find ASEI/PDSI lesson plan difficult to prepare. On teachers' lesson planning, the study found out that majority of teachers considered learners background before lesson planning. 83.3 percent of teachers do not use learner-centred approaches. From the study findings, the researcher concluded that ASEI/PDSI approach has not been fully implemented by science teachers as expected after the SMASE in-service training. From the study findings, the researcher recommended that Ministry of Education in conjunction with Centre for Mathematics Science and Technology in Africa and Kenya Institute of Curriculum Development provide prepared ASEI/PDSI lesson plans for teachers. To enhance learner centred approaches, monitoring and evaluation by SMASE coordinators at sub county level in liaison with quality assurance should intensify regular inspection. The researcher suggested further study on the influence of strengthening mathematics and science education on pupils' mathematics performance in public primary schools.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

In-service is accepted globally for enhancing effectiveness in professional development. Guskey (2004) states main characteristics of effective professional development are enhancement of teachers' content and pedagogic knowledge. This is in line with Zaslavsky and Leikin (2004) who argues that improving learning among students, depends on the teaching force with appropriate mathematics and science concepts, attitude and beliefs towards teaching and learning and that they poses content and pedagogical knowledge designed for instructional practice in the classroom.

Globally, countries like United States of America, Canada, Japan and Israel invest a lot in teacher in-service training to improve quality and relevance of education (Ogwel & Kisanga, 2009). The government of United States of America supports both pre and in-service training so as to strengthen the quality of teaching and enhance pupil's performance (Barret, 1998). According to Third International Mathematics and Science Study Report (TIMSS) 1998, Japan has greatly succeeded in educating its students effectively because as a country, it fully embraces continuous in-service programmes for its teachers through mentorship, research groups and workshops (NICASA, 1998).

According to Adewoyin (1991), many U.S. states, educators adhere to rigid standards of what content is to be taught to which age group. This often leads teachers to cover the material without truly teaching it. In addition, elements such as scientific method and critical thinking are often overlooked. In 1996, the United States National Academies of Sciences produced the National Science Education Standards whose focus is on inquiry based science, which is based on the theory of constructivism rather than on direct instruction of facts and methods (Okumbe, 1998).

According to Brooks and Brooks (1993) science instruction today has widely embraced support for 'hands-on', student centred, inquiry- oriented and constructivist classrooms. Strengthening Mathematics and Science Education (SMASE) would offer basic skills where learners would be engaged in inquiry, observation, inferring and experimenting. Inquiry is central to science learning. They use critical and logical thinking. In this way, learners actively develop their understanding of science by combining scientific knowledge with reasoning and thinking skills (Okumbe, 1998).

In Nigeria, studies shows that large numbers of students seem to learn very little science in schools, learning tend to be by rote and pupils find learning science to be difficult. Teachers read from the science text books, interspersed with a few explanations while pupils copy as their teachers dubs textbooks or old notes

(Salau, 1996, Okebukala, 1996, Uzoechi, 2006). In Nigeria, Uzoechi, (2006) and Ifebo, (2005) found that lack of adequate instructional materials and human resources contributes to poor performance in primary science hence low achievements of pupils in the subject.

Associations such as Western Eastern Central and Southern Africa (WESCA) have been formed to strengthen science and mathematics education and enhance learners' ability through improved teacher mastery of content, pedagogical skills, enhancing teachers and learners attitude towards mathematics and science through in-service education and training of teacher thus SMASE-WESCA (Nui &Wahome, 2006).

In Uganda, a survey done by the Secondary Science and Mathematics Project Training (SESEMAT) targeting mathematics and science teachers, shows that teachers who attended pilot in-service training had an attitudinal change, improved pedagogy and received support from parents and administration (SESEMAT, 2008). Study done by Komakech and Osuu (2013) reveals that the INSET programme on science education had great impacts on improved teachers and learner's attitude towards science education.

In the endeavour to improve pupils achievement in mathematics and science, the government of Kenya embarked on the implementation of SMASE-INSET programme for mathematics and science teachers in primary schools between

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2009 and 2013 (Republic of Kenya, 2008). The overall goal of the SMASE programme is to upgrade the capabilities of young Kenyans in mathematics and science education. The programme identified Activity, Student, Experiment and Improvisation (ASEI) and Plan, Do, See, Improve (PDSI) strategies for enhancement of classroom practices for quality teaching and learning of science.

Teachers are seen by pupils as an authority, role model and only source of knowledge and information in the formal classroom setting (Yara, 2009). Learners draw from their teachers' disposition to form their own attitude which may eventually affect their learning. Pupils' positive attitude towards science could be enhanced by teacher related factors such as enthusiasm, resourcefulness and helpful behavior. One of the themes in teacher training in SMASE is on attitude change such that development of positive attitude as a prerequisite for quality teaching and learning of science in primary education. According to Arunga (2007), teachers are encouraged to rethink the usefulness of the lesson plan as a critical tool for lesson delivery. A part from schemes of work and lesson plans, teachers carefully plans the lesson and tries out teaching and learning activities according to PDSI approach to teaching (CEMASTEA, 2010).

Cannon and Newble (2000), define student-centred learning as' ways of thinking about teaching and learning that emphasize student responsibility and activity in learning rather than content or what the teachers are doing'. The conventional

teacher-centred approach is focused on the teacher, where the teacher talks and the student just listen while student-centred approach the students are exposed to hands on activities thus, they will gain first- hand experience and they will also know how to use all their senses. Students will be able to make keen and reliable observations and develop the skill in employing the steps of scientific approach (Salandana, 2009).

Learners' performance is improved if the learning process is relevant to the learners as advocated by the principle of ASEI/PDSI. ASEI movement is important in the teaching method that SMASE-programme disseminates to the teachers through INSET-training (CEMASTEA, 2010). When the learner-centred approaches are well used in classroom practices, there will be positive effect on learners' performance in science.

The government of Kenya has made a lot of effort to upgrade teachers through inset programmes. The intervention of strengthening primary education project (SPRED) programme (1991-1996) aimed at strengthening primary education. However, partially it failed because teachers resisted its student-centred approach in teaching at classroom level. Despite the intervention of School based Teacher Development (SbTD) and the recent intervention by the government the SMASE-programme (Republic of Kenya, 2008), there is still consistent poor performance in science subject across the country which raises concern for all stakeholders.

Therefore, the researcher seeks to investigate how effectiveness of teacher training in SMASE on pupils' performance in science at Kenya Certificate of Primary Education in Samia sub- county, Busia county.

Table 1.1

National KCPE mean scores for science year 2009-2013

Year	2009	2010	2011	2012	2013
Mean scores	29.96	29.82	33.82	32.02	30.9

Source: Kenya National Examination Council Newsletter 2013

Table 1.1 shows poor performance in science in national examinations. There was improvement in 2011 compared to other years. Despite the consistency of poor performance nationally, the district performance as highlighted in table 1.2, is above the nationally performance.

Table 1.2   2009-2013 KCPE mean scores for science examinations in Samia, Busia and Bunyala Sub- Counties

Sub-counties	2009	2010	2011	2012	2013	Average
Samia	50.55	49.78	51.05	53.97	54.11	51.89
Busia	51.98	50.25	54.38	55.76	57.07	53.89
Bunyala	50.31	50.42	52.23	54.41	56.44	52.76

Source: **DEO's office Samia, Busia and Bunyala sub counties (2014)**

The three sub counties science performance mean score is slightly above the ideal mark of 50 percent and not regarded as perfect performance for the counties. Of the three sub county, Samia posted lower average mean score in science performance in KCPE results.

1.2 Statement of the problem

The in-service has not improved the performance of science subject in Samia Sub-County despite the rationale for the introduction of SMASE intervention in Kenya to improve the performance of pupils in mathematics and science. This poses the question teacher training in SMASE has been effective in enhancing the pupils' science performance in Samia Sub County. Teachers of science attended teacher training in SMASE for four cycles in April and August holidays that started in 2009 and ended in 2013. However, once the teachers are trained, they should be able to deliver science knowledge to pupils in a better way leading to improvement in science performance. However, the results mean scores shown in Table 1.1 draw a lot of concern among education stakeholders because it illustrates the poor performance nationally. Table 2.1 illustrates that despite teachers being trained in all four cycles, the performance of pupils in science is slightly above 50 percent from the year 2009 that SMASE began to the year 2013 when it ended.

Research study carried out by Mwagiru (2014) to investigate school factors influencing implementation of strengthening mathematics and science education in science teaching in public primary schools in Kandara Division, Muranga County found out that head teachers do not avail adequate teaching and learning resources for teachers to use during science lessons for effective implementation of SMASE, the study found out that teachers need to have positive attitude towards demonstrative teaching in science lessons and that learning process is effectively implemented by experienced teachers. There are limited studies carried out to investigate the influence of strengthening mathematics and science education on pupils' science performance at primary level. This prompted the researcher to investigate whether teachers' use skills from SMASE effectively in teaching of science subject in Samia Sub County, Busia County.

1.3 Purpose of the study

The purpose of the study was to investigate influence of strengthening mathematics and science education on pupils' science performance in public primary schools in Samia Sub County, Busia County.

1.4 Objectives of the study

The study was guided by the following research objectives:

i. To establish the influence of teacher's use of improvised teaching and learning resources on pupils' science performance in public primary schools in Samia Sub County, Kenya.

ii. To determine the influence of teachers' attitudes on pupils' science performance in public primary schools in Samia Sub County Kenya.

iii. To establish the influence of teachers' lesson planning on pupils' science performance in public primary schools in Samia Sub County, Kenya.

iv. To establish the influence of teacher's use of learner centred approaches on pupil's science performance in public primary schools in Samia Sub County**.**

1.5 Research questions

The following were the research questions for the study:

i. How does the teachers' use of improvised teaching and learning resources influence pupils' science performance in public primary schools in Samia Sub County?

ii. How does teachers' attitude influence pupils' science performance in public primary schools in Samia Sub County?

iii. How does teachers' lesson planning influence on pupils' science performance in public primary schools in Samia Sub County?

iv.   How does teachers' use of learner-centred approaches influence pupils' science performance in public primary schools in Samia Sub County?

1.6 Significance of the study

The outcome of this study may be helpful to school administrators on the usefulness of providing teaching and learning resources to teachers and learners. Research findings may help teachers evaluate their teaching methods in the classroom and help them incorporate improvised teaching and learning resources and learners have a positive attitude and may realize the importance of learning science. The findings may be helpful to the government through the Ministry of Education realize the need to reinforce those areas that contribute to learners' achievements in science subjects by providing more financial support to schools to purchase instructional materials, science equipments and employing more science teachers.

1.7 Limitations of the study

Strengthening mathematics and science education programme is a fairly new phenomenon in primary school in Kenya since it started in 2009 and ended December 2013.The researcher covered only one sub county which may have unique settings thus, the study could not be used to generalize results to the whole country. For conclusive results, all sub-counties in Kenya should be studied.

However, this could not be possible because of research constraints imposed of financial constraints and time.

1.8 Delimitations of the study

The study was conducted in public primary schools in Samia Sub County because SMASE-INSET was meant for public primary teachers teaching in public schools and not for private schools. The study was also limited to a few aspects that influence pupils' science performance like the use of teaching and learning resources, teachers' attitude, teachers' lesson planning and learners' centred approaches in learning. Other issues like school infrastructure and discipline that influence performance were not studied since they were not covered in the study. The study was limited to head teachers and science teachers' who participated and completed SMASE-Inset training and standard eight pupils. SMASE INSET centred on two subjects, that is mathematics and science therefore the study limited to science subject only

1.9 Assumptions of the study

The following were assumptions of the study;

    i.   That all the participants were cooperative in providing appropriate responses to the questionnaire.

ii.   That all science teachers had successfully completed the full four
SMASE-INSET cycles and were using ASEI/PDSI approach in their
classes.

1.10 Definitions of significant terms of the study

The study had the following operational definitions;

ASEI refers to the movement that advocates for activity focused teaching and learning which is learner centred learning, experiments and improvisation.

Improvisation refers to the producing locally available materials in the teaching and learning as advocated by SMASE programme.

Influence refers to teachers having the capacity to use the required teaching and learning resources and methodologies to improve learners' performance.

INSET refers to education and training activities engaged in primary and secondary schools teachers and principals following their initial professional certification and intended mainly to improve their professional knowledge, skills and attitudes in order to educate learners' more effectively.

Learner-centred approaches refer to teaching based on the motivation, interest and participation of learners' thus, Activity, Student-centred Experiment and Improvisation (ASEI).

Learning refers to the act of acquiring new or reinforcing existing knowledge or skills through SMASE-Inset.

Lesson planning refers to the teachers' detailed description of the science lesson instruction according to PDSI approaches.

PDSI refers to an approach that aims at helping teachers practice ASEI activities at the classroom.

Performance refers to the outcome of pupils ability in KCPE measured in terms of mean score or grades.

Resource refers to the physical facilities and materials which aid in the teaching and learning of science.

Teachers' attitude refers to a predisposition or a tendency to respond positively or negatively towards SMASE project.

Teaching refers to providing educational knowledge and skills to the learners.

1.11 Organization of the study

This study is organized into five chapters. Chapter one is introduction to the study and under it focuses on the background to the study, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, limitations of the study, delimitations of the study, assumptions of the study, definition of significant terms of the study and organization of the study. Chapter two explores the review of related literature to the study. This includes concepts on pupils' science performance, background on SMASE, improvised teaching and learning resources, teachers' attitude, teachers' lesson planning and teachers' use of learner-centred approaches and summary of literature review, theoretical framework and conceptual framework. Chapter three consists of research methodology, which includes research design, target population, sample size and sampling procedures, research instruments, validity of instruments, reliability of instruments, data collection procedures and data analysis techniques and ethical considerations. Chapter four comprises of data analysis, interpretation and discussions. Chapter five consists of summary, conclusions and recommendations.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

In this chapter, the researcher reviewed related literature under the sub-headings; concepts of performance, background of strengthening mathematics and science education, teachers' use of improvised teaching and learning resources, teachers' attitude, teachers' lesson planning and teachers' use of learner centred approaches on pupils' science performance.

2.2 Concept of performance

The Oxford English Dictionary (2006) defines performance as the accomplishment and execution of tasks. The accomplishment of task in the context of the academic function of school refers to academic efficiency which is measured of student performance in class work and national examinations. Academic performance is the outcome of education, the extent to which a pupil, teacher or institution has achieved their educational goals that is commonly measured by examinations.

In the context of teaching, performance refers to the teachers' ability to teach consistently with honesty and regularity. Campbell, Dunnette, Lawler & Weick (1990) argues that performance is something a person regards as an outcome of work, because they provide the strongest link to the strategic goals of the

organization, customer satisfaction, economic and social contribution. School performance should not only be viewed in terms of academic but also focus on other domains of education like affective and psychomotor. However, one can say that schools' performance is the response of the school to the needs of the stakeholders in terms of the education outcomes. Armstrong (2001) holistic approach to academic performance is helpful in exploring a comprehensive view of the constituents of academic performance.

2.3 Strengthening Mathematics and Science Education (SMASE)

According to Kibe et al (2008), studies on quality of education in Kenya indicate low quality and poor performance, especially in mathematics and science subjects compared to other social science subjects. According to Waititu (2009), SMASE came into being when the consistently poor performance in mathematics and science became a matter of serious concern. Broad curricula, lack of facilities and inadequate staffing were cited as the major causes of the major problem. Although dismal performance in mathematics and science had almost been accepted as the norm in most schools, the Ministry of Education and other stakeholders felt there had to be an intervention, hence the Strengthening of mathematics and science education (SMASE). National KCPE mean score for science is far much below average 2009 mean score of 29.96, 2010 mean score of 29.82, 2011 mean score of 33.82, 2012 mean score of 32.02 and 2013 mean score of 30.9. The performance is consistently below average.

CEMASTEA, (2011) from the results of the survey it conducted, it was evident that there were numerous problems in science performance. Among these were those problems were within the scope of SMASE operations that includes; attitudes towards science was generally found to be negative, this was contributed to low marks at KCPE, belief that the subject was difficult, peer influence, lack of facilities, harsh teachers and theoretical approach to teaching. Secondly, inappropriate teaching methodology, most were teacher centred without pupils' involvement in the lesson, that is using talk and chalk and thirdly teacher mastery of content was found to be low and impacted on delivery of content lastly few or no interactive forums for teachers to share appropriate approaches in teaching of science.

SMASE aims include the following upgrade teachers' content in their subject areas and provide forum for mathematics and science teachers to meet and exchange ideas and experiences through peer teaching and lesson observation, develop good work plan through ASEI-PDSI approach as a way of ensuring well utilization of available resources in terms of money and time and identifying ways of creating and sustaining interest, bringing about attitude change in the mathematics and science among education stakeholders, policy makers, administrators, teachers, learners and parents, equipping district trainers with skills of carrying out situational analysis in their respective districts and to develop a curriculum addressing their needs or gaps, equipping teachers with

skills for proper use of innovations as a problem solving in this era of 21st century which is characterized by technological changes and lastly provide mathematics and science teachers a chance for self-professional development which is one of the requirements for the teachers Teacher Service Commission as stipulated by the constitution (SMASE,2008).

2.4 Teachers use of improvised teaching and learning resources and pupils' science performance

Muriuki and Nyagah (2004) defines a resource as any source of information or support that the teacher uses to make teaching more effective and meaningful to learners. A supportive learning classroom is one which is student centred and involves use of a variety of teaching and learning resources. Resources are tools that classroom teachers use to help their students learn quickly (Choi and Tang, 2009). Wilkens (1976), observes that teaching resources when used while teaching, they supplement oral explanations and descriptions used in demonstration. This is in line with Bell (1978) concurs by noting that teaching and learning resources are used to promote learners' interest in science and mathematics, motivates and practice of skills that illustrate and clarify concepts in science.

The availability and use of materials like textbooks, science apparatus, chemicals and other supplementing reading materials have a vital influence on teaching and learning process with positive effect on learner's performance (Gakuru, 2005).

Teaching and learning resources enhances understanding of abstract ideas and improves performance (UNESCO, 2008). Wanjohi (2006) observed that the use of teaching and learning resources enhance retention of what is learnt about 80 percent.

Committed teachers are said to be spending a lot of time on activities related to students' affairs, such activities include collection and improvising teaching learning resources (Choi & Tang, 2011). CEMASTEA-Kenya (2012), reported a study carried out in 2010, where 12 districts, classes 6, 7 and 8 pupils and science teachers participated in the study. The findings showed that 37 percent of the teachers prepare appropriate and effective teaching and learning resources. CEMASTEA (2012) recommended that teachers should use teaching learning resources because they emphasize information, stimulates interest and facilitates the learning process of science. On the contrary, some studies show that in-service programme for teachers do not affect pupils' performance and that they are ineffective. A study done in Australia on INSET known as National Computer Education Programme reveals that despite teachers being serviced very few used computers back in school and used them differently from the way they were trained (Ingravarian & McKenzie, 1988).

2.5 Teacher's attitude and pupils' science performance

Newstrom and Davis (2002), attitudes are feelings and beliefs that largely determine how one perceives their environment, commit themselves to the intended actions and ultimately behave. Positive attitude motivates science teachers in primary to work and the end result is good performance. In Israel, studies done by Dori and Barneas (1994) shows that in-service programme was very effective in changing teachers' attitude towards use of computers in classroom especially in science. Bandura (1971) in his observational theory argues that attitude is acquired by watching another person who could be a model, teacher, parent, mentor or friend. Therefore, pupils' attitudes are reflected by teachers' attitude. Favorable teacher attitude carry student along.

Nui and Wahome (2006) argue that poor or negative attitude towards learning is caused by the belief that the subject is hard, lack of facilities, theoretical teaching, harsh teachers and teacher absenteeism. The student negative attitude toward learning is measured through student absenteeism, feigned sickness, and lack of attention in classroom. Lenga (2001), in everything we do, success is determined by the attitude with which we appreciate it and in most cases we become what we think. If teachers are to do well in their profession, then they should change their attitude towards the innovations and be ready to implement the resolutions in the classroom. Learners and parents should also change their attitude science subjects

and parents at home should make contributions by telling their children the importance of science subjects, check on their work and buy them necessary learning materials.

Cross (1999) notes that attitudes determine what students learn and their willingness to learn. Negative attitude can be powerfully inhibit intellect and curiosity and keep us from learning what is well within our power to learn. SMASSE project (1998) show that there was a general feeling among some teachers, students and key stakeholders that science is a difficult subject. SMASE-Inset consist of a theme on attitude change such that development of positive attitude as a prerequisite for quality teaching and learning of science in primary. John and Karaac (2004) stated that teachers' individual attitude about mathematics and science teaching and learning have a significant influence on their instructional practices. They further state that in some cases teacher's beliefs about science and mathematics teaching and learning are not consistent with classroom practices and though teachers are aware of the conflict between them, they never try to change.

According to Fairbank, Gerald, Beverly, Yette, Barbara and Stein (2010) did a study to explore why some teachers are more adaptive than others. They found out that knowledge alone does not lead to the kind of thoughtful teaching everyone strives to maintain. According to the study, teachers with similar

professional knowledge and qualifications were found to have differences in their teaching practices. They further suggested the need to move beyond knowledge in teacher education with an aim to explore questions about preparing thoughtful teachers. SMASE in-service training provides a basis for thoughtful planning for effective teaching of science using ASEI/PDSI.

2.6 Teachers lesson planning and pupils science performance

The third cycle of SMASE programme was actualization of ASEI/ PDSI approach. The teachers here were taught to develop ASEI/PDSI lessons which were tried out by their peers and then teach actual learners in the classroom (SMASE, 2009). ASEI is an abbreviation of Activity, Student, Experiment and Improvisation. PDSI is an abbreviation of 'Plan' (planning a lesson),' Do' (carrying out the planned activities or lesson), 'See' (assessing students understanding and evaluating the lesson) and 'Improve' (improving the lesson based on the evaluation). PDSI is a continuous reflection process which allows a teacher to improve science lesson, subsequent lessons and lesson delivery skills in general (CEMASTEA, 2010).

A part from schemes of work and lesson plans, teachers carefully plans the lesson and tries 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). This emphasizes the instructional activities that will enable learners to understand individual concepts and connects among them; learners get value for the lesson, get rid of the learning difficulties and have interest in the lesson. According to Arunga (2007), teachers are encouraged to rethink the usefulness of the lesson plans as critical tool for lesson delivery. Teachers are to consider learners background like needs interests, previous experiences in relation to the topic and learning difficulties (CEMASTEA, 2010).

The second part of PDSI is 'Do'. The teacher carries the planned lesson activities as intended. Here teachers focus on the innovative lessons, presenting the lesson in varied and interesting ways to arouse learner interest through role play, storytelling among others. The teacher ensures active learners participation and be facilitator to teaching and learning process (CEMASTEA, 2012). The third part of PDSI is 'See'. Teachers evaluate teaching and learning process during and after the lesson objectives and planned activities. This enables teachers to focus on good practices in the lesson and improve on the mistakes made in the previous ones. The teacher becomes more open to evaluation by fellow teachers, school administrators, quality and standards assurance officers and the learners (CEMASTEA, 2012).

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) notes that teachers evaluate the teaching and learning process by reflecting on performance and the effectiveness in achieving the lesson objectives. Nui and Wahome (2006) reported from SMASE project impact assessment survey of 2004 that students were actively involved in the learning process. However, noted that none of the teachers had written work plan but judging from the flow of the lesson, it was evident that teachers knew what they intended to do. Jangaa (2005) notes that teachers prepare lesson plans as a matter of requirement and only do it when followed by the administrators.

2.7 Teachers' use of learner-centred approaches and pupils' performance

Recent studies in science education show that the teaching of science subjects should be learner centred with the teachers role being that of a facilitator, guide, councilor, motivator, innovator and researcher (SMASE 2009). There must be student-centred activities involving a lot of improvisation in the experiments which helps to demystify science and also assist in changing the attitude of learner toward towards the subject (SMASSE, 1999).

Using inquiry based approach, learning takes a lot of time but it is often effective. Students practice problem solving and critical thinking skills to arrive at a conclusion. According to Brown and Adams (2001), describes the changing nature of the teacher in a constructivist learning that is 'teachers must shift their

attention away from themselves as effective presenters of scientific information towards a focus on students developmental needs to learn science with understanding. For those teachers who have undergone SMASE-INSET, the method is highly used in teaching and learning of science.

Other teaching approaches that are emphasized for teaching science during the SMASE-project include project work, which enables learners to engage in scientific investigation in areas of their own interest, field work excursions to provide pupils with first hand evidence of scientific phenomena and how they impact on everyday life. Modern methods of teaching such as simulation, games, skits and puzzles which may be very effective in teaching science if well understood and used (SMASSE, 2002).

The principle of ASEI movement and PDSI approach was noted to be very compatible with Kenya's educational aspirations because there was a need to move from knowledge- based to activity-based teaching, teacher-centred to learner centred, lecture method to experiment and research based strategies and then from full scale to small scale experiments and improvisation. The students are involved through hands-on, minds-on, eye-on and mouths-on activities and develop their knowledge (SMASSE, 2002).

2.8 Summary of literature review

The main challenge addressed by SMASE-INSET programme is the quality of teaching that needs to be strengthened and be made effective in order to achieve quality performance in national examination. Teaching and learning of science is promoted by use of resources. Gates (2003) points out that using physical apparatus helps learning easier. He also notes that using tangible and visible things helps pupils draw connections more easily and makes learning experience more memorable by relating different sensory areas.

A more learner-centred approaches need to be embraced where heuristic approach is upheld. Learners should be actively involved in learning process in observation, recording, data analysis and drawing conclusions. Many countries in Africa have developed new science and mathematics curricula at all levels of learning which were predicated by the discovery approach to learning as opposed to older curricula, using more didactic approaches to learning (Namuddu, 1989).

There is limited research that has been carried out to investigate the influence of SMASE on learner's science performance in public primary schools in Samia Sub County. The study is aimed at filling the knowledge gap by investigating effectiveness of teachers training in SMASE on science performance in public primary in Samia Sub County.

2.9 Theoretical framework

The research study is based on constructivist learning theory by Jerome Bruner (1966). The major theme in the theoretical framework is that learning is an active process in which learners construct new ideas or concepts based upon their current and past knowledge. The learner selects and transforms information, constructs hypotheses and makes decisions relying on a cognitive structure.

In practice, the teacher should encourage students to discover principles by themselves and also the teacher should engage learners in an active dialogue like inquiry approach. The theory advocates for active participation of learners in learning process rather than being passive receivers of knowledge. Learners should be involved in physical action, hands-on experience which engages mind. The learner is allowed to make mistakes and learn from them. Learning is more meaningful if the child is allowed to experiment on his own rather than listening to the lecture. The teacher should present learners with materials, situations that allow them to discover new learning. In this case the teacher becomes a facilitator of knowledge that is he guides and stimulates the learners.

The strengths of the theory are that the children learn more and enjoy learning more when they are actively involved rather than passive listeners, education works best when it concentrates on thinking and understanding rather than on rote memorization, constructivism gives learners ownership of what they learn, since

learning is based on pupils questions and explorations and often the students have a hand in designing the assessment as well. The weaknesses of constructivism theory is that it removes grading in the traditional way and instead places more value on students evaluating their own progress which may lead to students falling behind but without standardized grading and evaluation teacher may not know that the learner is struggling, another disadvantage is that it can lead students to be confused and frustrated because they may not have the ability to form relationships and abstracts between the knowledge they already have and the knowledge they are learning for themselves. Despite these problems, the theory is based on construction of learners' own perspective of the world through individual experiences and schema.

The researcher has adopted this constructivist theory because SMASE programme advocates for learner-centred approaches and learners being active participants in learning process. The SMASE programme encourages teachers to plan their lesson putting in mind learner's prior knowledge experiences on the topic and built new concepts on it. The same applies to the theory which acknowledges prior experiences on which learners construct new knowledge.

2.10 Conceptual framework

Orodho (2004) defines conceptual framework as a model of presentation where a researcher represents the relationship between variables in the study and show the relationship diagrammatically.
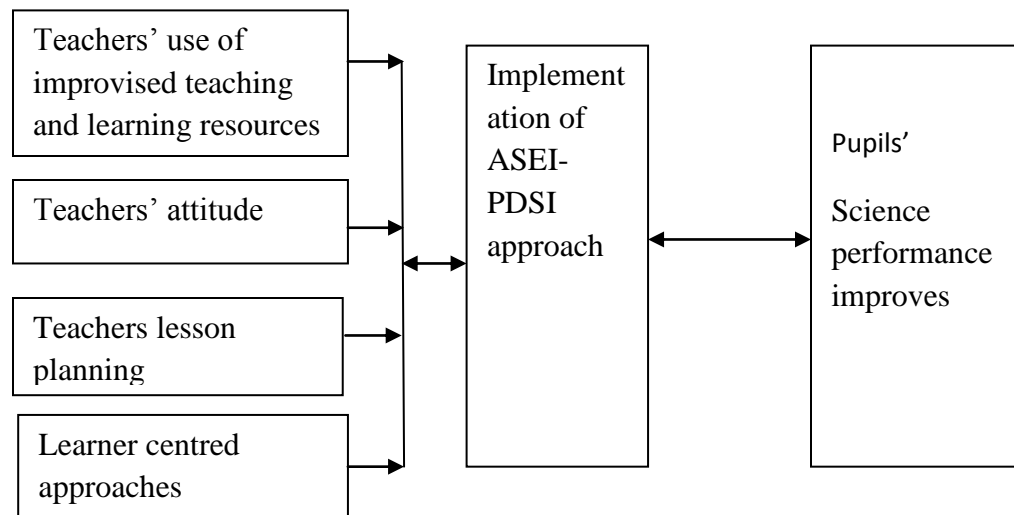
Figure 2.1 Relationship between factors influencing pupils' science performance in public primary schools in Samia Sub County.

Figure 2.1 shows the relationship between variables influencing performance of pupils' in science. Proper implementation of teaching and learning resources as required by SMASE-INSET will influence pupils' performance in science. Positive attitude by teachers in facilitating lessons will influence performance. Sizeable workload by teachers' leads to close interaction with pupils hence improves performance. Teachers' use of learner centred approaches as required by SMASE encourages step by step learning by pupils.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter describes the research methodology. These include research design, target population, sample size and sampling techniques, research instruments, instrument validity, instrument reliability, data collection procedures and data analysis techniques.

3.2 Research design

Kombo and Tromp (2006) define research design as an arrangement of conditions for collections and analysis of data in a manner that aims to combine relevance of research purpose. The research adopted a descriptive survey design. According to Mugenda and Mugenda (1999), descriptive survey is a method of collecting information by interviewing or administering questionnaires to a sample of individuals. Therefore, this study aimed at getting respondents opinions and attitude on the effectiveness of strengthening mathematics and science education on pupils' science performance in Samia Sub County.

3.3 Target population

Borg and Gall (1993) define population as the members of a real set of people, objects to which a researcher wishes to generalize the results of the study. According to the data from District Education Office (2014), there are 63 public primary schools, 63 science teachers from Standard Eight class and 1901 Standard

Eight pupils. According to the DEO's office, standard eight classes are single streamed. In descriptive studies, three categories of respondents are crucial, that is, the head teachers, informed specialist who are standard eight science teachers and the consumers of the intervention who are Standard Eight pupils.

3.4 Sample size and sampling procedure

Mugenda and Mugenda (2003), define a sample as a small group from the accessible population. According to Mugenda and Mugenda (2003) a sample size of 10-30 percent of the respondents should represent the target population. However, for this study, 30 percent of the head teachers and science teachers were used and 10 percent of pupils. In this case, 18 out of 63public primary schools in Samia Sub County were sampled. Science teachers and head teachers of sampled schools were automatically selected. The researcher adopted simple random sampling of 11 pupils per 18 sampled schools. To obtain the 18 schools and 190 pupils, the researcher wrote 63 names of schools on pieces of papers and on them, the word 'Yes' was written on 18 pieces and 45 written 'No'. The papers were folded and mixed together in a container, then the researcher handpicked one by one. Those picked written 'Yes' constituted the sampled schools. For pupils, the researcher find out the numbers of pupils in class eight in sampled schools and then wrote pieces of papers the word 'Yes' on eleven pieces of papers and the rest 'No'. Those picked yes constituted the sampled pupils in that particular school.

Table 3.1 Sample size frame

Category of respondents	Target population	Sample size	percent
Head teachers	63	18	30
Science teachers	63	18	30
Pupils	1901	190	10
Total	**2027**	**226**	

Table 3.1 above represents sample size of the target population in Samia Sub-County. Total target population was 2027 and the total sampled size was 226.

3.5 Research instruments

Data was collected using questionnaires for science teachers and pupils while structured interview guide for head teachers. According to Kombo and Tromp (2006), questionnaire is appropriate because it is the most suitable for descriptive research design. Mugenda and Mugenda (2003) questionnaires allow respondents to express themselves freely. Both open ended and closed ended questions were used. Science teachers' questionnaire has five sections. Section A which had three items on demographic data of teachers, section B on teaching and learning resources with five items, section C on teachers' attitude with eight items, section D on teacher's lesson plan with five items and section E on learner-centred approaches with five items. Pupils' questionnaire had four sections. Section A,

demographic information had five items , section B information on teaching and learning resources had five items, section c is teacher's attitude with five items and learner centred approaches which had four items. Interview guide is appropriate because accurate information can be collected. The guide had five sections. Section A had demographic information with four items, section B on teaching and learning resources had three items, and section C on teachers' attitudes had two items, section D on teacher's lesson plans which had two items and section E on learner centred approaches which had three items.

3.6 Validity of the instruments

 Mugenda & Mugenda (2003) validity refers to the degree which results obtained from analysis of the actual data represent the phenomena. Kothari (2003) define content validity as the degree to which measuring instrument provides enough content under study. To enhance content validity, appropriate and adequate items relevant to research objectives were included in the questionnaires. Pilot schools and pupils were randomly selected to respond to the questionnaires. After one week, the same items were administered to same respondents and the results compared to determine the reliability of the instrument (Orodho, 2009). Best and Khan (2004) supports the use of experts to check validity of the instruments.

3.7 Reliability of the instruments

Reliability of a research instrument concerns the extent to which instrument yields the same results on repeated trials Mugenda & Mugenda (2003). The researcher used two pilot schools that are two head teachers, two science teachers and twenty pupils in Samia Sub County before the actual data collection. Test retest technique was used to ascertain the reliability of the instrument. According to Mugenda & Mugenda (2003) a coefficient of 0.80 or more will imply a high degree of reliability. Pearson's Product Moment Correlation formula was used to compute the correlation coefficient.

$$r = \frac{\dfrac{\sum xy - \sum x \sum y}{N}}{\sqrt{\left(\sum x^2\right) \dfrac{\left(\sum x\right)^2}{N}}\left(\sum y^2 - \left(\sum y\right)^2\right)}$$

Where

r -   The degree of reliability

x -   The score obtained during the first test

y -   The score obtained during the second test

$\sum$ -   Means summation

N -   The number of scores within each distribution, Orodho (2009).

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The correlation coefficient of 0.82 for the teachers and 0.94 for pupils indicated high degree of reliability of the data.

3.8 Data collection procedure

A research permit was obtained from the National Commission for Science, Technology and Innovation. The District Commissioner and the District Education Officer Samia Sub County were presented with a copy of the permit. The head teachers of sampled schools were served with an introductory letter at least a day before the data collection. The researcher personally visited the schools and administered questionnaires to the teachers and pupils and interview guide to head teachers which was face to face interaction then immediately collected them upon completion.

3.9 Data analysis techniques

Raw data was collected and cross checked to ensure uniformity and then grouped according to objectives and research questions. Data was analyzed using descriptive and inferential statistics with the use of Statistical Package for Social Scientist Software (SPSS) 20.0 version. Descriptive statistics were used to summarize data in form of frequencies and percentages. Data was organized and presented in form of frequency tables and figures. Qualitative data was grouped in themes and used words for explanation. Chi-square test was used for observed and theoretical values.

3.10 Ethical considerations

The researcher explained the research objectives to head teachers and science teachers. All participants were informed that there will be no psychological risk and no financial benefits and their participation was voluntarily applied in this study. The researcher treated the respondents with respect and courtesy. The research procedures were non exploitative, carefully considered and well administered. The participants were assured of anonymity and confidentiality of their responses where they were not required to write their names on the questionnaire.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

This chapter deals with presentation, analysis and interpretation of data findings generated from public primary schools in Samia Sub County, Busia County. The findings have been presented with respect to each of the objective of the study. Data analysis is both qualitative and quantitative. The main issues discussed include the following; the respondents' response rate, demographic data of respondents and responses to the research objectives.

4.2 The response rate

The study presents a sample of 18 public primary schools, drawn from a target of 63 public primary schools. The information is shown in the Table 4.1.

Table 4.1
Questionnaire return rate

Respondents	Sampled	Returned	Return rate
Head teachers	18	17	94.4
Teachers	18	18	100
Pupils	190	190	100
Total	**226**	**225**	**98.1**

The results in Table 4.1 shows 18 head teachers targeted for the study of which 17 participated forming 94.4 percent return rate. The study also targeted 18 standard eight science teachers of whom all participated forming a 100 percent return rate and 190 standard eight pupils responded to the study questions making a response rate of 100 percent. According to Edwards, Robert, Clarke Diquiseppi, Pratop, Wentz and Kwan (2000) a questionnaire return rate of 80 percent and above is absolutely satisfactory, while 60 to 80 percent return rate is barely acceptable. The questionnaire return rate was 98.1 percent which is acceptable.

4.3 Demographic data of the respondents

The target participants were head teachers, science teachers and standard eight pupils in Samia Sub County. In order to gain understanding of participants involved in the study, each respondent were asked to indicate their personal information. Information that was included in the head teacher demographic data included gender, professional qualification and number of years in service. Teachers' demographic data were gender, age and professional qualification while for pupils the information was gender and age.

4.3.1 Distribution of head teachers by gender

An item on the head teachers sought the information on their gender with the aim of establishing gender distribution in the schools and if gender has influence on science performance. The distribution of head teachers' gender is shown in Table 4.2.

Table 4.2

 Distribution of head teachers' by gender

Gender	Frequency	percentage
Male	16	94.1
Female	1	5.9
Total	**17**	**100.0**

Table 4.2 shows majority of respondents were male head teachers at 94.1 percent while 5.9 percent were female head teachers. This indicates that there were gender imbalances in the schools under study.

4.3.2 Distribution of head teachers' by professional qualification

The head teachers were interviewed on their professional qualifications. This was necessary in order to determine the level of competence which is in the implementation of strengthening mathematics and science education**.** Table 4.3 shows the distribution of head teachers by professional qualification**.**

Table 4.3

Distribution of head teachers by academic qualification

Academic qualification	Frequency	Percentage
Masters	1	5.9
Bachelor of Education	4	23.5
Diploma	7	41.2
P1	4	23.5
ATS	1	5.9
Total	**17**	**100**

The data in Table 4.3 indicate that 41.2 percent of head teachers had diplomas followed by bachelors' of education holders and P1 at 23.5 percent respectively. Only one head teacher had Masters in Education.

4.3.3 Distribution of pupils by gender

The information on the pupil's gender was sought to establish the number of boys and girls in standard eight in sampled schools. Table 4.4 indicates the distribution of pupils by gender.

Table 4.4

Distribution of pupils by gender

Gender	Frequency	Percentage
Boys	93	48.9
Girls	97	51.1
Totals	**190**	**100**

Table 4.4 shows that the majority of the pupils' respondents were girls at 51.1 percent. This implies that girls were majority at primary level of education in Samia Sub County**.**

4.3.4 Distribution of pupils by age

Information on pupils' age was sought in the study. This was useful in order to establish if standard eight pupils were rightfully placed in the right class. Table 4.5 shows pupils distribution by age.

Table 4.5

 Distribution of pupils by age

Grouped years of pupils	Frequency	Percentage
12-14	54	28.5
15-17	132	69.4
18-21	4	2.1
Total	**190**	**100**

The findings in Table 4.5 revealed that majority of the pupils are between 15-17 years of age at 69.5 percent while the youngest pupils are between 12-14 years of age at 28.6 percent. The oldest pupils are eighteen years of age at 2.1 percent. This implies that many pupils were overage; the average age at primary level is at fourteen years of age. The age of a child may dictate the attitude towards science performance, however, this may can be assumed that the more advancement of pupils age the negative attitude in comprehension of science subject.

4.3.5 Distribution of science teachers' by gender

The science teachers were asked to indicate there gender, this information was important in showing gender distribution in the schools under study. This will help to indicate if there is gender balance in the teaching of science subject. This is shown in the table 4.6

Table 4.6

Distribution of teachers by gender

Gender	Frequency	Percent
Male	14	77.8
Female	4	22.2
Total	**18**	**100.0**

The data in Table 4.6 revealed that 14 (77.8 percent) of science teachers' were male and 4 (22.2 percent) were female. However, from the findings, the teaching of science subject in Samia Sub County is dominated by male. This may be attributed to the apathy and stereotypes that show science as a male domain (Gituthu, 2014).

4.3.6 Distribution of teachers by professional qualification

Science teachers were required to indicate their level of professional qualification. This is important to determine the level of competence in implementation of SMASE programme. This is illustrated in Table 4.7

Table 4.7

Distribution of teachers by professional qualification

Qualification	Frequency	Percentage
Bachelor of Education	5	27.8
Diploma	5	27.8
P1	7	38.8
ATS	1	5.6
Total	**18**	**100.0**

The result in Table 4.7 revealed that most of the science teachers' in Samia sub county were P1 certificate holders at 38.8 percent followed by degree holders in Bachelor of Education and those with Diploma at 27.8 percent respectively. This implies that science is taught by qualified teachers which are in line with Teacher Service Commission for hiring primary teachers with a minimum of a P1 certificate to teach at primary level.

4.3.7 Distribution of teachers by age

The science teachers respondents were categorized according to their age, the result were illustrated in figure 4.1.
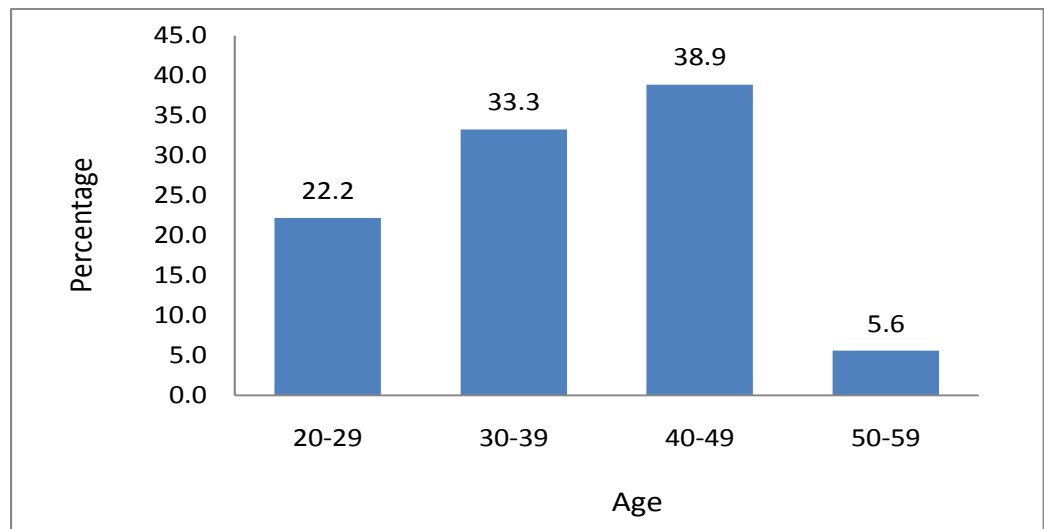
Figure 4.1: Age distribution of teachers

The data in Figure 4.1 indicates distribution of science teachers by age. Study findings shows that, majority of science teachers in Samia Sub-County were aged

between 40-49 years of age at 38.9 percent. This implies that teachers that participated in the study were mature and had long exposure to the content therefore, were in a better position to apply learner centred strategies. The group that followed ranges between 30-39 years of age at 33.3 percent. This is also an advanced group in age that has teaching experience which may have influence in the teaching of science. The study also revealed that science teachers were distributed in terms of age noting that there were young teachers ranging from 20-29 years of age and old teachers from 50-59 years of age in Samia Sub-County.

4.4 Findings on the improvised teaching and learning resources and pupils' science performance

The first objective of this study was to establish the influence of teachers' use of improvised teaching and learning resources on pupils' science performance in Samia Sub County, data was sought to provide information on improvisation done by teachers during science lesson.

4.4.1 Teachers' response on improvised teaching and learning resources

The researcher sought to find out the extent to which science teachers use improvised teaching and learning resources. They were to indicate the level of agreement or disagreement with the given statement as per the following.

 Key: **SA** (Strongly Agree), **A** (Agree), **D** (Disagree), **U** (Undecided), **SD** (Strongly Disagree). This data is presented in Table 4.8

Table 4.8

Teachers' response on use of improvised teaching and learning resources

Statement	SA		A		D		U		SD	
	F	%	F	%	F	%	F	%	F	%
Do you improvise teaching materials during science lesson	2	11.1	7	38.9	4	22.2	3	16.7	2	11.1
Use of readily teaching aids in science	16	88.9	2	11.1	0	0.0	0	0.0	0	0.0
Engage pupils in making teaching materials	2	11.1	10	55.6	4	22.2	2	11.1	0	0.0
School administration supportive in provision of materials	9	50.0	6	33.3	3	16.7	0	0.0	0	0.0
Availability of teaching materials in school	6	33.3	8	44.4	2	11.1	1	5.6	1	5.6

n=18

The result in Table 4.8, majority at 50 percent of teachers agreed that they improvise teaching and learning materials during science lesson. This implies that

the improvisation of teaching and learning resources has been partially implemented in the teaching of science as advocated by SMASE programme. Improvisation is in line with CEMASTEA (2012) which recommends improvisation and utilization of teaching and learning resources when/ where necessary. On the other hand, 76.5 percent of head teachers indicated that teachers in their schools in Samia Sub County improvise teaching materials. The study showed that 88.9 percent of teachers use teaching and learning aids.

From the study findings on the engaging pupils in the making of some teaching and learning materials, majority at 55.6 percent of teachers agreed in involving learners in the making of learning materials. Pertaining school administration supportive in the provision of teaching and learning, 50 percent of teachers' strongly agreed while 33.3 percent of teachers agreed and 16.7 percent strongly disagreed. This is not in agreement with head teachers interview where they all indicated by 100 percent in support of provision of teaching resources. From the study findings, 77.7 of teachers agreed on the availability of teaching and learning resources. This is in line with Gakuru (2005), Wanjohi (2006) who found out that the availability and use of learning materials have vital influence on teaching and learning process with positive effect on learners' performance.

4.4.2 Pupils' responses on teachers' use of improvised teaching and learning resources

The researcher sought information from the pupils on their teachers' improvisation in science in order to confirm the improvisation and also information on their current score in science as represented in in Table 4.9 and 4.10. **Key;** Very often **(VO**), Often **(O)**, Rarely **(R)** and Not at all**(NA).**

Table 4.9

Pupils' responses on the extent of improvisation of teaching and learning resources

Statement	VO		O		R		NA	
	F	%	F	%	F	%	F	%
Teacher improvise during science experiments	28	14.7	54	28.4	84	44.2	24	12.6
Teacher use more charts, model during science lesson	58	30.5	56	29.5	32	16.8	44	23.2
Carryout small scale experiments during the lesson	23	12.1	38	20.0	76	40.0	53	27.9
Are you involved in preparation of learning aids	18	9.5	32	16.8	113	59.5	27	14.2

The school provide reference materials	159	88.7	31	16.3	0	0.0	0	0.0

n=190

Table 4.9 indicates that 43.1 percent of pupils improvise during science experiments in class while 44.2 percent indicated that rarely improvise. This implies that most standard eight pupils in public primary schools in Samia Sub County are not involved in the improvisation of teaching and learning resources therefore, learners are not given adequate experiments to manipulate apparatus as advocated by SMASE-INSET. The study findings shows that 30 percent of pupils indicated very often use more teaching and learning aids like charts and models while 23.2 percent indicated not at all.

From the study findings, the result shows that 32.1 percent of pupils indicated they carry out small scale experiments during science lesson while 27.9 percent indicated not at all. The National Research Council (1996) believes that the best way of teaching science is to assist learners by arousing their curiosity. On involving pupils in the preparation of teaching aids, the study findings shows 26.3 percent of pupils indicated are involved while 14.2 percent indicated not at all. The study revealed that 100 percent of pupils indicated that the school provides reference materials. This is in line with Choi and Tang, (2011) who found out that committed teachers spend a lot of time improvising teaching and learning resources.

Table 4.10

Pupils' current science scores

Grouped scores	Frequency	Percentage
30-40	2	1.1
40-50	29	15.3
50-60	49	25.8
60-70	57	30.0
70-80	38	20.0
80-90	12	6.3
90-100	3	1.6
Total	**190**	**100.0**

The findings in Table 4.10 the study indicate that majority at 30 percent of pupils scored between 60-70 and the lowest at 1.1 percent ranges between 30-40. This is good indication that majority of pupils score above average. From the study findings, improvisation of teaching and learning resources in science influence performance at 83.6 percent of pupils score above average.

4.4.3 Chi-square test for pupils' science current scores and improvisation of teaching and learning resources

To determine the influence of improvisation of teaching and learning resources and the pupils' current scores in science, the researcher computed the variables and presented in Table 4.11

Table 4.11

Chi-Square test for pupils' current score and improvised teaching and learning resources

Improvised teaching and learning resources	Value	Df	Asymp.Sig. (2-sided)
Pearson Chi-Square	23.083[a]	6	.001
Likelihood ratio	18.241	6	.006
Linear-by-Linear	.018	1	.892
N of Valid Cases	190		

a. 6 cells (42.9%) have expected count less than 5. The minimum expected count is .33.

Table 4.11 shows the chi-square tests X^2 (6, N=190) =23.083, p=.001. This implies that there is a significant relationship between improvised teaching and learning resources and pupils' performance. The alpha level of .01 is significant

4.4.4 Chi-square test for improvised teaching and learning resources

To determine the influence of teachers' use of improvised teaching and learning resources in science, the researcher computed five variables as presented in Table4.12.

Table 4.12

Chi-square test for improvised teaching and learning resources

	Teacher improvisation	Readily use teaching aids	Pupils making learning aids	School administration support	Availability of teaching and learning resources
Chi-Square	4.778[a]	10.889[b]	9.556[c]	3.000[d]	11.444[a]
Df	4	1	3	2	4
Asymp. Sig.	.311	.001	.023	.223	.022

Table 4.12 shows the computed chi-square test value for teachers improvised teaching materials X^2 (4,N=18) =4.78, p=.311.The p-value .311 is higher than the alpha 0.05. Meaning there is no significance difference between observed and the

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theoretical. The computed chi-square test value for readily use of teaching and learning X^2 (1, N=18) =10.89, p=.001. This has significant difference between observation and theoretical values at alpha 0.01. The use of improvised teaching and learning aids has influence on pupils' science performance. However, computed chi-square test value for teachers engaging pupils in making teaching and learning material X^2 (3, N=18) =9.56, p=.023. This is significant value because it is lower than alpha 0.05. While pertaining availability of teaching and learning resources has computed chi-square X^2 (4, N=18) =11.44, p=.022. The p-value.022 is lower than alpha .05, meaning there is significance between the availability of teaching resources and pupils' performance, therefore availability of teaching and learning resources has influence on pupils' science performance.

4.5 Findings on influence of teachers' attitude and pupils' science performance

The second objective of this study was to determine the influence of teachers' attitude on pupils' science performance in Samia Sub County.

4.5.1 Teachers' responses on influence of attitude

The researcher sought information from the teachers on the influence of attitude in teaching science. They were required to indicate the extent to which they agree or disagree as indicated in the key.

Key: SA (strongly agree), **A** (agree), **D** (disagree), **U** (undecided) and **SD** (strongly disagree). The data is represented in Table 4.13.

Table 4.13

Teachers' responses on attitude and pupils' performance

Statement	SA		A		D		U		SD	
	F	%	F	%	F	%	F	%	F	%
ASEI/PDSI lesson plan is difficult to prepare	3	16.7	11	61.1	4	22.2	0	0.0	0	0.0
Not possible for activity in every lesson	14	77.8	4	22.2	0	0.0	0	0.0	0	0.0
Evaluation is necessary for effective teaching	7	38.9	11	61.1	0	0.0	0	0.0	0	0.0
ASEI activities help learners' understand	8	44.4	10	55.6	0	0.0	0	0.0	0	0.0

difficult concept										
ASEI/PDSI delays syllabus coverage	1	5.6	7	38.9	7	38.9	0	0.0	3	16.6

n=18

The findings in Table 4.13, the study shows that majority at 77.8 percent of teachers agreed ASEI/PDSI lesson plan is difficult to prepare while 22.2 percent disagreed. According to the teachers', ASEI/ PDSI approach is cumbersome and requires a lot of time to prepare and execute a lesson. Newstrom and Davis (2002) positive attitude motivates science teachers to work and end result is good performance. The study findings revealed that it is not possible to have an activity in every science lesson by 77.8 percent of teachers strongly agreeing while 22.2 percent of teacher agreeing. Teachers argued that allocated time of 35 minutes per lesson was not enough to cover the syllabus and realize results if ASEI/PDSI pedagogy was to be fully practiced in classroom. This is in line with Organization for Economic Co-operation and Development (2004) that pupils do not passively receive and process information; they are active participants in the learning process. Learners should be encouraged to participate during science lesson through activities.

From the study findings, majority of teachers agreed at 61 percent that evaluation is very necessary for effective teaching while 39 percent strongly agreed. This

means that science teachers give tests or questions after teaching their lessons. Teacher opinions on ASEI/PDSI activities help learners understand difficult concepts, 55.6 percent of teachers agreed while 44.4 percent of teachers strongly agreed. On ASEI/PDSI activities delay syllabus coverage, 44.5 percent of teachers agreed while 38.9 percent of teachers disagreed. Negative attitude towards an innovation like strengthening mathematics and science education can inhibit intellect and curiosity and keep teachers from teaching effectively. From the study findings, teachers unanimously indicated no by 100 percent that SMASE made no difference in the performance also from the findings; teachers indicated no by 100 percent that SMASE is a waste of time and resources. On the other hand, the study revealed that head teachers confirmed that teachers have positive attitude towards science by stating yes at 100 percent.

4.5.2 Pupils' response on influence of teachers' attitude

The researcher sought information from the pupils on the teachers' attitude to confirm their attitude in the teaching of science. They were to indicate the extent to which they agreed or disagreed with the statements by indicating the following;

 Key: SA (strongly agree), **A** (agree), **D** (disagree), **U** (undecided) and **SD** (strongly disagree). This information is presented in Table 4.14.

Table 4.14

Pupils' responses on teachers' attitude

Statement	SA		A		D		U	
	F	**%**	**F**	**%**	**F**	**%**	**F**	**%**
I have good rapport with teachers	94	49.5	72	37.9	14	7.4	10	5.2
The teacher come to class early	144	75.8	4	2.1	37	19.5	5	2.6
The teacher gives a lot of activity work in science	40	21.3	68	35.9	49	25.9	32	16.9
When involved in experiments I develop scientific skills	79	41.6	87	45.7	22	11.6	2	1.1
I gain by participating in teacher demonstration	16	8.4	19	10.0	81	42.7	74	38.9

n=190

Table 4.14, the findings show that 87.4 percent of pupils have good rapport with science teachers while 5.3 percent of pupils were undecided. This shows good relationship between teachers and learners. From the study, 75.8 percent of pupils strongly agreed that during science lesson, their teacher goes to class early while 2.6 percent of pupils were undecided though 19.5 percent of pupils disagreed.

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This shows a positive attitude towards science lessons among teachers however, a positive attitude from both teachers and pupils could lead to improved performance of science and SMASE teaching. This is confirmed by head teacher's findings who stated that teachers have good rapport with pupils at 100 percent indicating yes.

A statement posed to learners, if teachers give a lot of activity work, the study found that 35.9 percent of pupils agreed while 16.8 percent of pupils indicated undecided. On the other hand, the study shows that 45.8 percent of pupils agreed that they develop scientific skills when involved in an experiment. When learners are involved in an experiment, they learn how to observe, manipulate, measure, reason and develop skills for gathering information (JICA, 2007). Study finding indicates that 42.6 percent of pupils disagreed with the statement that learners gain a lot by participating in the teacher demonstration while 38.9 percent of pupils were undecided.

4.5.3 Chi-square test for observed teachers' attitude

The researcher sought to determine the influence of teachers' attitude using chi-square test as presented in Table 4.15.

Table 4.15

Chi-square test on teachers' attitude

	ASEI/PDSI lesson	Activity in lesson	Evaluation in teaching	Understand concepts	Syllabus coverage
Chi-Square	6.333^a	5.556^b	$.889^b$	$.222^b$	6.000^c
Df	2	1	1	1	3
Asymp. Sig.	.042	.018	.346	.637	.112

The data in Table 4.15, the chi-square values test of ASEI/PDSI lesson plan is difficult to prepare X^2 (2, N=18) = 6.33,P = .042, meaning there is significant difference between the observed and the theoretical values because p-value0.042 is less than alpha 0.05. The computed chi-square value of the statement 'it is not possible to have an activity in every lesson' X^2 (1, N=18)=5.56, p= 0.018. This means that the variable is significant because it is lower than the alpha 0.05. Chi-square value for evaluation is necessary for effective teaching X^2 (1,N=18) =.89 p=.346, is higher than the alpha 0.05, therefore there is significant.

4.6 Findings on influence of teachers' lesson planning and pupils' science performance.

The third objective for this study was to establish the influence of teachers' lesson planning on pupils' science performance in public primary schools in Samia Sub County.

4.6.1 Teachers' responses on influence of lesson planning

The researcher sought information from teachers on lesson planning, the teacher respondents were required to indicate the level of agreement where necessary. The data is presented in Table 4.16.

Table 4.16

 Teachers' responses on lesson planning

Statement	SA		A		D		U		SD	
	F	%	F	%	F	%	F	%	F	%
Teachers consideration of pupils background	4	22.2	7	38.9	1	5.6	6	33.3	0	0.0
Preparation of ASEI/PDSI lesson plan	1	5.6	3	16.7	8	44.4	4	22.2	2	11.1
Use pupils suggestion for teaching	0	0.0	5	27.8	6	33.3	7	38.9	0	0.0
Consider pupils feedback to improve lesson	3	16.7	6	33.3	4	22.2	2	11.1	3	16.7
Do you allow pupils to evaluate the lesson	0	0.0	3	16.7	1	5.6	12	66.6	2	11.1

n=18

Table 4.16 shows majority at 61.1 percent of teachers agreed with the statement that teachers consider learners background before planning science lesson while 33.3 percent of teachers were undecided. On the preparation of ASEI/PDSI lesson plan, the study found out that 44.4 percent of teachers disagreed while 22.2 percent of teachers were undecided however, only 22.3 percent of teachers agreed to prepare ASEI/PDSI lesson plan as advocated by SMASE INSET. According to

Arunga (2007), teachers are encouraged to rethink the usefulness of the lesson plans as critical tool for lesson delivery. This implies that very few science teachers in public primary schools in Samia Sub County prepare ASEI/PDSI lesson plan as required by SMASE training. Preparation of ASEI/PDSI lesson plan is in agreement with CEMASTEA, (2010) that emphasizes instructional activities. Pertaining teachers' use of pupils suggestions for teaching science, the study revealed that 33.3 percent disagreed while 38.9 percent of teachers were undecided but only 27.8 percent agreed to use pupils' suggestions in teaching science. This means that majority of teachers in Samia Sub County had not embraced the aspect of learners involvement in the learning process.

Teachers' consideration of pupils' feedback to improve on the lesson, the findings indicated that 50 percent of teachers agreed while 22.2 percent disagreed. Teachers make use of feedback to modify the lesson as it progresses in order to eliminate misconceptions as well as improve subsequent instruction (CEMASTEA, 2012). This indicates that PDSI approach has not been fully implemented. On allowing pupils to evaluate teachers' lesson, the study revealed that majority at 66.7 percent of teachers were undecided. This is not in agreement according to Mwigwi (2012) who notes that teachers evaluate the teaching and learning process by reflecting on performance and effectiveness in achieving the lesson objective.

4.6.2 Head teachers' responses on ASEI/PDSI lesson planning

The researcher sought information from the head teachers to confirm teachers' lesson planning. **Key**; **Yes** (agreed to teachers' planning) and **No** (disagreed) The data is presented in Table 4.17.

Table 4.17

Head teachers' responses on the teachers' use of ASEI/PDSI lesson planning

Item	Yes		No	
	F	%	F	%
Science teachers' preparation of ASEI/PDSI lesson plan	5	29.4	12	70.6
Teachers' consideration of learner background before lesson planning	3	17.6	14	82.4

n= 17, 1 missing

The findings on Table 4.17 shows that the majority at 70.6 percent of heat teachers stated that science teachers do not prepare ASEI/PDSI lesson plan while 29.4 percent of head teachers' indicated yes. On learners' background before planning science lesson, majority at 82.4 percent of head teachers stated No while

17.6 percent stated yes. This contradicts 39 percent of teachers who agreed with the statement that they consider learners' background before planning the lesson.

4.6.3 Chi-square test for observed teachers' lesson planning

The researcher sought to establish the influence of teachers' lesson planning and computed using chi-square test as presented in Table 4.17.

Table 4.18

Chi-square test for teachers' lesson planning

	Learner background	ASEI/PDSI lesson plan	Pupils suggestions	Pupils feedback	Evaluate teachers
Chi-Square	4.667^a	8.111^b	$.333^c$	2.556^b	17.111^a
Df	3	4	2	4	3
Asymp. Sig.	.198	.088	.846	.635	.001

Table 4.18, the chi-square tests value for consideration of learner background is X^2 (3, N=18)= 4.67, P= .198 is greater than the alpha .0.05, meaning there is no significance difference between learner background and performance. Chi-square test for value on evaluation of teachers X^2 (3, N=18) = 17.11, p= .001, this is significant at alpha .01, meaning there is significance between teacher evaluation and performance.

4.7 Findings on influence of teachers' use of learner centred approaches and pupils' science performance

The fourth objective for this study was to establish the influence of teachers' use of learner centred approaches on science performance in public primary schools in Samia Sub County.

4.7.1 Teachers' responses on the use of learner centred approaches

The researcher sought information on teachers' use of learner centred approaches in the teaching of science. To achieve this, the respondents were required to indicate the extent to which they agreed or disagreed with the statements by indicating the following.

Key: **SA** (strongly agree), **A** (agree), **D** (disagree), **U** (undecided) and **SD** (strongly disagree). The data is illustrated in Table 4.19

Table 4.19

Teachers' response on use of learners' centred approaches

Approaches used by teachers	SA		A		D		U		SD	
	F	%	F	%	F	%	F	%	F	%
Lecture method	7	38.9	2	11.1	3	16.7	0	0.0	6	33.3
Teacher demonstration	9	50.0	6	33.3	1	5.6	2	11.1	0	0.0
Group discussion	9	50.0	8	44.4	0	0.0	1	5.6	0	0.0
Peer teaching	2	11.1	5	27.8	9	50.0	2	11.1	0	0.0

n=18

The data on Table 4.19 revealed that 50 percent of teachers agreed with the statement that they use lecture method while 33.3 percent strongly disagreed. This implies that majority of science teachers use teacher-centred approaches rather than learner-centred approaches. This contradicts SMASE (2009) which states that teaching of science subject should be learner centred with the teachers' role being of a facilitator, guide, councilor, innovator and researcher. On teacher demonstration, 83.3 percent of teachers agreed. This means that pupils are not given opportunity to manipulate apparatus as advocated by SMASE-INSET. This

is not in line according Brown and Adams (2001) who describes the changing nature of teacher in constructivist learning that is 'teachers must shift their attention away from themselves as effective presenters of scientific information towards a focus on student developmental needs to learn science with understanding. From the study findings, 94.4 percent of teachers strongly agreed to use guided group discussion. This implies that learners are able to embrace themselves in group discussion while learning.

The study revealed that 94.4 percent of teachers agreed with the use of activity based teaching. This is in agreement with SMASE (2002) that advocates hands-on, minds-on, eyes-on and mouth on activities and develop their own knowledge. Pertaining peer teaching, majority at 61.1 percent of teachers disagreed while 38.9 percent of teachers agreed. This is not in line with the head teachers' interview who indicated at 52.9 percent of teachers conduct peer teaching in classroom while 47.1 percent disagreed. This means that most science teachers do not conduct peer teaching during their lessons.

4.7.2 Pupils responses on the teachers' use of learner centred approaches

The researcher sought information from pupils on the teacher use of learner centerd approaches in the teaching of science. They were required to indicate as follows;

Key: very often (**VO**), often (**O**), rarely (**R**) and not at all (**NA**). The data information is presented in the Table 4.20.

Table 4.20

Pupils' response on learner centred approaches

Activities	VO		O		R		NA	
	F	%	F	%	F	%	F	%
Carryout experiments	55	28.9	57	30.0	38	20.0	40	21.1
Group discussions	63	33.2	70	36.8	37	19.5	20	10.5
Peer teaching	34	17.9	51	26.8	59	31.1	46	24.2
Class demonstration	43	22.6	73	38.4	38	20.1	36	18.9

n=190

Table 4.20 revealed that 58.9 percent of the pupils' carryout experiments in science lesson while 21.1 percent indicated not at all. However, 20 percent indicated rarely. This means a good number of learners are not given chance to manipulate apparatus hence no observation skill is acquired. The study revealed that majority of pupils at 70 percent has group discussion. On peer teaching, 31.1 percent of pupils indicated rarely while 44.7 percent indicated often. However,

24.2 percent indicated not at all. Pertaining teacher class demonstration, the study revealed that 61.0 percent of pupils agreed while 38.9 percent disagreed.

4.7.3 Chi-square test for observed frequencies on teachers' use of learner-centred approaches

The researcher sought to establish the use of learner centred approaches by computing using chi-square test to measure learner centred approaches, this is presented in Table 4.21.

Table 4. 21

Chi-square test for learner centred approaches.

	Lecture method	Teacher demonstration	Group discussion	Activity based teaching	Peer teaching
Chi-Square	3.778[a]	9.111[a]	6.333[b]	8.333[b]	7.333[a]
Df	3	3	2	2	3
Asymp. Sig.	.286	.028	.042	.016	.062

The findings on Table 4.21 X^2 (3, N =18) =3.78, p = .286, This is greater than the alpha 0.05, meaning there is no significant between the lecture method and the performance. On teacher demonstration, chi-square test value X^2 (3, N= 18) =9.11, p = 0.028, this is less than the alpha .05, meaning there is significant.

Computed chi-square test values for group discussion and activity based teaching

are X^2 (2, N= 18)= 6.33, p = .042, X^2 (2, N = 18) = 8.33, p =.016 . The p-values of

0.042 and 0.016 are less than alpha of .05, meaning the is significant in the use of

activity based teaching and group discussion respectively.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

This chapter gives a summary of the study, summary of research findings, conclusions and recommendation. The chapter also provides suggestions for further studies.

5.2 Summary of the study

The purpose of the study was to investigate influence of strengthening mathematics and science education on pupils' science performance in public primary schools in Samia Sub County, Kenya. The study had four objectives which were to establish the influence of teachers' use of improvised teaching and learning resources, teachers' attitudes influences pupils' science performance, teachers' lesson planning influences pupils' science performance and teachers' use of learner centred approaches influences pupils' performance.

The study adopted descriptive survey research design. The study had a target population of 63 public primary schools, 63 head teachers, 63 science teachers and 1901 standard eight pupils. A sample of 18 (30%) schools was used for the study head teachers and science teachers who were single streamed were automatically selected and 190 (10%) standard eight pupils. Simple random

sampling was used to sample schools and select Standard Eight pupils in sampled schools. Piloting was done in two public primary schools, two head teachers, two science teachers and twenty standard eight pupils were used for piloting. Data was collected by researcher using self- administered questionnaires for science teachers and pupils then interview guide for head teachers.

To determine the reliability of the instruments, the researcher used Pearson's Product Moment Correlation. Correlation coefficient of 0.82 and 0.94 for teachers and pupils was sufficient. Statistical Package for Social Science was used to tabulate code and process data into database.

5.3 Summary of the study findings

The main findings of the study on teachers' use of improvised teaching and learning resources is that 50 percent of teachers improvised teaching materials during science lesson. Findings of the study revealed that improvisation has not been fully implemented. The study showed that all science teachers under the study fully implemented teaching and learning aids in the teaching and learning of science, as this enhances understanding of abstract ideas and retention of what is learnt, this had chi-square test value of 10.889 and the p-value .001. This had significant difference between the observed values and theoretical value, thus the use of readily teaching and learning resources influence pupils performance in science. The majority of pupils at 60% agreed that science teachers use teaching and learning aids like charts and models. The study showed that 66.7% of science

teachers engage pupils in making some teaching. On engaging pupils in making teaching and learning materials, the chi-square is at 9.556, p-value 0.023. This is significant between the observed and the theoretical values because p-value of .023 is higher than 0.01 and lower than 0.05. School administration supportive in the provision of teaching and learning resources, majority of science teachers at 83.3 percent agreed. On the availability of teaching and learning resources in the school, the study indicated that 77.6 percent of teachers agreed. The computed chi-square test value on pupils' responses current science scores and improvised teaching materials had chi-square (23.083), at p-value 0.001 (2-sided). This is greater than the critical chi-square 22.46 at p-value 0.001. Meaning there is significant different between the observed and the theoretical values. The two variables pupils' current science scores and improvised teaching and learning materials have relationship.

Findings of the study on teachers' attitudes on pupils performances were that majority at 77.8 percent of teachers agreed that ASEI/PDSI lesson plan is difficult to prepare. This had chi-square value of 6.333 with p-value 0.042. This is greater than the critical chi-square value (5.99), meaning there is significant difference between the observed values and the theoretical values. The study findings revealed that all science teachers agreed that ASEI/PDSI activities help learners understand difficulty concepts. On the statement that ASEI/PDSI activities delay syllabus coverage, 44.5 percent of teachers agreed however, 55.6 percent

disagreed. All science teachers under study agreed that SMASE made a big difference in the performance of science subject and also disagreed with the statement that SMASE was a waste of time and resources.

Findings of the study on influence of teachers' lesson planning on learners' science performance, the study found out that majority of teachers at 60.1 percent considered learners background before planning science lesson. Learners' needs, previous experiences in relation to the topic and learning difficulties are considered (CEMASTEA, 2010). From the study findings, majority of science teachers at 72.2 percent do not use pupils' suggestions for teaching science, this is important because the teacher integrates good practices and feedback in subsequent lessons.

Whether teachers consider pupils feedback to improve on science lesson, the findings revealed that half of the teachers considered. In this case, teachers make use of feedback to modify the lesson as it progresses in order to eliminate misconceptions as well as improve subsequent instruction (CEMASTEA, 2012). Majority of teachers in the study at 88.8 percent do not allow pupils to evaluate their lesson. The chi-square test value for pupils' evaluation of teachers' lessons is at 17.111 and p-value 0.001.this is greater than critical chi-square (16.27) at p-value .001 meaning there is significant difference between the observed values and the theoretical values.

The main findings of the study on teachers' use of learner centred approaches. Learner-centred approaches through Activity, Student Experiment and Improvisation pedagogic paradigm and Plan Do See and Improve are the focus of SMASE INSET. The study findings revealed that majority of science teachers at 83.3 percent use teacher demonstration, while using learner-centred approaches, learners are exposed to hands on activities thus, gain first-hand experience and will know how to use all their senses. Most of the teachers under the study at 94.4 percent used guided group discussions.

Group discussion had chi-square test value 6.333 and p-value 0.042 while the critical chi-square value (5.99) at p-value 0.05, this means there is significant difference between the observed values and the theoretical values because 0.042 is less than 0.05. This variable has influence on the pupils' performance in science subject. According to SMASE (2004) group discussions provide students with opportunities to express opinions and explain ideas based on their prior experiences. The study revealed that 94.4 percent of teachers use activity based teaching. The variable activity based teaching had chi-square 8.333 and p-value 0.016. This is significant between the observed and the theoretical values because p-value 0.016 is greater than 0.01 and lower than 0.05. The use of activity based teaching influence pupils' performance in science. This is in agreement with SMASE (2002) the learners are involved through hands-on, minds-on, eye-on and mouth-on activities and develop their knowledge.

5.4 Conclusion

The study findings revealed that not all science teachers have fully implemented improvisation of teaching and learning resources as expected after SMASE-in service. Through SMASE training, majority of teachers have learnt to integrate various teaching aids in their lessons and involve learners in the preparation of the teaching aids. This has had a positive impact on the pupils improved attitude towards science. From the study findings, the researcher concluded that science teachers and pupils' have positive attitude towards science. This is revealed from learners' responses where majority at 83.3 percent score above average, this influence science performance in public primary schools.

From the findings of the study, it can be concluded that ASEI/PDSI approach has not been fully embraced by science teachers as expected by SMASE INSET. This is because those trained by SMASE have failed to embrace hands on activities but instead reverted back to teacher- centred methods of teaching such as lecture method and teacher demonstration in the classroom. PDSI strategy is not fully implemented after SMASE training due to lack of inadequate planning of science lessons by teachers. Failure of majority of science teachers to prepare and use lesson plans during science lessons is a major setback in the implementation of learner centred strategy and this influences performance of learners at national examinations.

5.5 Recommendations

The following recommendations are necessary in light of responses from the respondents and in view of the research findings;

    i.   The government through the Ministry of Education and other stakeholders should finance adequately public primary schools and introduce a policy that all public primary schools should build school laboratory and equip them. This will encourage teachers to carryout experiments and improvise teaching and learning resources.

    ii.   Failure of most teachers to implement PDSI strategy implies that they did not own SMASE in-service. There is need to involve teachers at all levels of planning this is because from research findings, it indicated majority of teachers do not prepare lesson plans. Therefore the ministry of education in conjunctions with CEMASTEA and Kenya Institute of curriculum development provide prepared ASEI/PDSI lesson plans to all the topics in science so that teachers can have uniform information to refer to during teaching.

    iii.   To enhance teachers' attitude and performance of science, the sub county education board should organize regular workshops to sensitize teachers on how to practice ASEI/PDSI strategies in

classroom. During the workshops, an open forum should be encouraged to enable teacher participants share their experiences and come up with the solutions to their problems.

iv. The use of learner centred approaches has not been fully achieved. The monitoring and evaluation by SMASE coordinators at the sub county level in liaison with quality assurance officers should be intensified to assess whether they are achieving their objectives.

5.6 Suggestions for further research

There is need for further research in the following areas;

i. A study to investigate influence of strengthening mathematics and science on mathematics performance in public primary schools in other parts of the country other than Busia County.

ii. There is need for a study to be carried on influence of learner-centred approaches in the performance of mathematics at public primary schools in Samia Sub County.

iii. A study to investigate the evaluation of Strengthening Mathematics and Science Education on the performance of science and mathematics in public primary school in Busia County.

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APPENDICES

APPENDIX 1: LETTER OF INTRODUCTION

Barasa Agneta Natocho

University of Nairobi

CEES

P.O BOX 92

Kikuyu.

To the head teacher

Dear Sir/ Madam,

REF: PARTICIPATION IN   RESEARCH

I am a master student at the University of Nairobi, specializing in curriculum studies. I am carrying out research on '**influence of strengthening mathematics and science education on pupils' science performance in public primary schools in Samia Sub County'.** Your school has been chosen to participate in the research. I kindly request your permission to gather the required information from your school purely for academic purposes. Please your name and that of your school should not be written on the questionnaire.

Thank you.

Yours faithfully,

Agneta Natocho Barasa

APPENDIX II: HEAD TEACHERS' INTERVIEW GUIDE

I am a post graduate student of the University of Nairobi, currently conducting a research. I am therefore going to ask you a few questions related to the study. Please note that your identity will be treated with utmost confidentiality.

Section A; demographic information

1. What is you gender-----------Male ( ) Female ( )

2. What is your highest professional qualification?---------Med( ) BEd ( ) Diploma ( ) P1 ( )

   Others, specify-----------------

3. For how long have you served as a head teacher of this school?--------------

4 Have you attended teacher training in SMASE? Yes ( ) No ( )

Section B: improvisation of teaching and learning resources and pupils science performance

4. Does your school provide teaching resources like models and reference materials to science teachers? Yes ( ) No ( )

5. Science teachers involve pupils in the improvisation of teaching and learning materials in classroom. Yes ( ) No ( )

6. Are there more teaching and learning aids in the classroom ?Yes ( ) No ()

   Section C: Teacher's attitude and pupils science performance

7. Do science teacher have good rapport with pupils during science lessons? Yes ( ) No ( )

8. Is there positive attitude towards science teachers? Yes ( ) No ( )

   Section D: teacher lesson planning and pupils science performance

9. Do science teachers prepare an ASEI/PDSI lesson plan as required by SMASE-INSET? Yes ( ) No ( )

10. Do science teacher consider learner's background before planning the lesson? Yes ( ) No ( )

Section E: Learner centred approaches and pupils science performance

11. Do science teachers engage pupils in a variety of activities during science lessons? Yes ( ) No ( )

12. Does the school administration encourage pupil's peer teaching in the classroom? Yes ( ) No( )

13. In your own opinion, do you think SMASE programme has in anyway influenced the performance of learners in the school?---------------------

Thank you for your time and cooperation

APPENDIX III: QUESTIONNAIRE FOR SCIENCE TEACHERS

Please answer the following questions in this questionnaire as honestly as possible. Your responses will be treated confidentially. Your assistance is highly appreciated in advance. Please do not write your name or name of your school in the questionnaire. Please put a tick in the appropriate bracket or fill in the information in the blank spaces provided.

Section A: Background information

1. Please indicate your gender, male [ ] female[ ]
2. What is your age bracket, 20-29[ ] 30-39[ ] 40-49 [ ] 50-59 [ ]
3. Your highest professional qualification. Med [ ] BEd [ ] Diploma [ ] PI [ ]. Others , specify--------------------------

Section B: Improvisation of teaching and learning resources and pupils science performance

To what extent do you agree or disagree with each of the following statements on teaching and learning resources. **KEY**: SA (Strongly Agree), A(Agree), U (Undecided), D(Disagree), SD(Strongly Disagree**)**

Statement	SA	A	U	D	SD
Do you improvise teaching materials during science lessons					
Use of teaching and learning aids promote teaching and learning of science					
Do you engage pupils in making some of teaching and learning materials					
Does the school administration supportive in the provision of teaching and learning resources?					
Teaching and learning resources are readily available in you school					

Section C: Teachers attitude and pupils science performance

9. Please consider the statement written and then tick ( ) to indicate the level of agreement. `

Attitude	SA	A	U	D	SD
ASEI/PDSI lesson plan is difficult to prepare					
It is not possible to have an activity in every lesson					
Evaluation is very necessary for effective teaching					
Do ASEI/PDSI activities help students understand difficult concepts					
Does ASEI/PDSI activities delay syllabus coverage					

Which of the following statements describe your opinion about SMASE-INSET? (Tick as appropriate)

10. SMASE-INSET has improved the teaching and learning of science. True [ ], False [ ]

11. SMASE-INSET has made no difference in the performance of science subject? True [ ] False [ ]

12. SMASE –INSET is a waste of time and resources. True [ ] False [ ]

Section D: Teacher's lesson planning and pupils science performance

13. Consider the following statement and tick to indicate the level of agreement where necessary.

Statement	SA	A	D	U	SD
Consider learners background before planning science lesson					
Prepare ASEI/PDSI lesson plan					
Use pupils suggestions for teaching science					
Consider pupils feedback to improve on your science lesson					
Do you allow pupils to evaluate your lesson					

Section E: Learner centred approaches and pupils science performance

14. Please consider the following statements and tick ( ) to indicate the extent of agreement.

Which of the following teaching strategies or approaches do you adopt while teaching science to your pupils?

Approaches	SA	A	D	U	SD
Lecture method					
Teacher demonstration					
Guided group demonstration					
Activity based teaching					
Peer teaching					

Thank you.

APPENDIX 1V: QUESTIONNAIRE FOR PUPILS

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

Section A: Background information

1. What is your gender? Boy [ ] Girl [ ]
2. How old are you?-------- (years)

Section B : Teaching and learning resources and pupils science performance

3. Is science subject your favourite? Yes ( ) No ( )

4. What is your current score in science 20-30 ( ) 30-40 ( ) 40-50( ) 50-60 ( ) 60-70   ) 70-80 ( ) 80-90 ( ) 90- 100 ( )

5 How often do you do the following during science lesson? Key: Very often (1), Often (2), Rarely (3), Not at all (4)

Statement	1	2	3	4
Improvisation during science experiments in class				
Using more teaching and learning aids like charts and models during science lesson				
Carry out small scale experiments during science lesson				
Does your teacher involve you in the preparation of teaching aids				
Does the school provide reference materials during science lesson				

Section C: Teacher's attitude and pupil's science performance

6.To what extent do you agree or disagree with each of the following statements? Key: Strongly Agree (SA), Agree (A), Disagree (D), Undecided (U), SD (Strongly Disagree)

Statement	SA	A	D	U U	S SD
I have good rapport with my science teacher					
During science lesson , my teacher comes to class early					
The teacher gives a lot of activity work in science					
When involved in an experiment, I develop scientific skills					
I gain a lot by participating in the teacher demonstration					

Section D: Learner centred approaches and pupils science performance

7. Consider the following statement and put a tick where you agree. Key ; Very often (1), often(2), Rarely(3), Not at all(4)

Activities	1	2	3	4
How often do you carryout experiments in science lesson?				
How often do you have group discussions during science lessons?				
How often do you practice peer teaching during science lessons?				
How often do science teachers give class demonstrations in science?				

Thank you.

APPENDIX V: RESEARCH AUTHORIZATION

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

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

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

Ref: No.

Date:

NACOSTI/P/15/1415/6273

29th June, 2015

Agneta Natocho Baraza
University of Nairobi
P.O Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *"Effectiveness of teacher training in SMASE on pupils performance in science at Kenya Certificate of Primary Education in Samia Sub County, Busia County,"* I am pleased to inform you that you have been authorized to undertake research in **Busia County** for a period ending **6th November, 2015.**

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

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

SAID HUSSEIN
FOR: DIRECTOR GENERAL/CEO

Copy to:

The County Commissioner
Busia County.

The County Director of Education
Busia County.

National Commission for Science, Technology and Innovation is ISO 9001: 2008 Certified

APPENDIX VI: RESEARCH PERMIT

THIS IS TO CERTIFY THAT:
MS. AGNETA NATOCHO BARAZA
of UNIVERSITY OF NAIROBI, 144-50406
FUNYULA,has been permitted to
conduct research in *Busia*   County

on the topic: *EFFECTIVENESS OF
TEACHER TRAINING IN SMASE ON
PUPILS PERFORMANCE IN SCIENCE AT
KENYA CERTIFICATE OF PRIMARY
EDUCATION IN SAMIA SUB COUNTY,
BUSIA COUNTY*

for the period ending:
6th November,2015

Applicant's
Signature

Permit No : NACOSTI/P/15/1415/6273
Date Of Issue : 29th June,2015
Fee Recieved :Ksh 1,000

Director General
National Commission for Science,
Technology & Innovation

CONDITIONS

1. You must report to the County Commissioner and the County Education Officer of the area before embarking on your research. Failure to do that may lead to the cancellation of your permit
2. Government Officers will not be interviewed without prior appointment.
3. No questionnaire will be used unless it has been approved.
4. Excavation, filming and collection of biological specimens are subject to further permission from the relevant Government Ministries.
5. You are required to submit at least two(2) hard copies and one(1) soft copy of your final report.
6. The Government of Kenya reserves the right to modify the conditions of this permit including its cancellation without notice.

REPUBLIC OF KENYA

National Commission for Science,
Technology and Innovation

**RESEARCH CLEARANCE
PERMIT**

Serial No. A   5539

CONDITIONS: see back page