INFLUENCE OF STRENGHTHENINGMATHEMATICSANDSCIENCE EDUCATION IN-SERVICE TRAINING ON PUPILS' SCIENCE PERFORMANCE IN PUBLIC PRIMARY SCHOOLS IN RIGOMA DIVISION OF NYAMIRA COUNTY, KENYA

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DECLARATION

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

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DEDICATION

This research project is dedicated to the Almighty God who has given me sound physical and mental health to undertake this study. The research project is also dedicated to my dear parents Mr. and Mrs. Nyarumba and my dear wife, Deborah for their patience, perseverance and encouragement throughout my studies.

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TABLE OF CONTENT

Content	Page

CHAPTER ONE
INTRODUCTION

CHAPTER TWO
REVIEW OF RELATED LITERATURE

CHAPTER THREE
RESEARCH METHODOLOGY

CHAPTER FOUR
DATA ANALYSIS, PRESENTATION AND INTERPRETATION

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

APPENDICES

LIST OF TABLES

LIST OF FIGURES

Figure   **Page**

LIST OF ABBREVIATIONS

ASEI	Activity Student Experiment and Improvisation
CEMASTEA	Center for Mathematics and Science Teaching in Africa
INSET	In-service Education and Training
JICA	Japan International Co-operation Agency
KCPE	Kenya Certificate of Primary Education
PDSI	Plan Do See and Improve
ROK	Republic of Kenya
SMASE	Strengthening Mathematics and Sciences Education
SPSS	Statistical Package for Social Sciences
TSC	Teachers Service Commission
UNESCO	United Nations Educational Scientific and Cultural Organization
WECSA	Western, Eastern, Central and Southern Africa

ABSTRACT

Strengthening Mathematics and Science Education (SMASE) innovation is an initiative of the Government of Kenya in collaboration with Japan International Co-operation Agency (JICA). SMASE in-service training was started in 2009 as a measure to improve performance in science. To this end, the purpose of the study was to investigate the influence of strengthening mathematics and science education in service training on science performance in public primary schools in Rigoma Division. The objectives of the study were to establish the use of Activity, Student Experiment and Improvisation (ASEI) and Plan Do See and Improve (PDSI) intervention, use of teaching/learning resources, use of improvisation and teachers' workload. The study was based on constructivist learning theory which advocates or active participation of learners in the learning process. The study adopted descriptive survey research design. The target population consisted of 65 public primary schools and their head teachers, 65 standard 8 science teachers and 2400 class 8 pupils. The study sample consisted of 20 head teachers, 20 standard 8 science teachers and 240 standard 8 pupils. Simple random sampling was used to select public primary schools and purposive sampling was used on standard 8 pupils. Data were collected using questionnaires for head teachers, science teachers and standard 8 pupils. Piloting was conducted in two public schools using two head teachers,2 standard 8 science teachers and 20 standard 8 pupils to check the validity of the research instruments. The data obtained were computed for reliability using Pearson's product moment correlation. Correlation coefficient was 0.88 for head teachers,0.82 for teachers and 0.85 for class 8 pupils. Data were presented in form of figures and tables. The study findings revealed that 72.2 percent of the teachers used ASEI-PDSI approach in the teaching of science. Findings on ASEI-PDSI lesson plan use revealed that 55.5 percent of the teachers do not use ASEI-PDSI lesson to teach science lessons. The findings also revealed that 88.9 percent of the teachers do give class demonstrations. On use of teaching/learning resources the findings revealed that majority of science teachers at 72.0 percent agreed that they use teaching/learning resource when teaching science. The findings also revealed that 66.6 percent of the schools have adequate teaching/learning resources. Findings on use of improvisation revealed that 88.9 percent of the teachers used improvised teaching/learning resources. On influence of teachers' workload and science performance, 77.8 percent of the teachers agreed that workload did affect pupils' performance in science. Based on the findings, the researcher concluded that preparation of ASEI-PDSI lesson plan is a critical tool for effective lesson delivery. The researcher recommended that all science teachers who attend SMASE-INSET training should use ASEI-PDSI approach whenever they are teaching for better performance. The researcher suggested further study to investigate school factors that influence implementation of ASEI-PDSI practices in public primary schools in the division.

CHAPTER ONE

INTRODUCTION

1.1 Background to the study

Education is a fundamental human right according to the Constitution of Kenya (2010). It must, therefore be provided to every Kenyan child irrespective of gender, color, religion, race or political inclination. The vision for the education sector for 2030 is "to have a globally competitive quality education, training and research for sustainable development" while the mission is to "Provide and co-ordinate the provision of quality education, training and research for empowerment of individuals to become responsible and competent citizens who value education as a lifelong process." To achieve this vision, four strategic areas, namely access, quality, equity, science, technology and innovation have been identified for support based on their impacts on the economic, social and political pillars (Government of Kenya, 2007).

Teachers' skills & knowledge matter a great deal in curriculum renewal than do changes in content and methods (Okech&Asiachi, 1992). In-service programs for teachers are of great importance for teacher learning and improvement of teacher learning outcomes. According to Ingvarson, Meiersand Beavis (2005), professional development for teachers is a vital component of policies to enhance the quality of teaching and learning in schools. Professional development programs attempt to change teachers' beliefs about certain aspects of teaching a

particular curriculum or instructional innovation (Guskey, 2010). Professional development programs must provide participants opportunities for inquiry forms of teaching rather than textbook centered teaching; must focus on subject matter knowledge and deepen teachers' content skills. Thus for Vision 2030 to be realized teachers contribution is pivotal. For them to facilitate quality education, continuous training is necessary at all levels of learning. Globally, in service education has been embraced by countries such as United States of America, Finland, Portugal and Japan. In Finland, there is a more robust focus on the overall goals of professional development rather than only acquiring new knowledge to add to mental constructs. In-service education is just a portion of professional development. Its main purpose is to utilize knowledge gained within teachers' professional communities (Webb, 2009, in Michele, 2014).

In the United States of America, the government supports both pre-service and in-service training of teachers to strengthen the quality of teaching and learning (Barret,1998).In- service training addresses social changes and complements the brief in- service training. Education has succeeded in Japan because it fully embraces continuous in service programmes for its educators via mentorship, workshops and research groups. In Japan it is mandatory for newly recruited teachers to undergo in-service training courses (Japan International Co-operation Agency, 2004).A study done in Portugal reveals that use of in-service education and training programmes was successful in enhancing teaching and learning outcomes (Santos, 1993, in Sitonik, 2012).

In Nigeria studies have shown that large numbers of students seem to learn very little science at school. Learning tends to be by rote and learners find learning of science to be difficult. (Eyibe, 1990, Jegede, 1992, Salau, 1996) in Ogunmade (2005) This is corroborated by Okebukola (1997) cited in Ogunmade (2005) who points out that the science teacher introduces the science lesson with a brief chat followed by reading of notes to the students and at the end, the left over notes are left with the class captain to copy on the chalkboard or read them for other learners to copy.

In Malawi, the Strengthening of Mathematics and Science in Secondary Education in-service training (SMASE-INSET) led to improvement in students' performance in national examinations. The teaching and learning practices used also generated interest in science and mathematics among learners and more students started enrolling in the subjects for examinations.

Tanzania embraces in-service education and training for teachers through partnership with Mid Sweden University and JICA. The University of Dares-salaam has partnered with the government of Portugal to enhance teachers' professionalism by sponsoring teachers for master's and doctoral programmes.In realization of the noble role that In-service Education and Training plays in teacher development, the government, through the ministry of education, has brought ways for making the learning of science to be more real and meaningful by introducing Strengthening Mathematics and Science Education In-service

Education and Training In collaboration with Japan International Co-operation Agency (JICA).

Preparations for the Strengthening Mathematics and Science Education project started in 2009 after a need assessment survey was carried out in 52 primary schools across the country. According to SMASE Project (2009), the findings of the survey necessitated the training which was conducted for duration of three years (2010-2012). Findings from the survey depicted a learning environment which is teacher centered where pupils are engaged in the learning process as passive recipients of knowledge. The findings also showed that in the teaching and learning of science lessons, practical lessons are not conducted and learners are not involved in improvisation. It is from these findings that SMASE program was developed.

The main emphasis of SMASE In-service Training is the upgrading of teachers' teaching methodology through emphasis on Activity Student Experiment and Improvisation-Plan-Do-See and Improve (ASEI-PDSI). Planning is one of the key pillars of the INSET as the teacher is expected to plan for meaningful lesson activities that will be carried out by learners. The emphasis is that lessons should be activity – based. A teacher is expected to act as a facilitator and should ensure that lesson activities are linked to inherent concepts. The researcher, therefore, seeks to investigate the effectiveness of teacher training in SMASE on the

academic achievement of pupils at Kenya Certificate of Primary Education (KCPE) in Rigoma division, Nyamira County.

Table 1.1: K.C.P.E National means score in science

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mean score	29.67	29.92	29.96	29.82	33.82	32.02	30.91	32.88	33.36

Source: Kenya National Examinations Council Newsletter, 2016

Table 1.1 shows poor performance in national examinations. There was improvement in 2014 compared to other years. Despite the poor performance nationally, the division performance as highlighted in table 1.2 is above the national performance. Table1.2 shows the K.C.P.E Local mean score for science in Rigoma Division.

Table 1.2: The K.C.P.E local mean score for Science in Rigoma division

Year	2007	2008	2009	2010	2011	2012	2013	2014	2015
Mean score	44.89	45.68	45.97	46.45	46.04	44.22	46.58	46.87	46.92

Source: D.E.O's Office Masaba North District, 2016

The divisional science performance mean scores are above the national means but below the KNEC pass mark of 50 percent. There was, however, improvement in 2015 compared to other years. This could be attributed to SMASE INSET.

1.2 Statement of the Problem

The SMASE in service education and training that was conducted between the years 2009 and 2013 has not led to improvement in the performance of science in Rigoma division. Poor performance in science in Kenya Certificate of Primary Education examination at the national level as table 1.1 shows has drawn concern among key stakeholders as this may curtail the realization of the country's 2030 vision of industrialization. As Table 1.2 illustrates, despite teachers taking part in SMASE training the performance in science in Rigoma division still remains below the ideal mean mark of 50 percent from the year 2009 when SMASE training began to the year 2015,two years later since the training ended in 2013.

Research study carried out by Barasa (2015) to investigate influence of Strengthening Mathematics and Science Education on pupils science performance in public primary schools in Samia Sub-county revealed that only 50 percent of teachers improvise teaching and learning resources for the teaching of science. The study found out that ASEI/PDSI approach has not been fully embraced by science teachers as advocated by SMASE inset. There are limited studies carried out to investigate the influence of

strengthening mathematics and science education on science at primary level. This study aims at filling this knowledge gap by investigating the influence of SMASE inset on science performance in public primary schools in Rigoma division.

1.3 Purpose of the Study

The study sought to investigate the influence of Strengthening Mathematics and Science Education Inset on science performance in Rigoma Division of Nyamira County, Kenya.

1.4 Objectives of the study

The study sought to examine the following objectives:

i. To establish the influence of the use of ASEI-PDSI intervention on science performance in Rigoma Division of Nyamira County

ii. To examine the influence of the use of teaching/ learning resources on science performance in Rigoma Division.

iii. To determine the use of improvisation on science performance in Rigoma Division.

iv. To establish the influence of teachers' workload and science performance in Rigoma Division.

1.5 Research questions

The study was guided by the following research questions:

i. What is the influence of the use of ASEI-PDSI intervention on science performance in Rigoma Division?

ii. How does the use of teaching/learning resources influence science Performance in Rigoma Division?

iii. How does improvisation influence science performance in Rigoma Division?

iv. How does the teachers' workload influence science performance In Rigoma Division?

1.6 The significance of the study

The study seeks to provide vital feedback to science teachers who are directly involved in the implementation of science curriculum so that they can improve the quality of teaching in the classrooms. To the sponsors of the programme: JICA and Kenyan government (MOE), the study may be a useful future reference point when funding programs of the same nature. Findings from this study may also generate useful feedback to the Ministry of Education as it explores ways of improving quality implementation of science in public primary schools.

1.7 Limitation of the study

Limitations are those conditions beyond the control of the researcher which may place restrictions on the conclusions of the study and their application to other situations (Best & Khan, 2000).First, there may be other factors that may influence Science performance which the researcher may not be able to control and have not been incorporated in this study. Such factors include: learners' entry behavior, learners' economic background and school culture. This problem was solved by using applied random sampling.

1.8 Delimitation of the study

The study was confined to Rigoma Division; Nyamira County. The study was also delimited to the public primary schools since private schools did not send teachers to participate in the INSET. The study was also delimited to Science teachers despite the fact that mathematics teachers also participated in the SMASE INSET.

1.9 Assumption of the study

The study assumed that:

(i) All respondents gave desired information

(ii)The instruments that were used gave the appropriate data for data analysis.

1.10 Definition of significant terms

ASEI refers to an innovative approach that advocates for activity- based learning and teaching that is pupil centered experiments and improvisations.

In-service training refers to in-service education and training whose main aim is to enhance the quality of learning and teaching.

Improvisation refers to use of non-conventional apparatus/equipment in lesson delivery as advocated by SMASE-INSET.

Intervention refers to the ASEI-PDSI SMASE-INSET that was introduced with the aim of making the learning of science learner-centered.

Learning refers to the act of acquiring new knowledge or reinforcing skills or knowledge through SMASE in service training

PDSI refers to an approach that helps teachers to practice ASEI activities in the learning/teaching of science through proper planning, evaluation and improvement during the science lesson and in subsequent lessons.

Performance refers to the outcome of learners' ability in KCPE measured in form of marks or mean score.

Teaching/learning resources refer to virtual or physical material inputs in the teaching learning of science

Teachers' workload refers to the number of lessons and the class size the teacher handles.

1.11 Organization of the Study

The study is organized into five chapters. In chapter one, it comprised of the introduction which consisted of the: background of the research, statement of the problem, purpose of the study, objectives of the study, research questions, significance of the study, limitations and delimitations of the research study, assumptions of the study, definition of significance terms and the organization of the study.

Chapter two focused on review of literature under the following subheadings: ASEI-PDSI intervention and science performance, teaching and learning resources and science performance, improvisation of equipment and science performance, teachers' work load and science performance, summary of literature review, theoretical framework and conceptual framework.

Chapter three dealt in research methodology under the following subheadings: research design, target population, sample size and sampling procedures, research instruments, validity of instruments, instrument reliability, data collection procedures, data analysis techniques and ethical considerations were examined. Chapter four consisted of data analysis, interpretation and discussions of findings while chapter five provided summary, conclusion.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Introduction

This chapter presents the related literature pertaining to influence of SMASE-INSEI on science performance. It is organized into the following themes; overview of in-service training and science performance, use of ASEI-PDSI intervention and science performance, teaching and learning resources and science performance and improvisation of equipment and science performance.

2.2 Concept of in-service training and science performance

In service education and training (INSET) of teachers refers to a whole range of activities which serving teachers may participate in order to improve their pedagogical and professional competencies and an understanding of the roles they play in a dynamic society. In service education as opposed to pre-service education may be undertaken at any juncture or as full time during the continuous professional life of a teacher (Shiundu & Omulando, 1992). For teachers to effectively play their roles in such a dynamic environment, the importance of in-service Education and Training (INSET) to continuously update their skills cannot be overemphasized (CEMASTEA, 2010). In addition, quality teaching entails educators who are competent with appropriate knowledge and skills required for effective classroom management, pupil assessment and engage in regular

professional learning leading to knowledge activation, hands on learning and continuous reflection (Polland and Tann, 1993; Hooft 2005) cited by Ogunmade (2005).An argument for INSETS includes the notion that quality teaching practices have a profound effect on what and how learners learn (Guskey, 2000).

The performance of science in primary schools has remained below the average mark of 50 percent over a period of time in the KCPE Examinations. The quality of an education system cannot be better than the quality of its teachers. Notwithstanding the fact that teachers play a critical role in curriculum implementation, their capacity to deliver in the classrooms has been put to question as evidenced by the findings of the Needs Assessments Survey Report of May and June 2009 (CEMASTEA,2010). For teachers to shift from their conventional teacher-centered approaches to teaching , overreliance on textbooks and revision papers as well as inadequate content mastery, INSETS are necessary for it is during such fora that pedagogical aspects are re-examined without which teachers may find it difficult to discard old practices for the new. INSET helps teachers to upgrade their learning resource mobilization and classroom management skills.

According to UNESCO (2008) teachers' professional development, through INSET is a way of equipping teachers to teach diverse students population and meet their diverse needs. Towunshed and Bates (2007) point out that INSETS are necessary because they aid tutors to develop favorable attitudes about their work

and get the desirable skills and competencies which are a prerequisite for their noble task in nurturing and in provision of experiences in specific areas via practical experiences.

2.3 ASEI-PDSI intervention and science performance

Pupil- focused learning is practice that places the pupil at the center of the teaching and learning process. The ASEI-PDSI approach is an acronym for Activity Student Experiment and Improvisation and Plan Do See and Improve (SMASE-WECSA, 2010). Through Strengthening Mathematics and Science Education in-service education training, the ASEI-PDSI pedagogic shift is being championed to rally science teachers in re-engineering their classroom practices to promote learning and consequently learners' achievements. (CEMASTEA, 2010). To realize the ASEI condition, it is imperative to adopt the PDSI approach. Majority of teachers, according to the SMASE Needs Survey of 2009 were not preparing lesson plans. According to SMASE (2004), planning tools such as schemes of work and lesson plans were not being prepared by teachers. They were only prepared for QASOS rather than assisting the teacher in the teaching and learning process. SMASE advocates for ASEI-PDSI lesson plan where the teacher plans the likely classroom discourse well in advance before the actual lesson (CEMASTEA, 2010).According to CEMASTEA (2012), PDSI approach enables teachers to plan instructions based on the learners, community, knowledge of the subject matter and curricular goals whilst ensuring that the

objectives are specific, measurable, achievable, realistic and time bound. The approach endeavors to shift teaching and learning from knowledge-based teaching to activity-based teaching; teacher-centered teaching to student-centered learning, chalk and talk to experiment and improvisation. It equips teachers for effective classroom practices, with the belief that the battle against poor performance in Mathematics and science must be won in the classroom (SMASE-WECSA, 2010).

It is during planning that the teacher reflects on activities that are more likely to promote quality learning. Doing the activities should be collaboration between the teachers and pupils where the role of the teacher should be that of a facilitator rather than as a dispenser of knowledge. Seeing involves   evaluation of the performance versus the plan. It encourages the teacher to reflect on the teaching for improvement of current and future lessons (CEMASTEA, 2010). Lesson assessment and evaluation is seen as the key to improvement of delivery of subsequent lessons. Evaluation, therefore should essentially be formative rather than summative .This allows room for remedial work aimed at improving students' performance. For successful implementation, changes have to be introduced to the user effectively (Fullan, 2001).Education experts such as Lunerburg and Irby (2011), pointed out that, there is urgent need for teachers' preparation as a basic tenet for effective teaching and learning process.

2.4 Teaching and learning resources and science performance

A resource is any source of information that the teacher utilizes in order to make learning more relevant and meaningful to pupils (Muriuki & Nyagah, 2004, in Barasa, 2015).Resources include, but are not limited to, good science textbooks, teachers' guides, chemicals, and real objects, visual and audio visual aids. Teaching aids should be used because they stimulate the learners' imagination and allow children to apply various senses and this makes learning effective (Ngaroga, 2010). In line with this, Usman (2007) in Mucai (2013) pointed out that educational materials are salient in the process of learning because they play a pivotal role in the achievement of educational goals and promoting effective teaching in the classroom. Further, Olagunju and Abiola (2008) in Mucai (2013) pointed out that utilization of educational resources in the teaching process brings about meaningful learning because it stimulates learners' senses as well as motivating them. (Gakuru (2005) points out that the availability and use of materials like textbooks, Science apparatus, chemicals and supplementary reading materials has a vital contribution on the learning process with a positive effect on learners' performance. Whereas teachers use text books to prepare for Mathematics and Science lessons, resources are inadequate .Therefore teachers resort to demonstrations (SMASE, 2009). Lack of apparatus/kits was seen as major hindrance in the learning of science. Revision books and past papers were commonly used. CEMASTEA (2010) stresses that learning materials can be bought by the management of the school or they may be improvised by the

teacher in collaboration with learners. Further, SMASE emphasizes the need to capacity build teachers on how to employ proper work planning tools as well as improvisation and use of locally available materials to make the learning of science effective. This is corroborated by Odukwe (1983) in Umaru (2011) who noted that with patience, simpler versions of more complex apparatus can be made. The simper the resources, the more are the learners able to appreciate the method used and the scientific facts to be illustrated.

For any curriculum to be successively implemented , there must be adequate and suitable textbooks, , teachers' guide and other teaching and learning aids (Bishop, 1985).In line with this, Mutai (2006) in Mucai (2013) stressed that the learning process is strengthened when there is adequate resources like textbooks and teaching aids. Furthermore, CEMASTEA (2012) recommended that mathematics and science teachers should use educational resources since they emphasize information, stimulate interest and promote the learning of science. Use of teaching and learning resources promotes comprehension of complex ideas and enhances performance (UNESCO, 2008, in Mwagiru, 2014). Use of teaching and learning resources, according to Wanjohi (2006) enhances retention of about 80% of what is learnt. According to Rogan and Grayson (2003), implementation of innovations is hindered by lack of resources even when implemented by the best of teachers.

2.5 Improvisation of equipment and science performance

Improvisation refers to the art of creating and using materials as substitute of real phenomena. According to Fafunwa (1990) as cited by Sitonik (2012), improvisation means substituting for the real teaching and learning materials. Educational materials may not be readily available due to the high cost of acquiring them, the real actual resources are dangerous to use e.g. snakes or when dealing with delicate internal organs of the body e.g. lungs, liver and kidney among other organs. Creativity in the classroom is about how a teacher captivates learners and inspires them during the learning process. Learners come up with reservoir of strategies that are aimed at sparking new ideas and bring out a spirit of creativity in learners as they adapt and reconstruct ideas for their own curriculum needs (Sitonik, 2012).

According to JICA (2000), the teaching of science and mathematics should be learner centered. The report asserts that the teacher's role in the science classroom should be that of an innovator, counselor, motivator, guide, facilitator and researcher. In addition, Umaru (2011) indicates that with an alert mind a good agricultural science teacher adapts his or her lessons to the materials available. He further stresses that with patience, simplified versions of more complicated apparatus can be made. According to CEMASTEA (2012) teachers should use teaching and learning resources since they emphasize information, stimulate interest and facilitate the learning process in the teaching and learning of science.

Furthermore, Ouko (2012) stressed that teaching and learning materials contribute to the learners' achievement. He further points out that those taught using improvised teaching/learning resources tend to score good grades. Moreover, poor school facilities, inappropriate teaching methodologies and inadequate instructional materials are major causes for low achievement in mathematics and sciences (Eshiwani, 2004 cited by Nyakwama, 2012). Stonik (2012) observes that innovative teachers can use cheaper products to simulate experiments. He further points out that teachers can come up with strategies to improvise, thereby encouraging learners to critically meditate about the scientific concepts underlying the improvised apparatus. A study done by Patrick (2004) as cited by Shodeinde (2015) on the effects of instructional materials on performance of senior secondary biology students revealed that those students that were taught with learning resources obtained better grades compared with those learners that were taught without the use of learning resources. The research pointed out that the government should encourage teachers to improvise and utilize teaching and learning resources in their teaching. Babu (2003) in Wawira (2012) underscores the need for teachers to make optimum use of learning resources using locally available materials to assist learners comprehend the concept of science.

A research study by Mwagiru (2014) indicated that majority of the public primary schools (81.2%) have inadequate teaching /learning resources and that majority of teachers (78%) do not use teaching aids when teaching as advocated by SMASE-INSET programme. A study done by Barasa (2015) revealed that 50% of teachers

improvised teaching/learning materials during science lessons hence improvisation of teaching/ learning materials has not been fully implemented as advocated by SMASSE-INSET.

2.6 Teachers' work load and science performance

Njiru (2012) identified the following as the challenges faced by teachers in the teaching of biology using SMASSE approach: inadequate time, unequipped laboratories, large classes and lack of enough funds to purchase teaching materials. In line with this, Gachiri (2014) established that teachers had problems in implementing the skills learnt in SMASSE-INSET due to lack of teaching and learning materials, shortage of time, large classes and understaffing of teachers.

Ombaso (2008) pointed out that ASEI-PDSI skills could not be used due to inadequate learning resources, lack of enough time and pressure from administration to cover the syllabus and large class sizes that made it unreasonable for science teachers to offer individual attention to learners.

A study by Kibuthu (2011) on effects of SMASSE in secondary education in-service programme on physics teachers' performance revealed that high workload prevents teachers from preparing their lessons according to SMASSE-INSET program guidelines. According to statistics from the Ministry of Education, teachers' shortage stood at 85,000 as at October 2016. When teachers have a manageable workload in terms of number of lessons and class size, they would have amble time to prepare their lessons in line with SMASSE-INSET guidelines.

These findings are buttressed by Sifuna and Kaime (2007) cited in Nyakwama (2012) that, the inability of science teachers to apply learner centered methodologies in the teaching of science hinges on problems which include: large class sizes in science lessons with a few teachers, lack of well- equipped science laboratories in learning institutions and pressure to cover the syllabus in preparation for the national examinations. When teachers' workload is high, they become irritated and confused and this interferes with the efficiency of teachers. (Bray 1986, cited in Mwagiru, 2014).

2.7 Summary of literature review

A study done by Onchon'ga (2013) on implementation of ASEI-PDSI approach in Mathematics lessons in Nyamaiya Division revealed that teachers have not embraced the ASEI-PDSI approach in spite of the SMASSE impact assessment surveys indicating so. This is in line with Barasa (2015) study which revealed that only 22.3 percent of teachers agreed that they prepared ASEI-PDSI lesson plans as advocated by SMASE-INSET. Mugo (2015) study on influence of SMASE-INSET in Embu West District revealed that inadequate teaching and learning materials was the major challenge that hampered effective implementation of ASEI-PDSI lessons. However a study done by M.Kiambi (2013) revealed that majority of teachers (93.3 percent) use teaching and learning materials and also involves learners in making teaching and learning aids.

Ozorere (1998) cited in Umaru (2011) asserts that instructional materials aid teachers' competence and enhance effective class control during instruction. A study by Mwagiru (2014) revealed that teachers were overloaded in terms of class size and the number of lessons they handle making it unfeasible to effectively implement skills acquired from SMASE- INSET in their classes. Learners should participate actively in the teaching/ learning process. They should be actively involved in group discussion, carrying out experiments, improvisation and in practical work. It is clear that there are different factors that inter play to influence the implementation of SMASE project approach and they affect the teaching of science. There is limited research which has been carried out to investigate the influence of SMASE-INSET on the performance of pupils in science at the public primary school level in Rigoma Division. The study is aimed at filling this knowledge gap by investigating how SMASE- INSET Influences science performance in public primary schools in Rigoma Division.

2.8 Theoretical framework

The research study is anchored on constructivist learning theory by Jerome Bruner (1966). The cornerstone of constructivism is that learners get actively involved in the learning process by constructing their own knowledge by linking new information to pre-existing knowledge, interacting with knowledge, the learning environment and with other learners. The theory champions for active involvement of learners in the learning process instead of being passive receivers

of scientific knowledge. Learners discover their own knowledge actively thorough the guidance of the teacher instead of passively acquiring knowledge through the text books or the teacher.

Bruner (1966) points out that practice in making own discoveries for individuals enables them to acquire knowledge in a way that makes that information more readily usable in solving problems.

In a constructivist classroom, the focus is on the learner rather than on the teacher. The learning environment is no longer an area where teachers transmit packaged knowledge to learners who are passive. The leaner has prior knowledge and he/she does not come to the learning area empty headed with a tabula lasa. The learners make sense of a new situation by using their own existing ideas. Learners are encouraged to be actively involved in their own process of learning. It is in the variations of discovery learning and active learning that SMASE is anchored. The task of a teacher in the science lesson is that of a facilitator encouraging learners' free exploration of knowledge within a given framework or structure to arrive at their own understanding of scientific concepts. The researcher will adopt the constructivist learning theory since SMASE INSET also advocates for active participation of learners in the learning process as well as learner-centered approaches in teaching/learning of science.

2.9 Conceptual framework

Orodho (2014) views conceptual framework as a representational model where a researcher represents the relationship between variables in the study and shows the relationship diagrammatically.

Use of ASEI-PDSI: • Pupils involvement • Experiments • Lesson planning		
Teaching and learning resources: • Availability of text books • Learning charts		**Sciences performance:** Improvement in pupils' performance in science subjects.
Improvisation of equipment		
Teachers' workload • Number of lessons • Class size	Learner abilities Administrative issues	
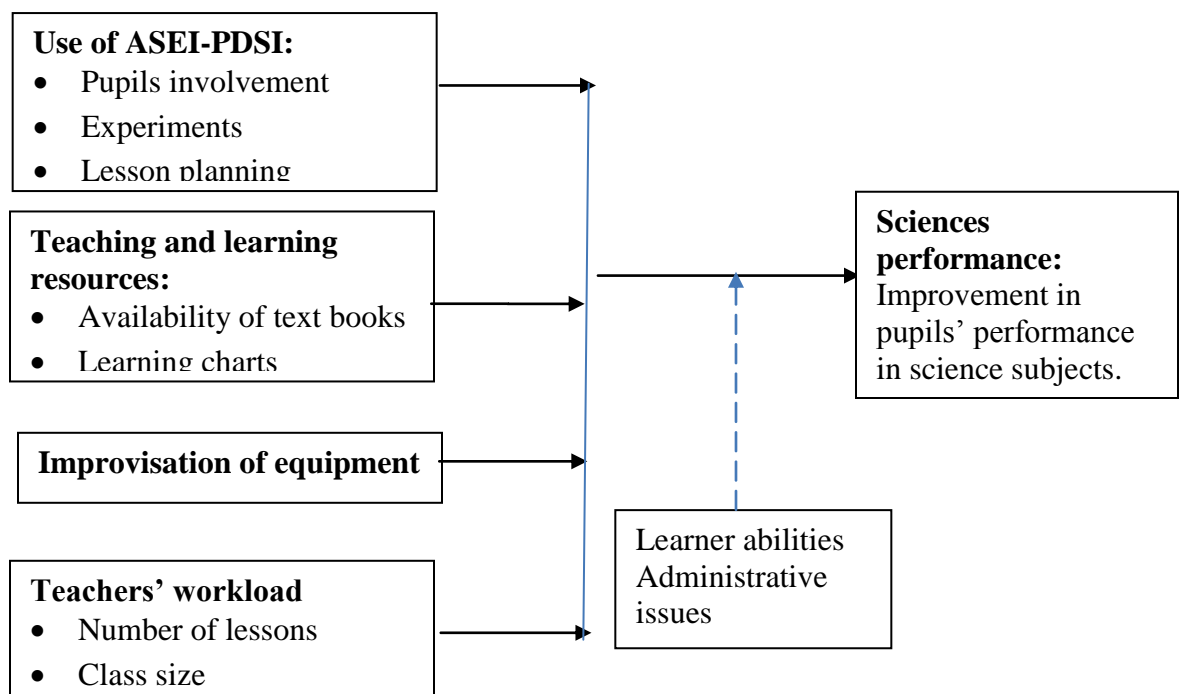
Figure 2.1: The inter-relationship between the variables influencing the performance in science.

The conceptual framework shows the interaction between variables that influence implementation of SMASE –INSET practices and consequently performance of pupils in science.

ASEI-PDSI practices, teaching and learning resources, improvisation of equipment and teachers workload are the independent variables while improvement in pupil's performance in science is the dependent variable. Actualization of ASEI-PDSI approach as advocated by SMASE-INSET will influence the performance of teachers in science. Teachers' use of adequate learning resources will influence performance in science. Improvisation of teaching and learning resources as required by SMASE-INSET facilitates quality in delivery of science lessons, hence better performance. A sizeable teachers' workload in terms of class size and number of lessons promotes individualized attention with pupils which leads to improved performance.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

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

3.2 Research design

The research used a descriptive survey design. Mugenda and Mugenda (1999) view descriptive survey design as a method of gathering information by use of interviews or administering questions to a representative group of individuals. The design is appropriate for this study because the teachers have already undergone the SMASE-INSET and the researcher does not have the opportunity to manipulate the training conditions and objectives. The study is therefore, aimed at getting respondents' opinions on the influence of SMASE-INSET on science performance in Rigoma Division.

3.3 Target Population

According to data from the District Education Office (2016) there were 65 public primary schools in Rigoma Division, 65 science teachers from standard Eight class and a population of 2400 class 8 pupils since they have been in school for

long and they can read, and respond to the questionnaires easily and65 head teachers of those primary schools due to the crucial role they play in curriculum innovations and implementation.

3.4 Sample Size and sampling procedures

Mugenda and Mugenda (2012) define sample size as the number of items or units in the sample. According to Mwituria (2012), sampling is the process of selecting a number of items for a study in such a way that the items selected represent the entire group from which they were selected. Mugenda and Mugenda (2003) point out that a sample size of 10-30 percent of the respondents should represent the target population. For this study, however, 30 percent of the Science teachers and head teachers were used while 10 percent of the pupils were used.

Table 3.1 Sample Size

Category of Respondents	Target Population	Sample Size	%
Head teachers	65	20	30
Science teachers	65	20	30
Pupils	2400	240	10
Total	**2530**	**280**	

A sample of 20 public primary schools was used for the study that is 30 percent of the 65 schools. Head teachers and Science teachers of these schools were selected using simple random sampling. 240 class 8 pupils' (12 pupils per school) which is 10 percent of the total number of 2400 class 8 pupils was selected. Purposive sampling was used to select learners from the public primary schools selected.

3.5 Research instruments

Data for the research was gathered using questionnaires for pupils' science teachers and head teachers. A questionnaire is a research instrument comprising a series of questions that are typed or printed for the purpose of gathering information (Kothari, 2004).Questionnaires was used because it aids the researcher in getting information from a large sample and also safeguards confidentiality (Kombo& Tromp, 2006).The questionnaires for the science teachers and pupils' consisted of both structured and unstructured questions. Section A in both had questions on respondents' demographic information. Section Bhad structured questions on ASEI-PDSI intervention; section C had items on teaching and learning resources, section D had items on improvisation of teaching and learning resources and section E had items on teachers' workload where the respondents were expected to tick their suitable responses. In open ended questions, the respondents were required to answer to capture the set objectives of the study. Questionnaires for head teachers consisted of five sections. Section A had four items on demographic information of respondents,

28

section B on use of ASEI-PDSI intervention had four items, section C on teaching/learning resources had two items, and section D on improvisation of teaching/learning resources had two items and section E on teachers work load which had three items.

3.6 Validity of the Instruments

According to Mugenda and Mugenda (2012) validity is the extent to which data collected in a research precisely represent the variable that is being measured. Content validity is the degree to which a research instrument provides enough coverage of topic under research (Kothari, 2003).The purpose of content validity is to establish whether the content of the instruments actually serves its intended purpose. Mugenda and Mugenda (2003) opined that a sample of 10-30 percent is acceptable sample size for a pilot study. The researcher used two pilot schools that consisted of 2 head teachers, 2 Science teachers and 20 pupils in Rigoma division. The researcher administered the questionnaires on two different occasions. The results obtained from the same respondents after one week were compared to ascertain the reliability of the instrument.

The results from the pilot study were used to modify ambiguous questions. The researcher also sought for opinion from the supervisors and other experts in the department of Educational Administration and Planning, University of Nairobi to ascertain the validity of the instruments.

3.7 Reliability of the instruments

According to Mugenda and Mugenda (2003), reliability of research instruments is the degree to which they yield same results after repeated trials. The researcher used test-retest technique during piloting to ascertain the reliability of the questionnaires. The responses given in the second administration of the instruments were correlated with responses with the first administrations. A coefficient of 0.80 or more will imply a high degree of reliability (Mugenda & Mugenda, 2003). Pearson's product moment correlation coefficient was used to calculate reliability.

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

Where

r   Coefficient correlation

n   Number of respondents in each test

x   Scores in first test

y   Scores in second test

∑   Summation sign

These study research questionnaires yielded a coefficient correlation index of 0.88 for questionnaires of head teachers, 0.82 for questionnaires of science teachers and 0.85 for pupils 'questionnaire.

3.8 Data Collection Procedure

The researcher obtained an introductory letter from the University of Nairobi. He then obtained a research permit from the National Commission for Science, Technology and Innovation (NACOSTI). The researcher then presented copies of the research permits to the Commissioner of Nyamira County, the Director of Education and the District Education officer's office, Masaba North. He then served the head teachers of sampled schools with introductory letters which enabled him to visit and administer the interview guides and questionnaires. The researcher then personally administered the interview guides to head teachers and questionnaires to Science teachers were collected immediately upon completion. Administering the questionnaires personally accords the researcher time to create rapport, explain the rationale for the study and elaborate more on items that may not be clear to the respondents (Mugenda and Mugenda, 2003)

3.9 Data Analysis Techniques

Data analysis is a process of summarizing data such that it leads to information that can be interpreted easily and conclusions arrived at (Mugenda & Mugenda, 2012). To analyze data, questionnaires were examined to check their completeness, accuracy and uniformity. Collected data was analyzed by use of inferential and descriptive statistics.

The data was computed using Statistical Package for Social Science (SPSS) Program. Quantitative data obtained from open- ended questions was analyzed using descriptive statistics using percentages and frequencies. Bar charts and pie graphs was used to present the data. The researcher then used inferential statistics to draw conclusions and make generalizations for the whole of Rigoma Division by use of information from the sampled schools.

3.10 Ethical Considerations

To ensure confidentiality, the names of the participants were not written on the questionnaires and the researcher assured the participants that their responses would be confidential. The researcher treated respondents with courtesy and respect. The researcher also explained the purpose of the study and assured the respondents that there was no financial benefits accruing from the study and their willingness to participate in the study was voluntary.

CHAPTER FOUR

DATA ANALYSIS, PRESENTATION AND INTERPRETATION

4.1 Introduction

The purpose of this study is to investigate the influence of Strengthening Mathematics and Science Education Inset on science performance in Rigoma Division of Nyamira County, Kenya. This chapter presents data analysis, findings, presentation and interpretation of findings. Data collection relied on questionnaires administered to science teachers and pupils together with interviews conducted through interview schedules to the head teachers. Quantitative data was analyzed using descriptive statistics; frequencies and percentages and the findings presented on tables, pie charts and bar graphs. Qualitative data was analyzed into themes and presented in tables and discussions.

4.2 Response rate

The study sampled 20 public primary schools. Head teachers and teachers of the sampled schools were automatically selected and 240 class 8pupils.Therefore, 280 research instruments were administered.

Table 4.1 shows the response rate for the study

Table 4.1: Response rate

Targeted respondents	Total sample	Responses	Response rate Percent (%)
Head teachers	20	15	75.0
Science Teachers	20	18	90.0
Pupils	240	214	89.2
Total	**280**	**247**	**88.2**

Table 4.1 indicates that the response rate was 75.0 percent, 90.0 percent and 89.2 percent for head teachers, teachers and pupils respectively. This shows an overall response rate of 88.2 percent for all the respondents. According Baruch (1999), a response rate of above 80 percent is adequate for social sciences studies. This implies that the response rate is good and adequate for analysis, as it is representative of the population under study.

4.3 Demographic data of the respondents

This section presents the demographic data of head teachers, science teachers and that of pupils that were used in the study. The section presents the demographic data of head teachers precede that of science teachers and then follows that of the learners. Information was sought on the gender and professional qualification of head teachers. The results are shown in table 4.2 below.

34

Table 4.2: Distribution of head teachers by gender and professional qualification

Respondent	Category	Frequency	Percent (%)
Gender	Female	6	40.0
	Male	9	60.0
Professional	Diploma	3	20.0
Qualification	Graduate	10	66.7
	Masters	2	13.3

n=15

Findings from Table 4.2 indicate that most head teachers 9 (60 percent) were male while 40 percent were female. This indicates that there is gender disparity in schools leadership in public schools under study. This implies that majority of female teachers shy away from applying for leadership positions. Eventually, girls may lack role models to emulate hence this may affect their performance in science.

The data on Table 4.2 indicates that most of the head teachers 10 (66.67 percent) had bachelors' degree; three had a diploma while 2 had masters qualification. This implies that majority of head teachers had higher qualifications. Head teachers need to hold at least a diploma in education management so that they can be able to manage their schools efficiently. This could also be as a result that the

current policy on promotion of teachers by Teachers Service Commission (T.S.C) which is pegged on not only merit but academic qualification.

The researcher further sought to find out from head teachers the duration of service in their current schools. Table 4.3 presents data on head teachers' duration of service in current school.

Table 4.3: Head teachers' length of service in current school

Length of service in years	Frequency (f)	Percentage (%)
1 – 5	5	33.3
6 – 10	7	46.7
11 – 15	2	13.3
16 – 20	1	6.7
Total	**15**	**100**

The data on Table 4.3 shows that many head teachers (46.7 percent) had served in their current schools for between 6 – 10 years. This implies that they have been in their current schools for long and have required information about the school performance and implementation of ASEI-PDSI.

The researcher sought Information on the gender, age and professional qualification of science teachers. Table 4.4 shows the distribution of science teachers by gender, age and professional qualification.

Table 4.4: Distribution of science teachers by gender, age and professional qualification

Respondent characteristics	Category	Frequency	percent (%)
Gender	Female	12	67.0
	Male	6	33.3
Age in years	20-29	3	16.7
	30-39	527.8	
	40-498	44.4	
	Over 50	2	11.1
Level of	P1	10	55.5
qualification	Diploma	3	16.7
	Bachelors	4	22.2
	Masters	1	5.6
			100

n=18

The gender, age and level of professional qualification were considered in this study. These characteristics were salient to establish whether they had any influence on the way teachers were translating SMASE in-service training practices into classroom teaching and learning activities.

Table 4.4 indicates that majority of science teachers at 67.0 percent were male while female teachers were 33.0 percent. This implies that there are more male science teachers than female. An analysis of the gender of science teachers is important since it may be linked to their liking for the subject and ultimately that of the pupils. Gituthu (2014) attributed this to the apathy and stereotypes that show science as a male domain.

Findings from the table indicated that many science teachers (44.4 percent) were aged between 40 – 49 years at 44.4 percent. This implies that the teachers were mature and have experience in teaching science. The group that followed ranges between 30-39 years of age at 27.8 percent. This group of teachers is also advanced in age and has experience in teaching/learning of science.16.7 percent of the teachers were aged between 20-29 years. This is because most of the teachers below 30 years have not been employed by Teachers Service Commission as those with 40 years and above are given priority.11.1 percent of the teachers were aged over 50 years. This may be because most teachers in this bracket are tired and focused on retirement.

Teachers were required to indicate their level of professional qualification. This was important to ascertain their level of competence to implement SMASE in-service training teaching and learning techniques. The results revealed that majority of science teachers 10 (55.56 percent) had P1 certificate. They were followed by Bachelor of Education degree holders at 22.2 percent, those with diploma at 16.7 percent and those with masters at 5.6 percent. This implies that all the teachers studied were qualified to teach science as required by SMASE.

Pupils were asked to indicate their gender and age. The results are presented in Table 4.5.

Table 4.5: Distribution of standard eight pupils by gender and age

Respondents	Category	Frequency	percent (%)
Gender	Male	111	52.0
	Female	103	48.0
Age in years	12-13	17	7.9
	14-15	179	83.7
	Over 16	18	8.4
Total		14	100

n=214

Table 4.5 indicates that majority of pupils 111 (52.0 percent) are male while girls were at 48.0 percent. This implies that there are more boys than girls and gender imbalance exists among pupils in Rigoma division. Information on pupils' age

was also sought in this study. This was useful in order ascertain if the pupils'
respondents were mature enough to comprehend the items in the questionnaires.

The findings revealed that majority of the pupils (83.7 percent) were aged
between 14–15years while the youngest pupils were between 12-13 years at 7.9
percent. The oldest pupils of over 16 years were 8.4 percent. This implies that the
pupils were old enough to answer the questionnaires.

4.4 Use of ASEI-PDSI intervention and science performance

Head teachers were requested to indicate whether they had attended ASEI-PDSI
training. Their responses were tabulated in Table 4.6

Table 4.6: Head teachers' attendance of ASEI-PDSI training

Attended SMASE Training	Frequency	Percent (%)
Yes	13	87.0
No	2	13.0
Total	15	100.0

Table 4.6 indicates that majority of head teachers 13 (87.0 percent) had attended ASEI-PDSI training while 13.0 percent had not attended. This implies that the respondents had the requisite knowledge about ASEI-PDSI which could positively influence implementation in science learning.

Head teachers were further asked whether science teachers in the schools do prepare ASEI-PDSI lesson plans. The results presented in Table 4.7.

Table 4.7: Head teachers' responses on science teachers preparing ASEI-PDSI lesson plans

Science teachers prepare ASEI/PDSI (%) lesson plan	Frequency	Percent
Yes	11	73.0
No	4	27.0
Total	15	100.0

From the findings in Table 4.7 many head teachers 11 (73.0 percent) agreed that science teachers in their schools do prepare ASEI-PDSI lesson plans while 27.0 percent indicated that they do not prepare ASEI/PDSI lesson plans. Preparation of ASEI-PDSI lesson plan is in agreement with CEMASTEA (2010) that stresses on instructional activities. Lesson plans are a critical tool for effective lesson delivery.

The researcher sought to establish from science teachers on how often they use ASEI-PDSI approach. The findings are presented in Table 4.8.

Table 4.8: Frequency of use of ASEI-PDSI approach by teachers

Response	Frequency	Percent (%)
Very often	6	33.3
Often	7	38.9
Moderate	2	11.1
Rare	2	11.1
Very rare	1	5.6
Total	**18**	**100.0**

Findings from Table 4.8 indicated that 38.9 percent of the teachers often used ASEI-PDSI approach while 33.3 percent of the teachers studied indicated that they very often use the approach On the other hand, 11.1 percent of the teachers and another 5.6 percent indicated that they rarely and very rarely used ASEI-PDSI approach respectively. This means that72.2 percent of the teachers used the approach in teaching science. The ASEI-PDSI approach could be used because it led to improvement in science performance. It was also indicated by teachers that active learner involvement in the learning process is one of the targets in the teachers' performance appraisal and development tool. Use of ASEI-PDSI approaches in teaching is in line with SMASE (2009) which points out that the teaching and learning of science should be learner centered with the role of the teacher being that of a guide, facilitator, researcher and innovator.

The science teachers were further requested to indicate their level of agreement
with the following statements. The results are tabulated in Table 4.9.

Table 4.9: Teachers level of agreement on using ASEI-PDSI

Statement	Strongly agree		Agree		Disagree		Strongly disagree		Undecided	
	F	%	F	%	F	%	F	%	F	%
Prepare ASEI-PDSI lesson plan	3	16.7	5	27.8	6	33.3	4	22.2	-	-
Consider pupils feedback to improve on subsequent science lesson.	2	11.1	5	27.8	9	50.0	2	11.1	-	-
Give class demonstration	10	55.6	6	33.3	1	5.6	1	5.6	-	-
Try out experiments before going to class	7	38.9	3	16.7	5	27.8	1	5.6	2	11.1
Invite a colleague to supervise you in class	1	5.6	4	22.2	11	61.1	2	11.1	-	-
Engage learners in group work	11	61.1	6	33.3	-	-	-	-	1	5.6
Engage learners in practical work	10	55.6	5	27.8	2	11.1	1	5.6	-	-

n = 18

43

Findings revealed that that (33.3 percent) of the teachers disagreed that they do prepare ASEI-PDSI lesson plan while 22.2 percent strongly disagreed. This means that majority of the teachers at 55.5 percent do not use ASEI-PDSI lessons to teach science lessons. This may be because preparing an ASEI- PDSI lesson plan requires a considerable amount of time to prepare and this could lead to untimely syllabus coverage. On the other hand, 16.7 percent strongly agreed while 27.8 percent agreed. This implies that 44.5 percent of the teachers were not preparing ASEI-PDSI lesson plans. This is in line with Luneburg and Irby (2011) who pointed out that there is urgent need for teachers' preparation as a basic requirement for effective lesson delivery.

Results from the study also indicate that majority (61.1 percent) of teachers do not consider pupils feedback to improve on subsequent science lesson. This implies that the teachers do not embrace evaluation by their learners because they might not be well prepared for their lessons and or they may feel ashamed being corrected by their learners.

On giving class demonstrations, 88.9 percent of teachers agreed. This means that learners are not accorded an opportunity to manipulate learning aids as advocated by SMASE-INSET. From the study findings, 55.6 percent of the respondents indicated that they try out experiments before going to class while 27.8 and 5.6 percent disagree and strongly disagree respectively. This implies that more teachers prepare their lesson activities in advance before the actual lessons. This

may make learners have confidence in their science teachers as a lesson well prepared is a lesson half taught.

From the findings, majority of the respondents at 72.2 percent indicated that they do not invite a colleague to supervise them in class while 27.8 percent agreed. This implies that the teachers have not embraced peer teaching in their science lessons as advocated by SMASE INSET. Findings from the study also revealed that 83.4 percent of the teachers engaged learners in practical work. Engaging learners in practical work is in agreement with SMASSE (2002) which advocates for hands- on, minds- on and mouth-on activities while learning science.

On engaging learners in group work, findings from the study revealed that 61.1 percent and 33.3 percent of the teachers strongly agreed and agreed respectively. This means that 94.4 percent of the teachers engage their learners in group work activities. This means that learners are able to build confidence among themselves while learning science. This is in line with JICA (2000) which stresses that the learning of science and mathematics ought to be learner centered.

The researcher sought to establish from pupils whether they enjoy science lessons as indicated Table 4.10.

Table 4.10: Pupils' responses on enjoying science lessons

Enjoy science lessons	Frequency	Percent
Yes	153	71.0
No	61	29.0
Total	**214**	**100.0**

The findings in Table 4.10 stipulate that most pupils 153 (71.0 percent) enjoy science lessons while 29.0 of the pupils do not. This may be as a result of the use of discovery methods of learning like practical and group work which arouse the curiosity learners and make science lessons interesting.

The researcher further sought to establish from pupils their current scores in science. The results are tabulated in Table 4.11.

Table 4.11: Pupils current score in science

Scores	Frequency (f)	Percent (%)
41 – 50 marks	52	24.3
51 – 60 marks	94	43.9
61 – 70 marks	41	19.2
Over 70 marks	27	12.6
Total	**214**	**100.0**

Table 4.11 indicates that most pupils (75.7 percent) scored above 50.0 percent in science while those who scored 50 marks and below were 24.3 percent. This shows that most learners are participating actively in the learning of science.

The researcher sought to find out from head teachers the extent by which school administration encourage teachers' peer teaching in the classroom and the results are tabulated Table 4.12.

Table 4.12: Extent by which school administration encourages teachers' peer teaching

Administration encourages teachers Peer teaching	Frequency	Percent
Very high	2	13.3
High	6	40.0
Medium	4	26.7
Low	2	13.3
Very low	1	6.7
Total	**18**	**100.0**

The data in Table 4.12 indicates that 40.0 percent of the head teachers highly encourage teachers' peer teaching in the classroom while 13.3 percent very highly encourage it. The findings revealed that majority of head teachers' at 53.3 percent encouraged peer teaching amongst teachers. This encourages team work and may

lead to improvement in performance. However, 26.7 percent of the head teachers moderately encourage peer teaching and 13.3 and 6.7 percent of the head teachers indicated low and very low respectively. This shows that the head teachers did not appreciate the importance of teachers collaborating with others in lesson presentation and evaluation and this could negatively influence the teaching of science and consequently performance in the subject.

4.5 Use of teaching/learning resources and science performance

Head teachers were required to indicate whether the schools had enough science textbooks and teachers guides. This is presented in Table 4.13.

Table 4.13: Head teachers' responses on adequacy of science textbooks and teachers guides

Schools have enough text books and teachers' guides	Frequency	Percent
Yes	9	60.0
No	6	40.0
Total	**15**	**100.0**

Table 4.13 indicates that many head teachers 9 (60.0 percent) agreed that their schools had enough science textbooks and teachers guides. Availability of textbooks improves learner's performance. Gakuru (2005) found that availability and use of materials like textbooks had a vital influence on teaching and learning

process with positive effect on learner's performance. However, 40.0 percent of the respondents indicated that their schools did not have enough science textbooks and teachers' guides. This may be due to inefficient management of financial resources in the schools since statistics from ministry of education show that the Kenyan government has disbursed over 300 billion shillings to schools for the purchase of teaching and learning materials since the inception of free primary education in 2003.

The pupils were also asked whether their schools provided them with adequate science textbooks. They were required to indicate as follows;

Table 4.14: Pupils' responses on provision of adequate science textbooks by school

School provides adequate science Text books	Frequency	Percent
Yes	129	60.3
No	85	39.7
Total	**214**	**100.0**

As Table 4.14 illustrates, most pupils 129 (60.3 percent) agreed that schools provided them with their own science textbooks. The results are in agreement with Bishop (1985) who asserts that for any curriculum to be implemented effectively there must be adequate teachers' guides, textbooks and other learning materials. However 39.7 % of the respondents indicated they shared acopy

between two pupils. These findings imply that not all schools in Rigoma division have achieved the pupil book ratio of 1:1 and this may negatively affect curriculum implementation. This is in line with Rogan and Grayson (2003) who pointed out that implementation of innovations is hindered by lack of resources even when implemented by the best of teachers.

The researcher sought to establish whether teaching/learning resources influence teachers' performance and tabulated the findings in Table 4.15.

Table 4.15: Influence of teaching/learning materials on teachers' performance

Learning resources Influence teachers' performance	Frequency (f)	Percent (%)
Yes	14	77.8
No	4	22.2
Total	**18**	**100.0**

Findings from Table 4.15 indicate that most science teachers (77.8 percent) agreed that teaching and learning aids influence teachers' performance. This is in line with UNESCO (2008) which stresses that teaching aids promote comprehension of complex ideas and enhances learning outcomes.

Teachers were further required to indicate their degree of agreement with the following statements pertaining to teaching/learning resources.

50

Table 4:16 Teachers' responses on availability, influence and use of teaching/learning resources

	Strongly agree		Agree		Disagree		Strongly disagree		Undecided	
Statements	F	%	F	%	F	%	F	%	F	%
Teaching/learning resources are adequate.	4	22.2	8	44.4	3	16.7	1	5.6	2	11.1
Administration supportive in the provision of teaching and learning resources.	3	16.7	8	44.4	2	11.1	2	11.1	3	16.7
Use of teaching / learning resources promotes teaching and learning of science.	13	72.2	5	27.8	-	-	-	-	-	-
Use teaching/ learning aids in the teaching of science.	11	61.1	6	33.3	-	-	-	-	-	-

n = 18

The data on Table 4.16 indicates that majority 66.6 percent of the public primary schools have adequate teaching/learning resources. This implies that science teachers have enough resources to effectively implement science curriculum. This is in line with Ngaroga (2010), Wanjohi (2006) who noted that use of teaching and learning resources enhances retention thus making learning effective.

51

However 22.3percent of the respondents indicated that teaching and learning resources were inadequatewhile11.1 percent of the teachers were undecided. When resources are inadequate lessons are not delivered effectively. On administration is supportive in provision of teaching and learning resources, 16.7 percent of teachers strongly agreed while 44.4 percent agreed and 11.1 percent strongly disagreed. This shows that in majority of the schools at 61.1 percent, teachers are supported in the provision of teaching and learning resources.

Pertaining use of learning resources promotes teaching and learning of science, 72.2 percent of the teachers strongly agreed while 27.8 percent agreed. This implies that all teachers are cognizant of the important role that teaching resources play in the learning of science in line with SMASE- INSET training. The findings are in agreement with Umaru (2010) who pointed out that instructional materials are very important since they influence learners' academic performance as they simplify and clarify concepts that are difficult and complex to express in words.

On use teaching/learning aids in the teaching of science, results from the study show that 66.7 of the teachers strongly agreed while 33.3 percent agreed. This shows that all teachers have embraced the rationale for use of learning resources in science learning.

This is in line with CEMASTEA (2012) which pointed out that teachers should use teaching/learning resources since they emphasize information, stimulate interest and facilitate the learning process.

The researcher further sought to establish from the pupils whether science teachers use teaching/learning aids like models and charts when teaching Science and presented the findings in Table 4.17.

Table 4.17: Pupils' responses on use of teaching/learning aids by science teachers

Teachers use teaching and learning aids in class	Frequency (f)	Percent (%)
Yes	154	72.0
No	60	28.0
Total	**214**	**100.0**

Findings from Table 4.17 indicate that majority of pupils (72.0 percent) agreed that science teachers use teaching/ learning aids like models and charts when teaching Science. However, 28.0 percent of the teachers do not use teaching and learning resources. This is not in agreement with teachers where all responded in support of using teaching and learning resources when teaching science. Nevertheless, it can implied that majority of teachers in Rigoma Division use teaching and learning resources when teaching hence the teaching of science has been effective.

The researcher sought to find out from the head teachers how they rate utilization of teaching/learning resources in their school. The findings are tabulated in Table **4.18.**

Table 4.18: Head teachers' responses on effective utilization of teaching/learning resources

Utilization of learning resources	Frequency	Percent (%)
Very effective	4	26.7
Effective	7	46.7
Average	2	13.3
Ineffective	1	6.7
Very ineffective	1	6.7
Total	15	100.0

The data on Table 4.18 revealed that 26.7 percent of the head teachers indicated utilization of learning resources as very effective while 46.7 percent indicated effective. This implies that resources are utilized adequately in 73.34 percent of the public primary schools in Rigoma Division. However, 13.3 percent of the head teachers indicated that utilization of resources was average while 6.7 percent and another 6.7 percent of the respondents indicated ineffective and very ineffective respectively. It can therefore be established that in 26.7 percent of the

schools, learning resources are not being utilized effectively and this is not good for effective teaching /learning of science.

4.6 Improvisation and science performance

Head teachers were required to indicate whether science teachers use improvisation during lessons. This information is represented in Table 4.19.

Table 4.19: Head teachers' responses on science teachers 'use of improvisation during lessons

Science teachers improvise during lessons.	Frequency (f)	Percent (%)
Yes	10	66.7
No	5	33.3
Total	**15**	**100.0**

Findings on table 4.19 indicate that, most head teachers (66.7 percent) agreed that science teachers in their schools improvise teaching/learning resources during science lessons. This shows that improvisation of teaching learning resources has been implemented in the learning/teaching of science as advocated by SMASE-INSET programme and this will enhance the teaching/learning of science and affect performance positively. This is congruent with Babu (2003) in Wawira (2012) who underscored the need for science teachers to make optimum use the

55

available resources using locally available materials to assist learners comprehend the concept of science.

Science teachers were asked how often they use locally improvised teaching/learning aids in science lessons. Their responses are shown in Table4.20

Table 4.20: Frequency of science teachers' use of locally improvised teaching/ learning aids

Use locally improvised teaching/ Learning aids	Frequency	Percent
Very often	4	22.7
Often	12	66.7
Rare	2	11.1
Total	**18**	**100.0**

Findings from Table 4.20 revealed that22.2 percent of the teachers very often used locally improvised teaching/learning aids in science lessons while 66.7 percent indicated that they often used locally improvised teaching learning resources and 11.1 percent rarely improvised. This means that 88.9 percent of the teachers used improvised teaching and learning resources. This was feasible since there were several locally available learning materials from the immediate environment. It was also cheaper to improvise as compared to buying. This implies that the teachers are dedicated to their work and want learners to perform

56

better in science. This is line with hoi and Tang (2011) who found out that dedicated teachers spend a lot of time improvising teaching and learning resources.

The researcher also sought to establish from pupils how often their teachers use locally improvised teaching/learning resources in the teaching of science and presented the findings in Table 4.21.

Table 4.21: Pupils' responses on how often teachers use locally improvised teaching/learning resources

Teachers use locally improvised teaching/learning resources	Frequency (f)	Percent (%)
Every lesson	23	10.8
Most lessons	93	43.5
Some of the lessons	55	25.7
Rarely	34	15.9
Not at all	9	4.2
Total	**214**	**100.0**

From the findings, 43.5 percent of the pupils indicated that their science teachers use locally improvised teaching/learning resources in the teaching of science in most of the lessons while 10.8 percent use teaching and learning resources in every lesson. This is in contrast to 88.9 percent of the teachers who indicated that

they often and very often used improvised teaching/learning resources. The remaining 25.7 percent of the pupils however indicated that teachers sometimes use locally improvised learning resources while 15.9 percent rarely improvise and 4.2 do not use them at all. This shows that 45.8 percent of the teachers are reluctant to use locally available materials in science teaching in line with SMASE in-service training. According to Babu (2003) in Wawira (2012) there is need for science teachers to make optimum use of locally available resources to assist learners comprehend the concept of science.

The pupils were further asked to rate their teachers in terms of teaching/learning resources improvisation. The results are tabulated in Table 4.22.

Table 4.22: Pupils' rating of teachers in terms of teaching/learning resources improvisation

Pupils' rating of teachers	Frequency (f)	Percent (%)
Excellent	19	8.9
Good	62	30
Average	101	47.2
Poor	21	9.8
Very poor	11	5.1
Total	**214**	**100.0**

As the results in Table 4.22 indicate, 47.2 percent of the pupils rate their teachers as average in terms of teaching/learning resources improvisation while 30 percent and 8.9 percent rate them as good and excellent respectively. The remaining 9.8 percent and 5.1 percent rate their teachers as poor and very poor respectively. This implies that 86.1 percent of the teachers are above average in terms of teaching/learning resources improvisation. Improvisation of locally available materials into learning aids enhances learners understanding in science and this contributes to better performance in science. This is in line with CEMASTEA (2010) which advocates for improvisation of teaching/learning resources when/where necessary.

The researcher requested head teachers to indicate the extent by which science teachers in their schools involve learners in improvisation of teaching/learning resources. Their responses are shown in Figure 4.1.
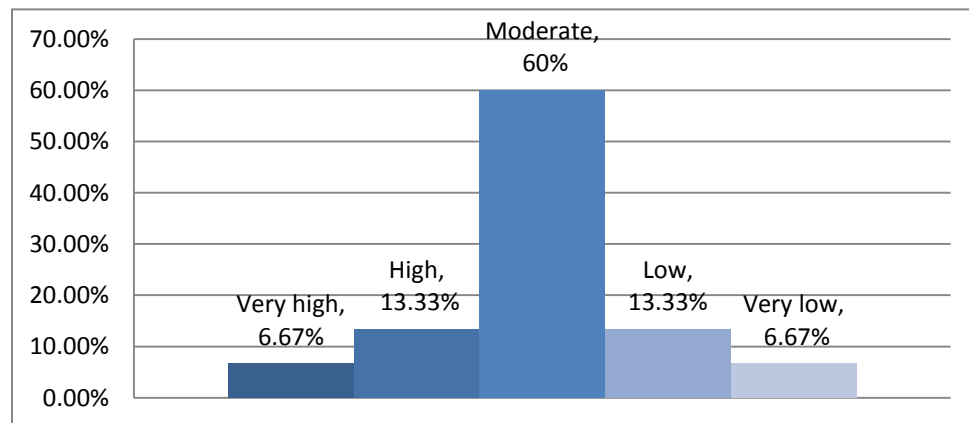

Figure 4.1: Head teacher's responses on teachers' involvement of learners in the improvisation of teaching/learning resources

Figure 4.1 reveals that most head teachers at 9 (60 percent) indicated that teachers moderately involved learners in the improvisation of teaching/learning resources while 13.3 percent and 6.7 percent of the head teachers indicated that learners were highly and very highly involved respectively.

On the other hand, 13.3 percent indicated low and the other 6.7 percent indicated very low involvement. These results imply that most pupils have not been actively involved in improvisation of learning materials. The findings contradict Stonik (2012) who observes that teachers can work with learners to come up with strategies to improvise hence encouraging learners to critically meditate about the scientific concepts underlying the improvised apparatus.

The researcher further sought responses from science teachers on whether they engaged learners in making some of the teaching materials and presented the results in table 4.23.

Table 4.23: Teachers' responses on involvement of learners in making teaching/learning resources

Involve learners in making teaching/learning resources	Frequency	Percent (%)
Yes	16	88.9
No	2	9.1
Total	**18**	**100.0**

Findings on Table 4.23 revealed that most teachers (88.9 percent) agreed that they involved their learners in making some of the teaching and learning resources while 9.1 percent indicated that they did not. It can, therefore be established that most learners in public primary schools in Rigoma Division are involved in making teaching/learning resources and this may motivate them and arouse their curiosity in the subject.

The researcher also sought the opinions of pupils on whether their science teachers involve them in making teaching and learning resources. The results are tabulated in table 4.24.

Table 4.24: Science teachers involve pupils in making teaching/learning resources

Pupils prepare learning resources	Frequency	Percent (%)
Yes	200	93.5
No	14	6.5

 n=214

The results on Table 4.24 show that majority of the pupils (93.5 percent) agreed that their teachers involved them in making some of the teaching/learning materials while 6.5 percent indicated that they were not involved. These results corroborate those of the teachers where 88.9 percent indicated that that they involve learners in making learning resources. This implies teachers actively involve their learners in improvising teaching/learning materials for science learning. This is in line with CEMASTEA (2010) which points out that

improvisation encompasses scaling down resources for utilization in experiments and use of non-conventional materials to enhance learning.

4.7 Teachers' workload and science performance

Manageable workload allows teachers to apply more learner centered methods and use new and innovative techniques in the teaching of science.

The researcher sought to find out the influence of teachers' workload on science performance. Science teachers were asked whether teaching workload affected their performance. The findings are shown in Table 4.25

Table 4.25 Effect of teaching load on science teachers' performance

Teaching load affects performance	Frequency	Percentage
	18	100.0
No	_	_

n =18

From the findings in Table 4.25, majority of the teachers at (100 percent) agreed that it did affect. The researcher further asked them the number of lessons they had per week and presented the results in Table 4.26.

Table 4.26: Teaching load

Number of lessons per week	Frequency (f)	Percent (%)
10 – 14	1	5.6
15 – 19	2	11.1
20 – 24	4	22.2
25 – 29	10	55.6
Over 30	1	5.6
Total	**18**	**100.0**

The results in Table 4.26 indicate that majority of public primary school science teachers (83.4 percent) had over 20 lessons in a week with only 16.7 percent having less than 20 lessons. This means that most teachers had 5 – 6 lessons in a day. This implies that most teachers in Rigoma Division may be overloaded with lessons to adequately implement SMASE methods of teaching and consequently improve performance in science.

The researcher sought pupils' opinion on what was the major factor that hindered their performance in terms of teaching load of science teachers. The results are presented in Table 4.27.

Table 4.27 Pupils' opinions on major factors that hinder their performance in terms of teachers 'work load

Factors affecting performance	Frequency	Percent (%)
Poor lesson attendance by teachers	133	62.1
Poor syllabus coverage	8138.9	
Total	**214**	**100.00**

n=214

Findings from Table 4.27 revealed that majority62.1 percent of the pupils indicated poor lesson attendance by teachers while 38.9 percent indicated poor syllabus coverage. This implies that science teachers may not be attending all the lessons as scheduled in the timetable and science syllabus may not be covered in time and this may affect performance of learners negatively. These findings are in line with Kipkoech (2011) who identified some of the challenges hindering implementation of ASEI-PDSI lessons as: heavy teaching load, lack of sufficient time to plan for lessons and mark or even evaluate the lessons so as to make improvements and an overloaded syllabus.

The researcher sought to establish from head teachers whether science teachers in their schools were facing challenges when implementing ASEI-PDSI approach. The data is presented in Table 4.28.

Table 4.28: Head teachers' responses on challenges facing their science teachers, in implementation of ASEI-PDSI approach

Challenges facing teachers	Frequency	Percent
Yes	8	53
No	7	47
Total	**15**	**100.0**

Figure 4.28 shows that most head teachers 8 (53.0 percent) indicated that their schools were experiencing challenges reported to them by science teachers while 47.0 indicated they had not received any reports. They stated that high workload was the major challenge. They also cited understaffing in their schools as another challenge impeding implementation of SMASE-INSET teaching methods. The findings are in agreement with Kibuthu (2011) who states that high workload prevents teachers from preparing their lessons according to SMASE-INSET program guidelines. Lack of adequate teaching and learning resources was also cited as another challenge in implementing SMASE-INSET programmes. Ngaroga (2010) states that teaching and learning resources promote retention and memory; and allow children to apply various senses and this makes learning effective.

Science teachers were asked whether their work load influences pupils' performance in the subject. Their responses are tabulated in Table 4.29.

Table 4.29: Influence of work load on science performance

Teaching load affects pupils performance	Frequency (f)	Percent (%)
Yes	14	77.8
No	4	22.2
Total	**18**	**100.0**

Findings on 4.29 indicate that most science teachers (77.8 percent) agreed that work load influence pupils' performance in science while 22.2 percent disagreed. They argued that having heavy work load negatively influences content delivery and implementation of ASEI-PDSI approach which in turn negatively affects pupils' performance in science. The findings concur with Ombaso (2008) who pointed out that ASEI-PDSI skills could not be used due to lack of enough time and pressure from administration to cover the syllabus that made it unreasonable for science teachers to use learner-centered practices when teaching.

CHAPTER FIVE

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1. Introduction

This chapter presents the summary of the study, conclusions, recommendations as well as suggestions for further studies.

5.2. Summary of the study

The purpose of this study was to investigate the influence of Strengthening Mathematics and Science Education Inset on science performance in Rigoma Division of Nyamira County, Kenya. Specifically, the study was set to establish the influence of the use of ASEI-PDSI intervention, teaching/learning resources, improvisation of equipment and teachers' workload on science performance. The study adopted a descriptive survey research design where the target population consisted of 65 public primary schools and their head teachers, 65 science teachers from standard eight classes and a population of 2400 class 8 pupils. A sample of 20 public primary schools was used for the study that is 30 percent of the 65 schools. Head teachers and science teachers of these schools were automatically selected. 240 class 8 pupils were selected using simple random sampling.

The study used questionnaires forehead teachers, science teachers and pupils for data collection. After getting introductory letter from the University of Nairobi and permit from the National Commission for Science, Technology and Innovation, the researcher then presented copies of the research permit to the County Commissioner, County Director of Education Office, and the Sub-County Education office, Masaba North. He then served the head teachers of sampled schools with introductory letters which enabled him to visit and administer the interview guides and questionnaires. The researcher then personally administered the interview guides to head teachers and questionnaires to Science teachers and pupils were collected immediately upon completion.

5.3 Summary of findings

The researcher discovered that majority of head teachers at 87.0 percent had attended ASEI-PDSI training, meaning that they had knowledge about ASEI-PDSI which could positively affect its implementation and performance in science. Majority of head teachers at 73.0 percent agreed that science teachers in their schools do prepare ASEI-PDSI lesson plans which are critical tools for effective lesson delivery. Majority of teachers at 72.2 percent agreed that they used ASEI-PDSI approach in the teaching of science. The study also found that 61.1 percent of the teachers did not consider pupils' feedback to improve on subsequent science lesson, but gave class demonstration at 88.9 percent and tried out experiments before going to class at 55.6 percent

The study findings revealed that 72.2 percent of the teachers did not invite their colleagues to supervise them in class but all of them engaged learners in group work and 83.4 percent engaged learners in practical work. Whether pupils enjoy science lessons, the findings revealed that Majority, 71percent of the pupils enjoyed the lessons. On pupils' current scores in science, the findings revealed that 75.7 percent of the pupils scored above the average mark of 50 percent which implied that most learners were actively participating in the learning process. On peer teaching, 53.3 percent of the teachers highly encouraged the innovation in the classroom which encourages team work and improvement in performance.

Findings of the study on use of teaching/learning resources indicated that majority of head teachers at 60 percent agreed that their schools had enough science textbooks and teachers guides. Availability and use of materials like textbooks had a vital influence on teaching and learning process with positive effect on learner's performance. Majority of pupils at 59 percent agreed that schools provided them with adequate science textbooks. On availability of teaching/learning resources are adequate, findings from the study revealed that 55.5 percent of the schools were adequately resourced while 61.1 percent of the teachers indicated that administration was supportive in provision of teaching/learning resources.

Majority of teachers at 72.2 percent strongly agreed that use of teaching/learning resources promoted teaching/learning of science. The study found that all teachers use teaching/learning aids when teaching and that in majority of schools at 73.3 percent, teaching/learning resources were adequately utilized.

On use of improvisation, the study found that 88.9 percent of science teachers used locally improvised teaching/learning resources in science lessons and this implied that they were dedicated in their work and wanted learners to perform well. Most pupils at 86.1 percent rated teachers as average and above in terms of teaching/learning resource improvisation while of Majority of teachers at 60 percent moderately involved their pupils in improvisation of teaching/learning resources.

On teachers' workload and science performance, science teachers unanimously agreed that teaching workload affected their performance. Regarding the number of lessons that they handled in a week, majority 83.4 percent of the teachers indicated that they handled between 5-6 lessons in a week. This was a clear indication that the teachers were overloaded and this negatively affected them in lesson preparation due to lack of enough time.53.0 percent of head teachers agreed that their schools were experiencing challenges reported to them by science teachers while 47.0 percent indicated that they had not received any reports. The study found that majority of science teachers at 78.8 percent indicated that workload negatively influenced pupils' performance in science.

5.4 Summary of Conclusions

Based on the foregoing findings, several conclusions were arrived at; Preparation of ASEI-PDSI lesson plans are a critical tool for effective lesson delivery. The use of ASEI-PDSI approach leads to improvement in science performance as pupils enjoyed science lessons which are learner-centered and interesting. The performance in science was above average for many pupils. Head teachers highly encouraged teachers' peer teaching in the classroom which encourages team work and improvement in performance.

Most schools had enough science textbooks and teachers' guides. Availability and use of materials like textbooks had a vital influence on teaching and learning process with positive effect on learner's performance. The use of teaching/learning resources promoted learning/teaching of science. Many science teachers used teaching/learning resources when teaching and the resources are utilized effectively. The effective utilization of teaching/learning resources contributed to better performance especially in science.

Science teachers used the knowledge acquired from SMASE/INSET to improvise and utilize teaching/learning materials. They used locally improvised teaching/learning aids in science lessons and this showed that the teachers were dedicated to their work and wanted learners to perform better. Improvisation was viewed as being cheaper than buying. Teachers were rated as average in terms of teaching/learning resources improvisation.

Teacher's workload influences their performance and that of pupils in science. Heavy work load negatively influence content delivery and implementation of ASEI-PDSI approach which in turn negatively affects pupils' performance in science. It negatively affected them in preparation as there was no time. The more a teacher has in terms of work load, the less effective in content delivery and the poor the performance.

5.5 Recommendations

The following recommendations were made by the study:

i. Head teachers should attend ASEI-PDSI training for effective implementation. All science teachers who attend SMASE/INSET training should use ASEI-PDSI approach whenever they are teaching for better performance.

ii. Science teachers should effectively use the available teaching/learning resources for better performance. Head teachers should ensure that the resources are adequate. The government should avail more funds for the purchase of needed teaching/learning resources and put in place mechanisms to ensure that the funds are utilized effectively.

iii. Teachers should improve in terms of improvisation of teaching/learning resources. They should utilize locally available resources in improvisation.

iv. The workload for science teachers should be reduced to a manageable size for effective content delivery and better performance.

5.6 Suggestions for further study

There is need for further research in the following areas:

i.   A study to investigate influence of strengthening mathematics and science education in-service training on science performance should the extended to public primary schools in other areas of the county other than Rigoma division

ii.   A further study to investigate school factors that influence implementation of ASEI-PDSI practices in public primary schools in the division

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APPENDICES

APPENDIX I: LETTER OF INTRODUCTION

University of Nairobi

Department Of Education

Administration and planning

P.O Box 30197

Nairobi.

Date…………………

To The Head teacher

_____

Primary School.

Dear sir/madam,

I am a post graduate student at the school of education, University of Nairobi. I am currently working on a research project on **influence of SMASE inset on science performance in public primary schools in Rigoma division;Kenya.** The purpose of the study is purely academic. I humbly request that you allow me to gather data in your school because it is under the target population. Your assistance will be of great value in conducting this study.

 Thank you in advance

Yours Faithfully,

Nyarumba Albert Nyagwansa

APPENDIX II: QUESTIONNAIRE FOR HEADTEACHERS

This study seeks to investigate the influence of SMASE-INSET on Science Teachers' Performance in Rigoma Division of Nyamira County. Given the significance of the study, I kindly request you to spare your time to inform this study by answering the following questions .To ensure confidentially please do not write your name in this questionnaire.

SECTION A: Demographic information.

1. What is your gender? Male [ ]   Female   [ ]

2. What is your highest professional qualification? PhD[ ]

    Masters[ ] Bachelors[ ] Diploma[ ] P1 [   ]Other, specify_____

3. For how long have you served as a head teacher of this school? 1-5 years[

    ]6-10years[ ] 11-15 years [ ] 16-20 years[ ] 21 years-and above[   ]

4. How would you rate your school performance in K.C.P.E science examination at national level?

    Very good [ ] Good [ ] Average [ ] Below average [ ] Poor [ ]

SECTION B: Use of ASEI-PDSI intervention and sciences teachers' performance.

5. Have you attended teachers' training in SMASE? Yes [   ] No [   ]

6.   In your institution, do science teachers prepare an ASEI-PDSI lesson plan?

     Yes [ ] No [ ]

7.   On your opinion, do science teachers engage learners in a variety of practical activities during science lesson? Yes   [ ]   No [ ]

8. To what extent does your school administration encourage teachers' peer teaching in the classroom? Very High [ ]   High[   ]   Medium[]   Low[ ] Very Low[   ]

SECTION C: Teaching /Learning Resources and Science Teachers Performance.

9. Are there enough science textbooks and teachers guides in your school?

    Yes [   ]   No   [   ]

10. How can you rate effective utilization of teaching / learning resources in your school?

    Very Effective [   ]   Effective [   ]   Average [   ]

    Ineffective [ ]   Very ineffective [ ]

SECTION D: Improvisation of teaching /learning resources and science teachers' performance.

11. Do science teachers in your school use the knowledge acquired from SMASE INSET to improvise and utilize teaching /learning materials? Yes [   ]   No [   ]

12. To what extent do science teachers in your school involve learners in the improvisation of teaching/learning resources?

    Very High[   ]   High [   ]   Moderate[   ] Low[   ]   Very Low [   ]

SECTION E: Teachers' workload load and SMASE trained science performance.

13. Is your school experiencing any challenges that have been reported to you by science teachers in reference to implementation of ASEI-PDSI approach?

    Yes [   ]   No [   ]

14. In your school which is the major challenge to implementation of ASEI-PDSI approach?

    Poor lesson planning   [   ]

    Inadequate pupil involvement in learning process   [   ]

    Inadequate learning/teaching materials   [   ]

15. In your school suggest ways to improve the implementation of ASEI-PDSI approach in the teaching of science?

    …………………………………………………………………………………

Thank you for your co-operation.

APPENDIX III: QUESTIONNAIRE FOR SCIENCE TEACHERS

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

SECTION A: **Background Information.**

1. Please indicate your gender. Male [   ] Female[   ]

2. Please indicate your age bracket.

    20-29 years [   ] 30-39 years[   ] 40-49 years[   ] 50 years and above [   ]

3. What is your highest professional qualification? Masters [ ]Bachelors[

    ]Diploma[ ]P1   [ ]

4. How would you rate your class performance in K.C.P.E science examination at the national level?

    Very good [   ] Good [   ] Average [   ] Below average [   ] Poor [   ]

SECTION B: ASEI-PDSI and Science Performance:

5. Do you use ASEI-PDSI approach while handling your lessons?

    Yes [   ]   No [   ]

6. How often do you apply ASEI-PDSI approach?

    Very often [   ] Often [   ] Moderate[   ] Rare [   ] Very rare [   ]

7. Rate the following statements and tick to indicate the level of agreement or disagreement.

Key: SA (Strongly Disagree), A (Agree), D (Disagree), SD (Strongly

Disagree) U (Undecided).

Statement	SA	A	D	SD	U
Prepare ASEI-PDSI lesson plan					
Consider pupils feedback to improve on subsequent science lesson.					
Give class demonstration					
Try out experiments before going to class					
Invite a colleague to supervise you in class					
Invite a colleague to supervise you in class.					
Engage learners in group work					
Engage learners in practical work					

SECTION C: **Teaching /Leaning Resources and Science Performance**

8. Do teaching/learning resources influence teachers' performance?

    Yes [ ] No [ ]

Statement	SA	A	D	SD	U
Teaching /learning resources are adequate.					
The school administration is supportive in the provision of teaching and learning resources.					
Use of teaching / learning resources promotes teaching and learning of science.					
You use teaching/ learning aids in the teaching of science.					

9. Please consider the statement given and then tick to indicate the level of agreement.

10. Which is the major factor that hinders effective use of teaching learning resources in your school? Inadequate learning and teaching resources[ ]Inappropriate use of teaching/learning aids [ ]Lack of administrative support on provision of teaching/learning resources[   ]

SECTION D: Improvisation of Teaching /Learning Resources and Science Performance.

11. How often do you use locally improvised teaching/ learning aids in science lessons? Very often [ ] Often [ ] Rare[ ] Very rare[ ] Never [ ]

12. Do you engage learners in making some of the teaching/ learning materials? Yes [ ] No [ ]

SECTION E: Teachers' work load and   science performance

13. Does teaching workload affect your performance in teaching science? Yes [ ]No [].If yes, how many lessons do you take per week?10-15 [ ]15-20[ ]20-25[] 25-30[ ] 30 and above [   ]

14. Does teacher's work load influence the pupils' performance in science?

   Yes [ ]   No   [ ]

   If yes explain how

   …………………..……………………………………………………………………………

   …………………………………………………………………………………………..

15. On your opinion which is the major challenge to science teachers on their performance? Poor lesson planning [   ]Inadequate pupil involvement in learning process [ ]Inadequate learning/teaching materials[   ]Inadequate administrative support [ ]

Thank you in advance

APPENDIX IV: QUESTIONNAIRE FOR PUPILS

Please answer all the questions by ticking (√) against your answer after carefully

reading through them. Do not write your name or the name of you school.

SECTION A: Demographic information.

1. What is your gender? Male [   ] Female [   ]

2. What is your age?   10-11years [] 12-13years []

    14-15 years [] 16 years and above   [   ]

SECTION B: ASEI-PDSI approaches and Science performance

3. Do you enjoy science lessons? Yes[   ]No[   ]

4. What is your current score in science?Below20 [   ]20-30[   ]30-40[

   ]40-50 [   ]50-60[   ] 60-70[ ]70 and above[ ]

5. Consider the following statements and put a tick where you agree or

   disagree. Rating: Very often (A) Often (B), Rarely(C) Not at all (D)

ASEI-PDSI activities	A	B	C	D
How often do science teachers give class demonstrations in science?				
How often do you have group discussion during science lesson?				
How often do you carry out small experiments in science lesson?				
How often do you engage in practical work during science lesson?				
How often does your teacher consider you feedback to improve on future science lessons?				

SECTION C: Teaching /Learning Resources and Science Performance:

6 Does your school provide you with adequate science textbooks?

Yes [   ] No [   ]

If yes, do you have a copy each or you share? Own copy [   ] Share[   ]

7. Does your science teacher use teaching/ learning aids like models and charts

When teaching Science? Yes [   ] No   [   ]

SECTION D: Improvisation and Science Performance

8. How often does your teacher use locally improvised teaching/ learning resources in the teaching of science Every lesson [   ]

Most lessons [   ] Some of the lessons [   ] Rarely [] Not at all [   ]

9. Does your teacher involve you in making some of the teaching /learning materials?

Yes [   ] No [   ]

10. How can you rate your teacher in terms of teaching/learning resources improvisation?

Excellent [ ] Good [   ] Average[   ] Poor[   ] Very poor [   ]

SECTION E: Teachers' work load and science performance

11. On your own opinion which is the major factor that hinders performance in terms of teaching load? Tick   appropriately.   Poor lesson attendance by sciences teachers [   ] Poor syllabus coverage [   ]

Thank you in advance

APPENDIX V: RESEARCH CLEARANCE PERMIT

CONDITIONS

1. The License is valid for the proposed research, research site specified period.
2. Both the Licence and any rights thereunder are non-transferable.
3. Upon request of the Commission, the Licensee shall submit a progress report.
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REPUBLIC OF KENYA

NACOSTI

National Commission for Science, Technology and Innovation

RESEARCH CLEARANCE PERMIT

Serial No.A 15914

CONDITIONS: see back page

THIS IS TO CERTIFY THAT:
MR. ALBERT NYAGWANSA NYARUMBA
of UNIVERSITY OF NAIROBI, 2703-40200
kisii,has been permitted to conduct
research in *Nyamira County*

on the topic: *INFLUENCE OF STRENGTENING MATHEMATICS AND SCIENCE EDUCATION INSET ON SCIENCE PERFOMANCE IN RIGOMA DIVISION OF NYAMIRA COUNTY ,KENYA*

for the period ending:
21st September,2018

Permit No : NACOSTI/P/17/31243/19263
Date Of Issue : 22nd September,2017
Fee Recieved :Ksh 1000

....
Applicant's Signature

....
Director General
National Commission for Science, Technology & Innovation

88

APPENDIX VI: RESEARCH AUTHORIZATION

NATIONAL COMMISSION FOR SCIENCE, TECHNOLOGY AND INNOVATION

Telephone: 020 400 7000,
0713 788787,0735404245
Fax: +254-20-318245,318249
Email: dg@nacosti.go.ke
Website: www.nacosti.go.ke
When replying please quote

NACOSTI, Upper Kabete
Off Waiyaki Way
P.O. Box 30623-00100
NAIROBI-KENYA

Ref: No. **NACOSTI/P/17/31243/19263**

Date: **22nd September,2017**

Albert Nyagwansa Nyarumba
University of Nairobi
P.O. Box 30197-00100
NAIROBI.

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on *"Influence of strengthening mathematics and science education inset on science performance in Rigoma Division of Nyamira County ,Kenya"* I am pleased to inform you that you have been authorized to undertake research in **Nyamira County** for the period ending **21st September, 2018.**

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

Kindly note that, as an applicant who has been licensed under the Science, Technology and Innovation Act, 2013 to conduct research in Kenya, you shall deposit **a copy** of the final research report to the Commission within **one year** of completion. The soft copy of the same should be submitted through the Online Research Information System.

GODFREY P. KALERWA MSc., MBA, MKIM
FOR: DIRECTOR-GENERAL/CEO

Copy to:

The County Commissioner
Nyamira County.

The County Director of Education
Nyamira County.

National Commission for Science, Technology and Innovation isISO9001:2008 Certified