

**ASSESSMENT OF ACTIVITY STUDENT EXPERIMENT IMPROVISATION (ASEI)  
/PLAN DO SEE IMPROVE (PDSI) INSTRUCTIONAL APPROACH EFFICACY IN  
TEACHING AND LEARNING OF SCIENCES IN PUBLIC PRIMARY SCHOOLS IN  
BARINGO CENTRAL SUB COUNTY**

**BY**

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**A RESEARCH THESIS SUBMITTED TO THE SCHOOL OF EDUCATION,  
IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE  
DEGREE OF MASTER OF PHILOSOPHY IN EARLY  
CHILDHOOD AND PRIMARY EDUCATION  
MOI UNIVERSITY, KENYA**

**NOVEMBER, 2017**

## DECLARATION

### DECLARATION BY THE CANDIDATE

This research thesis is my original work and has not been presented for examination in any university. No part of this work may be reproduced without prior permission of the author and/or Moi University.

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This research thesis has been submitted for examination with our approval as the University supervisors.

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## **DEDICATION**

This work is dedicated to my wife Irene Koech, and my children Kibet, Emmanuel and Kemboi for their emotional support and cooperation you gave it to me all throughout my studies

## ABSTRACT

Efforts to realize quality education in all levels of education has been marred by poor performance in Mathematics and Sciences especially at primary school level. The performance of science in primary school has been very poor as indicated by their results in K.C.P.E examinations. This has caused a major concern to the parents, government and educators in the country. As a result this study sought to assess Activity Student Experiment Improvisation / Plan Do See Improve instructional approach in teaching and learning of science in public primary schools. The research was based on Constructivist theory of learning. The study was guided by the following objectives: to establish the extent to which ASEI/PDSI approach is used in teaching and learning of science; to establish the level of competence among science teachers in using ASEI/ PDSI approach in teaching science; to establish the influence of ASEI/PDSI towards teacher attitudes in teaching science; to establish the pupils attitude towards learning of science using ASEI/PDSI approach and to establish challenges faced by the teachers and pupils while using ASEI/PDSI approach. The study design adopted in this study was descriptive survey design. The study population included all the public primary schools in Baringo Central Sub County; Simple random sampling was used to select the respondents in respective schools. The sample included: 34 head teachers, 68 science teachers and 266 standard seven pupils- making a total sample size of 368 respondents. Questionnaires and interview schedule were used to collect data, in establishing reliability and validity of the research the questionnaire was piloted to ascertain its validity and reliability. The researcher presented questionnaires to school in the neighbouring County. The data was analysed using descriptive statistics through the use of SPSS and summarized into percentages, and frequency distributions. The information was represented through tabulation and graphs. The study found out that, teachers' use of the ASEI-PDSI approach in their lessons is inadequate. The study concludes that the teachers were facing many challenges in implementations of ASEI-PDSI approach which lowers the effectiveness of the approach. The study therefore recommends that follow-up efforts should be made to further improve teachers understanding in using the ASEI-PDSI approach which could take various forms, from school-level professional development activities to future nationwide in-service refresher training. The findings of this study were of good benchmarking for the Ministry of Education and SMASE administrative team, education policy makers, teachers, students and other stake-holders in Education on the way forward in improving the teaching and learning of Science.

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**LIST OF ABBREVIATION**

<b>ALE</b>	Activity Learner Encouragement
<b>ASEI</b>	Activity Student Experiment Improvisation
<b>CEMASTE</b>	Center for Mathematics Science and Technology Education in Africa
<b>CPD</b>	Continuous Professional Development.
<b>DEB</b>	County Education Board
<b>DQUASO</b>	County Quality Assurance and Standards Officers
<b>EFA</b>	Education For All
<b>INSET</b>	In-service Education Training
<b>JICA</b>	Japan International Cooperation Agency
<b>KIE</b>	Kenya Institute of Education
<b>KICD</b>	Kenya Institute of Curriculum Development
<b>KNEC</b>	Kenya National Examination Council
<b>MAT</b>	Mathematics Achievement Test
<b>MOEST</b>	Ministry of Education Science and Technology
<b>PDSI</b>	Plan Do See Improve
<b>PRESET</b>	Pre-service Education and Training
<b>PTTC</b>	Primary Teacher Training Colleges

<b>QUASO</b>	Quality Assurance Standard Office
<b>SEED</b>	South Easter Education Division
<b>SESEMAT</b>	Secondary School Science and Mathematics teachers
<b>SET</b>	Science, Engineering and Technology
<b>SMASE</b>	Strengthening of Mathematics and Science Education
<b>SMASSE</b>	Strengthening of Mathematics and Science of Secondary Education
<b>SMASTE</b>	School Mathematics Science and Technology
<b>SPSS</b>	Statistical Package for Social Sciences
<b>SSA</b>	Sub-Saharan Africa
<b>TIMSS</b>	Trends in International Mathematics and Science Study
<b>UNESCO</b>	United Nations, Scientific and Cultural Organization
<b>WECSA</b>	Western Eastern Southern countries of Africa
<b>NCST</b>	National commission of Science and Technology

## **CHAPTER ONE**

### **INTRODUCTION TO THE STUDY**

#### **1.0 Introduction**

This chapter outlines the background to the study, statement of the problem, objectives of the study, research questions, and justification of this study, significance of the study, scope of the study, limitations of the study, study assumptions, theoretical framework, and conceptual framework, definitions of operational terms and summary of the chapter.

#### **1.1 Background of the Study**

As it is widely acknowledged that science education contributes to laying the foundation for scientific human resources, many African countries have endeavored to strengthen science education, in particular, by shifting the focus of education on from basic education to post-basic education (Takemura, 2008). However, the experience of high-performing economies in Asia suggests that providing quality science education at the primary education level is even more important because science education at that level can effectively foster core skills such as scientific thinking skills and problem solving skills, referred to as scientific literacy for ordinary citizens. The Kenya government in its vision 2030 has highlighted education as one of the pillars, which will be used to propel Kenyan into industrialized country by 2030. Therefore, the need for Strengthening of Mathematics and Sciences in Education (SMASE) for young Kenyans in mathematics and sciences become necessary. While its relevance, ownership and sustainability has been established (JICA, 2007), there is

need to statistically assess the overall goal. SMASSE was initially set up to improve science education in secondary schools. However, it was introduced to primary schools in the year 2009 in order to improve the performance of primary school pupils in learning sciences.

However the KCPE performance of Baringo Central Sub County in comparison to other sub counties in Baringo County as shown in table 1.1 reveals otherwise.

**Table 1.1 Performances in KCPE Science in Baringo County Districts**

<b>Sub Districts</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
Eldama Ravine County	61.62	59.40	64.56	61.92
Mogotio County	61.40	60.47	63.89	62.91
Baringo Central Sub County	59.64	56.63	60.75	58.50
Kabartonjo County	59.78	61.79	61.43	59.71
Marigat County	59.85	60.79	60.79	60.00

Source: County Education Office Baringo Central District, (2015)

The core principle of SMASE INSET is the ASEI-PDSI pedagogical paradigm. The ASEI principle (Activities Student Experimental Improvising) involves providing meaningful teaching Activities focused on Student learning mainly Experimental/practical work and Improvising resources where necessary. PDSI (Planning Doing Seeing Improving) approach embraces orderly steps of executing learning activity by first Planning for the activity, then Doing it while seeing, observing with intent to evaluate and then finally improving on the process. This is the conceptual foundation of the SMASE program, it suggest that it has had a positive effect on the achievement of students in Science and Mathematics.

The responses to poor performance in Mathematics and Science before the introduction of Strengthening of Mathematics and Science in Secondary Education (SMASSE) overwhelmingly focused on teacher related factors such as employing qualified teachers, increasing salaries, providing equipment and constructing laboratories and mathematics classrooms. While increasing the convenience of the working environment for teachers is a step in the right direction, it does not address another factor in learning that may be just as significant as the teachers, namely, the role of students in the learning process. It was in order to include both students and teacher in the improvement of performance in sciences and mathematics that the SMASSE-INSET program was established.

According to the National Development Policy (Republic of Kenya, 2007), Kenya is aiming to be an industrialized country by 2030. The poor performance in mathematics and science was a matter of concern as industrialization relies heavily on the two subjects (Kibe et al., 2008). Fortunately, there was already an intervention in place to deal with the problem. As early as 2008, the government of Kenya, through the Ministry of Education (MOE) and the Government of Japan (GOJ), through Japan International Cooperation Agency (JICA), started an in-service education and training known as Strengthening of Mathematics and Science in Secondary Education (SMASSE) project for teachers. The pilot project in 2008 was conducted in 9 out of the (then) 72 districts in the country, namely Murang'a and Maragwa in Central Province, Kisii and Gucha in Nyanza, Butere-Mumias, Kakamega and Lugari in Western, Kajiado in Rift Valley, and Makueni in Eastern. SMASSE aimed at upgrading the capability of youth in Mathematics through in-service education of teachers in response to poor performance and achievement.



The pilot project was a success, and it was followed by two conferences in Nairobi in 2000 and 2001 (Kibe, et al., 2008) which culminated in the formation of SMASSE - Western, Eastern, Central and Southern Africa Countries Association (WECSA). Expansion of this project saw the formation of Centre for Mathematics, Science and Technology in Africa (CEMASTEA) with its headquarters in Nairobi. SMASSE personnel also collaborate with the Association for Development of Education in Africa (ADEA) as a working group for mathematics and science education and play a role in capacity building networks, analytical work, information dissemination and advocacy (Inyega, 2002).

At the local level, SMASSE INSET was made available and compulsory to all serving Mathematics and Science teachers in Kenya in 2004 at the County level. The SMASSE-INSET program was to be implemented through the principle of ASEI-PDSI, which stands for Activity, Student, Experiment and Improvisation (ASEI) and Plan Do See Improve (PDSI). SMASSE INSET has assisted the countries in which it has been implemented in adopting the learner-centered teaching and learning method of ASEI-PDSI which is a continuous reflection process, which allows a teacher to improve the particular lesson, the subsequent lessons, and lesson delivery skills in general (CEMASTEA, 2005). By adopting this teaching and learning approach, SMASSE has transformed teacher-centred teaching and learning methods into learner-centred ones.

## 1.2 Statement of the Problem

The Kenyan government goal for being a middle level industrialized country under vision 2030 is based on science technology and innovation hence there is need for capacity development. The performance of science in Baringo Central primary schools as shown in table 1.1 has been very poor as indicated by their results in K.C.P.E examinations causing a major concern to the parents, government and educators (KNEC, 2015). This poor performance of science in primary schools is a major blow to education system since it replicates in both secondary and tertiary institution as a result of weak foundation of the pupils in science subject. According to baseline survey by PTTC principals and tutors (2006, 2008 and 2009), it was found that the attitude of primary school learners in learning of science was wanting. The teachers were also using inappropriate methods including lecture method, other teacher centred approaches for teaching and over reliance on textbooks and revision papers. For some teachers, mastery of the content was inadequate and needed upgrading and yet there were very few in-service programmes where the teachers could meet and interrogate issues (Ministry of Education, Science and Technology, 2005).

Baringo Central Sub-County primary schools are rated among the low K.C.P.E performers in Science in Baringo County despite SMASE INSET project that was conceived as an intervention measure to upgrade the capability of primary school pupils in Mathematics and Science. This is evidenced by the K.C.P.E performance in science in the mean grades of 2011, 2012, 2013, 2014 of Baringo County (Table 1.1). The low performance in Science in Baringo Central Sub County prompted the

researcher to assess the SMASE innovation ASEI-PDSI instructional approach which was intended to upgrade the capability of pupils in Science. It was expected that after SMASE INSET, teachers would acquire knowledge and skills that would translate into quality teaching approach, changing pupils' attitudes and -improving performance in Science.

### **1.3 The Purpose of the Study**

The purpose of this study was to assess ASEI-PDSI instructional approach in teaching and learning of science in public primary schools in Baringo Central District.

### **1.4 Objective of the Study**

The main objective of this study is to determine the influence of SMASE inset on teaching and learning of sciences using ASEI/PDSI approach in public primary schools in Baringo Central Sub County. The following specific objectives guided this study:

- i. To investigate the extent to which ASEI/PDSI approach is used in teaching and learning of Science.
- ii. To establish the level of competence among science teachers in using ASEI/ PDSI approach in teaching Science.
- iii. To find out the influence of ASEI/PDSI towards teacher attitudes in teaching Science
- iv. To determine the pupils attitude towards learning of Science using ASEI/PDSI approach.

- v. To establish challenges faced by the teachers and pupils while using ASEI/PDSI approach.

### **1.5 Research Questions**

To address the above objectives, the study was guided by the following research questions:

- i. To what extent do teachers use ASEI/ PDSI approach in teaching and learning of science?
- ii. What level of competence do science teachers have in using ASEI/ PDSI approach in teaching science?
- iii. How has the approach influence the teacher's attitude in teaching science?
- iv. To what extent has the approach influenced the pupil's attitude towards learning science?
- v. What challenges do teachers and pupils face while using ASEI/PDSI approach?

### **1.6 Justification of the Study**

Two factors contributed towards the motivation of this study. Firstly, there are few published research studies on the teaching and learning of sciences using ASEI/PDSI approach in primary schools in Baringo Central Sub County of Rift Valley Province. Secondly, the topic offers learners scientific reasoning and strategies to investigate and solve problems they encounter in everyday contexts.

This study is justified because Kenya's vision of becoming industrialized by 2030 will among other factors depend on the cadre of scientists and technologists who can be involved in the selection and adaptation of important technologies. The Ministry of Education is aiming at nurturing cadre of scientists and technologists through SMASE

whose main goal is to improve the capability of young Kenyans in Science and Mathematics. SMASE like any other education advancement has had to go through various stages to ensure it succeeds. This study therefore will provide data needed for evaluation of SMASE inset and subsequent improvement to meet the dynamic changes on the curriculum to enable the students perform well in National examinations. This study therefore sought to assess the use of ASEI/PDSI approach in teaching and learning of sciences in public primary schools in Baringo Central Sub County.

### **1.7 Significance of the Study**

The objective of Science in Primary School is to advance knowledge and skills in scientific inquiry and problem solving. Using SMASE INSET, this study sought to investigate the development and evaluation of activities that enable learners to predict, interpret and explain their observations. The learners will be able to manipulate equipment making decisions using critical and creative thinking. Learners will be encouraged to use science equipment effectively showing responsibility towards the environment and the well-being of other learners by being resourceful and collaborative. The developed activities could have implications for the effective preparation and continuous support of teachers. Substantial information on the SMASE INSET is provided in the instructional manual to improve on the teacher effectiveness by increasing teacher content knowledge and suggesting an alternative teaching method.

The findings of this study will be of good benchmarking for the Ministry of Education and SMASE administrative team, education policy makers, teachers, students and

other stake-holders in Education on the way forward in improving the teaching and learning of Science. Professional development programs for Mathematics and Science teachers will be equipped with appropriate teaching skills which will enable them to handle the subjects appropriately. Furthermore, the findings of this study will be important to researchers who may be interested to carry out further research in the same field.

## **1.8 Scope and Limitations of the Study**

### **1.8.1 Scope of the Study**

Geographically, the study was carried out in Baringo Central sub County whci is located in the Rift Valley part of Kenya, and conducted within public primary schools. The study focused on 114 primary schools in the region. The boundary of the study was ASEI/PDSI approach in teaching of Science. Objectives covered included; establishing the extent to which ASEI/PDSI approach is used in teaching and learning of Science, establishing the level of competence among science teachers in using ASEI/ PDSI approach in teaching Science, establishing the influence of ASEI/PDSI towards teacher attitudes in teaching Science, establishing the pupils attitude towards learning of Science using ASEI/PDSI approach and establishing challenges faced by the teachers and pupils while using ASEI/PDSI approach. The study took place between May 2015 and December 2015.

### **1.8.2 Limitations of the Study**

The researcher experienced the following challenges during data collection:

**Accessibility to schools** - Most of the sampled schools in almost all the zones except Kabarnet zone are located in none motor-able areas. Accessing these schools was

therefore difficult and made the researcher use motorcycles to reach the schools hence taking longer than anticipated.

**Teacher Absenteeism** - Teacher absenteeism including head teachers was a major problem experienced cutting across most schools in the districts. Due to absences on the part of the head teachers, the researcher was received by the Deputy Head teacher or the senior teacher and standing on their behalf to be interviewed.

**Pupil Participation** - There were number of instances where a number of selected pupils failed to fill the questionnaire hence less questionnaires being filled than expected.

### **1.9 Assumptions of the Study**

The study assumed the following to be true with regard to the area under consideration

- i. The respondents read and understood the questionnaire.
- ii. The records obtained from primary schools were relevant and updated.
- iii. The science teachers answered all questions honestly and to the best of their abilities since science teachers in all the schools selected for the study had fully implemented the skills acquired during SMASE INSET in teaching approaches and methodology

### **1.10 Theoretical Frame Work**

The theoretical framework for this study was derived from Constructivism theory of learning. Constructivism is a theory of knowledge that argues that humans generate knowledge and meaning from an interaction between their experiences and their

ideas. According to Lamanuskas, (2010). Constructivism essentially states that students learn best through building or constructing their own knowledge through practical activities. As a philosophy of learning, constructivism can be traced to the eighteenth century as seen in the work of the philosopher Giambattista Vico who maintained that human can understand only what they have themselves constructed (Von Glasersfield, 1995). However the formalization of the theory of constructivism is generally attributed to Jean Piaget and John Dewey. John Dewey believed that education depended on action. He contended that knowledge and ideas only emerged from a situation in which learners had to draw them out of experiences that make meaning. On the other Jean Piaget articulated mechanisms by which knowledge is internalized by learners. Piaget's theory of constructivist learning has had wide ranging impact on learning theories and teaching methods in education and is an underlying theme of many education reform movements (Airasian & Russel, 2008).

In this approach, instructors have to adapt to the role of facilitators and not teachers. Whereas a teacher gives a didactic lecture that covers the subject matter, a facilitator helps the learner to get to his or her own understanding of the content. The emphasis thus turns away from the instructor and the content, and towards the learner (Gamoran, et, al, 2008). This dramatic change of role implies that a facilitator needs to display a totally different set of skills than a teacher (Brownstein, 2001).

A teacher tells, a facilitator asks; a teacher lectures from the front, a facilitator supports from the back; a teacher gives answers according to a set curriculum, a facilitator provides guidelines and creates the environment for the learner to arrive at his or her own conclusions; a teacher mostly gives a monologue, a facilitator is in continuous dialogue with the learners Smith, (2008). Contrary to criticisms by some



(conservative/traditional) educators, constructivism does not dismiss the active role of a teacher or the value of expert knowledge. Constructivism modifies that role, so that teachers help pupils to construct knowledge, rather than to reproduce a series of facts. The constructivism classroom is as equally concerned with the process of learning as it is with the product of learning. To provide feedback teachers must constantly assess learning and behaviors of the students. Such practices help pupils by allowing for the intervention or enrichment to enhance learning as it is happening (Airasian & Russel, 2008).

Nevertheless, it still presupposes that the role of the learner is primarily to assimilate whatever the teacher presents. Constructivism particularly in its "social" forms suggests that the learner is much more actively involved in a joint enterprise with the teacher of creating ("constructing") new meanings. Furthermore, it is argued that the responsibility of learning should reside increasingly with the learner (Glaserfeld, 2009). Von Glaserfeld, (2009) emphasized that learners construct their own understanding and that they do not simply mirror and reflect what they read. Learners look for meaning and will try to find regularity and order in the events of the world even in the absence of full or complete information. Research support for constructivist teaching techniques has been mixed, with some research supporting these techniques and other research contradicting those results. Dođru & Kalender, (2007) compared science classrooms using traditional teacher-centered approaches to those using student-centered, constructivist methods. In their initial test of pupil performance immediately following the lessons, they found no significant difference between traditional and constructivist methods. However, in the follow-up assessment 15 days later, students who learned through constructivist methods showed better

retention of knowledge than those who learned through traditional methods. Several educators have also questioned the effectiveness of this approach toward instructional design, especially as it applies to the development of instruction for novices (Mayer, 2004; Kirschner et al, 2006). While some constructivists argue that "learning by doing" enhances learning, critics of this instructional strategy argue that little empirical evidence exists to support this statement given novice learners (Mayer, 2004; Kirschner, et al, 2006). Indeed, Mayer (2004) reviewed the literature and found that fifty years of empirical data do not support using the constructivist teaching technique of pure discovery; in those situations requiring discovery, he argues for the use of guided discovery instead. Mayer, (2004) argues that not all teaching techniques based on constructivism are efficient or effective for all learners, suggesting many educators misapply constructivism to use teaching techniques that require learners to be behaviorally active. He describes this inappropriate use of constructivism as the "constructivist teaching fallacy". "I refer to this interpretation as the constructivist teaching fallacy because it equates active learning with active teaching." (Mayer, 2004, p. 15).

Instead Mayer proposes learners should be "cognitively active" during learning and that instructors use "guided practice." Scholars and educators have grappled with tensions between teacher directed instruction and student-centred constructivist approaches, each offering evidence for its effectiveness in achieving some scientific outcome for instance improvement in teacher facilitation of classroom discussion, development of classroom scientific norms, student learning of particular topics. Black, (2007) cites three models of pupil: (1) inquiry and problem based learning where students have control over their learning; (2) authentic curriculum where

learning is connected to pupils' interest and needs using rich and authentic tasks; and (3) constructivism where teachers tailor their instruction students learning needs. Studies focused on improving science teaching and learning often adopt a constructivist perspective of pupil learning approaches.

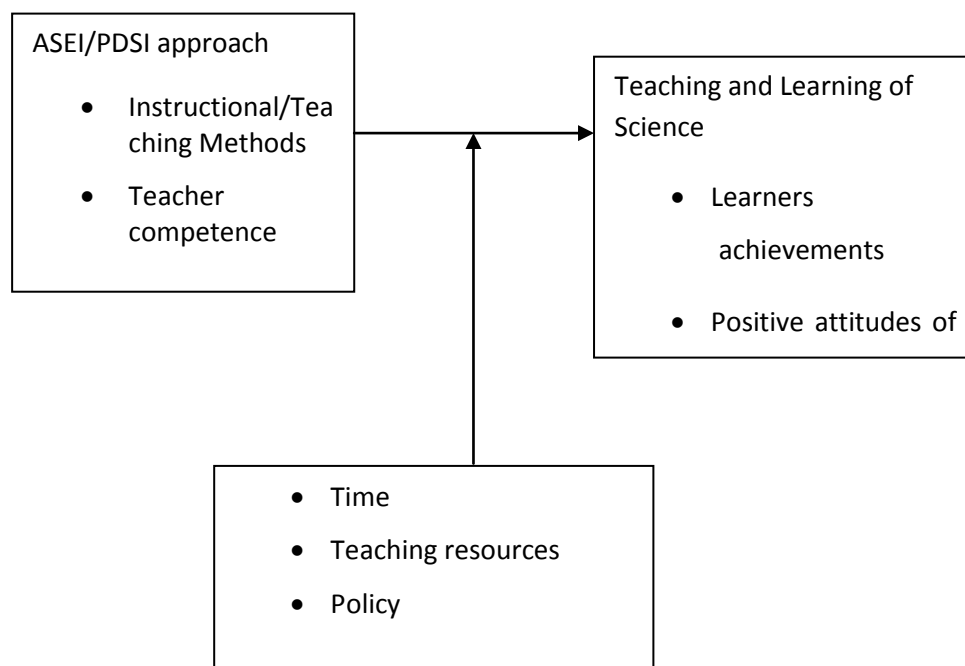
This study assesses the ASEI/PDSI instructional approach in teaching and learning science in public primary schools in Baringo Central Sub County. In this approach teaching is for the pupils and the emphasis on teaching for understanding by actively engaging in the construction of knowledge. The strength of ASEI/PDSI lies in the recognition that meaningful learning only takes place in an environment in which pupils are actively engaged in focused and sequenced activities for acquisition of knowledge. Through improvisation the teacher is able to demystify conventional experiments by scaling down experiment thereby relating Science to real life situation. In these lessons a bridge is created to enable learners to relate and integrate practical activities with theoretical knowledge. Teachers facilitate, encourage, and coach but do not explicitly instruct by showing and explaining how things work.

The study adopted Blacks' (2007) third student model of constructivism where teachers tailor their instruction to the students learning needs. Studies focused on improving Science teaching and learning often adopt a constructivist perspective of student learning approaches. Constructivism theory enhanced the analysis of this study as it emphasizes the importance of learner being actively involved in the learning process, unlike previous educational viewpoints where the responsibility rested in with the instructor as the learner played a passive, receptive role.

## 1.11 Conceptual Framework

### Independent Variables

### Dependent Variables



### Intervening Variables

**Figure 1.1: An assessment of ASEI/PDSI approach in teaching and learning of sciences**

SMASE project aimed at improving the quality of the teacher in teaching methodology such as application of ASEI-PDSI approach. The ASEI-PDSI approach advocates for activities, student centred, experiment, improvisation, planning and improving on executed lesson plans to enhance content delivery. The attitudes of the science teachers towards the ASEI/PDSI play an instrumental role towards content delivery, teaching methodology and practical approaches which influence pupil performance. From the figure 1.1 the independent variable is ASEI/PDSI approach embedded with teacher competence whereas the dependent variable is teaching and learning of science with attitude of teachers and students embedded. The intervening variables included time, pressure to cover the syllabus and education policy.

### 1.12 Operational Definitions of Key Terms

The following concepts are defined to convey the sense in which they were used in this study:

**Activity:** Implies meaningful and constructive participation of the learner in learning situations by way of activities.

**Actualization:** A teacher preparing for a lesson and doing the actual teaching in the classroom as others in the group observe and note areas that need improvement

**Actualization Centres:** Schools where aspects SMASE training for example, ASEI and PDSI were put into practice.

**Assessment:** the act of making a judgement on the use of ASEI/PDSI approach in teaching and learning of sciences

**Attitudes:** Away of feeling or thinking about someone or something, especially as this influences ones behaviour.

**Curriculum:** This refers to the plan for learning which focuses on rationale, aims, objectives and content, striving to enable all learners to reach their maximum learning potential by setting the learning outcomes to be achieved by the end of the educational process.

**Effective Teaching:** Teachers' ability to teach in a way in which learning is viewed as a meaningful and significant to teachers' ability on teaching Science.

**Feedback:** Information provided to instructor by their performance and recommendation for future improvement

- Implementation:** Process of putting into practice an idea, program or set of activities new to people attempting to bring change.
- Improvisation:** Refers to the use of locally available resources and materials for teaching and learning.
- Intervening variable:** This is one that occurs between the independent variable and dependent variable. It is caused by the independent variable and itself a cause of the independent variable.
- In-service Training:** Planned courses and activities in which a serving teacher, headteacher, school inspector or educational administrator may participate for the purpose of improving his/her instructional or professional knowledge, interest or skills
- Participant Schools:** Other primary schools in the districts that had to send their teachers for SMASE training but were neither SMASE centre nor Actualization centres’.
- Performance:** The action or manner of carrying out an activity or piece of work. In this study performance will measure by pupil’s achievement in sciences and KCPE science mean score.
- Pre-service Training:** Training in a teachers’ college, where a student teacher is introduced to the knowledge and skills needed to do a professional job in teaching.
- Professional development:** The individual teacher is responsible for his/her lifelong career advancement and this includes those processes that improve the job-related knowledge, skills, or attitudes of school employees.

**Student centred approach-** refers to the education programme (ASEI/PDSI) approach which intends to address the distinct needs and interest in teaching/learning of science.

**Teaching approach:** Teaching approaches refer to teaching strategies, ways of conducting instructional activities and techniques that are used by teachers to achieve their teaching objectives.

**Training:** Processes of providing employees with specific knowledge and skills, to enable them perform specific work tasks.

**Competence:** Refers to the ability of the science teacher to teach learners effectively

### **1.13 Chapter Summary**

The study consisted of five chapters. Chapter 1, the introduction to the study, provided background information. Also included is the statement of the problem, the purpose of the study, and the research questions that guided the study, theoretical framework (constructivist's theory of learning), conceptual framework, and definition of operational terms

## CHAPTER TWO

### LITERATURE REVIEW

#### 2.0 Introduction

This literature review examines current and previous scholarly work on SMASSE. It consists of analyses of books, journals, articles, conference proceedings, periodicals, government documents, scientific abstracts, legislative documents, textbooks, newsletters, theses and internet sources. The review is meant to exemplify the key concepts of the implementation of SMASSE, and to see whether the techniques used to teach science at secondary level can be used at primary school level. It provides the basis of critical review and a clearer understanding of the problem. The literature is presented thematically. The review is divided into different sub-sections under the following headings.

#### 2.1 Innovation in Teaching

Education is a light that shows the mankind the right direction to surge. The purpose of education is not just making a student literate but adds rationale thinking, knowledgeability and self-sufficiency. When there is a willingness to change, there is hope for progress in any field. Creativity can be developed and innovation benefits both students and teachers.

Education is thus the starting point of every human activity. A scholar (alim) is accorded great respect in the hadith. According to a hadith the ink of the pen of a scholar is more precious than the blood of a martyr. The reason being that martyr is engaged in defense work while an alim (scholar) builds individuals and nations along



positive lines. In this way he bestows a real life to the world. “Education is the manifestation of perfection already in man” – (Swami 2007)

Education is a light that shows the mankind the right direction to surge. If education fails to inculcate self-discipline and commitment to achieve in the minds of student, it is not their fault. We have to convert education into a sport and learning process has to generate interest in the students and motivate them to stay back in the institution than to run away from it. Education should become a fun and thrill to them rather than burden and boredom. It is an integral part of their growth and helps them become good citizens.

Education is an engine for the growth and progress of any society. It not only imparts knowledge, skills and inculcates values, but is also responsible for building human capital which breeds, drives and sets technological innovation and economic growth. In today’s era, information and knowledge stand out as very important and critical input for growth and survival. Rather than looking at education simply as a means of achieving social upliftment, the society must view education also as an engine of advancement in an information era propelled by its wheels of knowledge and research leading to development.

The profile of our learners has changed. They are digital natives weaned on video games and Web 2.0, and have been described as “marching through our schools, carrying a transformational change in their pockets in the form of powerful multimedia handheld devices” (Chen, 2010, pp. 213). Without the constraints of classroom relevance and test accountability, these digital technologies have changed the traditional pedagogical paradigm, bypassing the educator to reach the student

directly and revolutionize their learning experiences. While many educators today lament that these learners are impossible to engage, game designers are solving with enviable success the dilemma that educators still grapple with: getting students to master something that is time-consuming and challenging, and derive pleasure from it. Gee (2003) made the plea for educators to build schooling on better principles of learning, which currently comport poorly with the theories of learning in good video games. For a long time, school has been endured rather than experienced by students as “a series of exciting explorations of self and society” (Aronowitz, 2004).

More recently, Prensky (2010) asserts in *Teaching Digital Natives* that what today’s kids do have a short attention span for are “our old ways of learning”. Against such persistent portraits of student disaffection, it is time to reflect if our curricular and pedagogical approaches are congruent with the learning styles of this generation. Today pockets of innovation are sprouting up across the educational landscape, but many schools continue to keep at arm’s length the democratizing imperative of “giving voice” to the students, asserting instead a singular top-down authority in the classroom (McWilliam, 2008). The underlying assumptions and organization of the school into classrooms, hallways, and departments that were instituted so long ago also remain unchanged, and “the basic instructional approach of teachers talking to students as they sit passively in their seats” continues to be the main teaching strategy (Kelly et al, 2008, pp. 12).

This could be attributed to the educational policy in the United States, which continues to shape curriculum to reflect the realities of priorities: academic performance is taking center stage especially when many countries are clamoring to join international tests like TIMSS, PISA to benchmark their education systems with

the best in the world in their quest to create world-class education systems – based on test scores.

In the pre-technology education context, the teacher is the sender or the source, the educational material is the information or message, and the student is the receiver of the information. In terms of the delivery medium, the educator can deliver the message via the “chalk-and- talk” method and overhead projector (OHP) transparencies. This directed instruction model has its foundations embedded in the behavioral learning perspective and it is a popular technique, which has been used for decades as an educational strategy in all institutions of learning. Basically, the teacher controls the instructional process, the content is delivered to the entire class and the teacher tends to emphasize factual knowledge.

In other words, the teacher delivers the lecture content and the students listen to the lecture. Thus, the learning mode tends to be passive and the learners play little part in their learning process (Orlich et al.,2008). It has been found in most universities by many teachers and students that the conventional lecture approach in classroom is of limited effectiveness in both teaching and learning. In such a lecture students assume a purely passive role and their concentration fades off after 15-20 minutes.

Multimedia, is the combination of various digital media types such as text, images, audio and video, into an integrated multi-sensory interactive application or presentation to convey information to an audience. Traditional educational approaches have resulted in a mismatch between what is taught to the students and what the industry needs. As such, many institutions are moving towards problem- based

learning as a solution to producing graduates who are creative; think critically and analytically, to solve problems.

Currently, many institutions are moving towards problem-based learning as a solution to producing graduates who are creative and can think critically, analytically, and solve problems. Since knowledge is no longer an end but a means to creating better problem solvers and encourage lifelong learning. Problem-based learning is becoming increasingly popular in educational institutions as a tool to address the inadequacies of traditional teaching. Since these traditional approaches do not encourage students to question what they have learnt or to associate with previously acquired knowledge (Teo & Wong, 2000), problem-based learning is seen as an innovative measure to encourage students to learn how to learn via real-life problems (Boud & Feletti, 2009).

The teacher uses multimedia to modify the contents of the material. It will help the teacher to represent in a more meaningful way, using different media elements. These media elements can be converted into digital form, modified and customized for the final presentation. By incorporating digital media elements into the project, the students are able to learn better since they use multiple sensory modalities, which would make them more motivated to pay more attention to the information presented and retain the information better.

## **2.2 Effect of SMASE on Performance in Sciences**

The Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) has been implemented in secondary schools in Kenya, and it has been shown that it has beneficial effects on students' performance in science subjects. However, it would

be preferable for a similar program to be introduced at primary school level, to facilitate a smoother transition to secondary school science. Therefore this section examines the effect of SMASSE by comparing performance of students before and after its implementation.

In order to evaluate the effect of SMASSE, a program known as SPIAS (SMASSE Project Impact Assessment Survey) has been conducted every year since 2004. The SPIAS questionnaire is given to students, teachers and principals, and the individual data was compared with the socio-economic regional data, in order to assess whether the socio-economic background of students has an effect on their performance pre and post SMASSE. Statistical analysis of this data has been done and recommendations made for future operation of the project (SMASSE Project, 2008).

According to the report (SMASSE Project, 2008), the hypothesis that INSET (In-Service Training) under SMASSE will enhance students' performance through the consequent processes of teachers' attitude change followed by students' attitude change has been tested and proved as promising. However, the findings suggest that INSET under SMASSE will have to be continued and harmonized to achieve the ultimate goal of improving student performance in the sciences. Although the benefits of SMASSE are evident, it is suggested that it be expanded to include a similar program to be implemented at primary school level (preferably under the more general title SMASE, for Strengthening of Mathematics and Science in Education). Such a program in primary school is likely to have a multiplier effect on performance of sciences at secondary and tertiary levels, as students will apply the skills and techniques learned in primary school to science lessons in secondary school, which should result in an even greater effect on performance.

The first major finding in the SMASSE Project (2008) was that the “capability” of students, measured by SPIAS tests score, was improved by implementation of SMASSE/INSET. Especially, remarkable improvement was detected in mathematics and biology. The second major finding was that students’ capacity, measured by test scores, would be improved by “students’ attitude to the subject”, rather than by their direct efforts to master the subject contents. This indicates that the role of teachers is crucial in the implementation of SMASE. The attitudes and techniques used by teachers are expounded in detail in a subsequent section. They play a significant role in improving students’ own attitude towards sciences, which further enhances the goals of SMASE.

The third major finding is that the Science teacher/Principal’s encouragement affects the improvement of teachers’ teaching process. This means that improvement of performance under SMASE is the end of a continuum, in which better performance in sciences is subsequent to improvements in attitude of the students, which in turn is brought about by improvement in the teachers attitude, which is also affected by encouragement from Principals, adequate training, availability of teaching materials and resources, and support from peers, among others, which are discussed in further detail below.

Fourth, it is observed that while the quality of INSET has given the impetus for learning sciences, the effects of the program have been gradually realized as a result of the quantity of INSET (SMASSE Project, 2008). Therefore, both quantity and quality should be well considered in training plan and implementation. As SMASSE has been shown to work, the focus should now shift to scaling it up to meet the needs

of the nation. This includes extending it to primary schools as well, so that students entering secondary school will be able to apply its techniques at a more advanced stage, and thus generate multiplier effects that can be used to strengthen science teaching even further.

Fifth, although the overall impact has been observed, the impact on County schools was greater than that on provincial schools (SMASSE Project 2008). This might indicate that there is more room for improvement at provincial schools through teacher training. This may also be due to the multiple levels of training, with national trainers who train County trainers, who then train teachers at County level. Thus it is conceivable that the training is more intensive at certain levels. For these reasons, respective training suitable to respective subgroups (County schools and provincial schools) should be redesigned to maintain the effects of SMASSE. The relevance of SMASSE is therefore very high and so is its effectiveness and efficiency. Its impact with respect to the national achievement in mathematics and sciences is high because impact is felt in all public secondary schools in Kenya as reported in the SMASSE Project (2008). This positive result is attributed to the establishment of County INSET centres; support from DEB (County Education Boards) in financing County INSETS and the quality of both County and national training (JICA, 2007).

A crucial aspect of SMASSE is the training of teachers, as professional development occurs when teachers aim for continuous improvement in their professional skills and content knowledge. This may require teachers to attend further classes. A way around the time constraints faced by teachers is the use of In-Service Training (INSET). The SMASSE INSET has neatly addressed issues of time and teachers' workload by conducting training sessions during the school holidays. However, some teachers may

be reluctant to attend training at this time because they use private tuition during the holidays as a means to supplement their income.

Nevertheless, professional development is important because improving teacher knowledge and teaching skills raises learners' performance (Sparks & Hirsh, 2000). Thus SMASSE INSET should be beneficial to science teachers, even if they intend to use SMASSE techniques during private tuition. The attitudes of students towards science can only be improved by their teachers, thus teachers also need a positive attitude, and this can be ensured by ongoing professional development (Kriek, 2005). A subject-based professional development activity is more effective in empowering the teacher with the content knowledge and skills (Souls by and Swain, 2003). This requires specialization on the part of teachers, but due to the shortage of teachers in Kenya, resulting in a heavy workload; teachers are required to teach two or more subjects. Thus, maximum effectiveness in SMASSE INSET can be attained only if subject based in-service training is provided to single subject teachers. However, a study by MacBeath and Galton (2004) found that teachers were not given enough opportunities for subject-based professional development. Scientific discoveries are made yearly and textbooks are edited to include the new discoveries. Thus training and curriculum development should be continuous, although this will create problems for teacher trainers and examiners alike. Nevertheless, as the scientific world is dynamic; a teacher should always be researching and learning about new ideas and discoveries (King, 2002). Even if there is no formal teacher training, a teacher should be involved in personal studies in order to improve on skills and knowledge (Smith & Lovat, 2005) so as to attain ongoing personal, academic, occupational and professional growth (Killen, 2007).



Teachers who give themselves time to study and research could enhance their content knowledge and they might gain confidence which is essential in qualifying the teachers` competitiveness (Schmidt & Cogan, 2006). Unfortunately, it may not be advisable for a teacher to impart all such newly obtained knowledge to pupils/students. This is due to the constraints of the syllabus, and the fixed term times. As Kenya has an examination based system, both teachers and students are well aware of the topics that need to be learnt, and any knowledge outside the established syllabus is treated as irrelevant. Thus there needs to be a formal INSET that can establish what needs to be taught and what can be avoided. For a teacher to gain new knowledge, even in a formal INSET, the teacher must be open minded, creative and innovative, and must be able to explain scientific concepts in real-world situations, and to provide resources, guidance, and instruction to learners as they develop content knowledge and problem-solving skills” (Mayo et al., 2003).

Teacher professional development programs are necessary because enhanced learner performance correlates with teachers continued learning activities (Wiley and Yoon, 1995). Learners are more likely to be motivated to learn when they know that their teachers are making a similar effort. Furthermore, according to Mayer et al., (2001) effective teaching is achieved by quality professional development involvement by the teachers.

### **2.3 Effect of ASEI-PDSI on Teaching and Learning of Science**

ASEI-PDSI is a pedagogical paradigm. ASEI stands for Activities Student Experiment Improvise. Teaching under ASEI requires learners to focus on Activities in the classroom/laboratory which are to be conducted by the Student who, with

teacher supervision, is expected to carry out Experimental/practical work and should improvise resources by using locally available materials as substitutes in the event that the prescribed materials are not available for experiments. This last aspect of ASEI has been included as a way of overcoming the resource constraints facing science teaching in Africa. PDSI refers to Planning, Seeing, Doing and Improving. This approach embraces orderly steps of executing experiments by first Planning for the activity, then Doing it while Seeing, which is observing it with intent to evaluate and then to finally Improve upon the process.

One of the benefits of ASEI/PDSI is that it creates opportunities for learners to take responsibility for their own learning. This is important because the teacher-centered approach, which has been favoured by science teachers in the past, removes responsibility from the learner and places it on the teacher. This approach also favours rote learning, which most learners consider to be dull, and does not account for personality or aptitude differences between learners, forcing all learners to progress at the teachers' rate, which may only be possible for the fastest learners.

The inquiry-based approach in science is more useful, as opposed to recipe-type experiments, because it allows learners to exercise the freedom of their imaginations, making lessons more interesting. Furthermore, by encouraging improvisation, not only to augment conventional equipment, but also to arouse interest and curiosity among learners, the inquiry based approach ensures comprehensive understanding and long term retention of what has been learnt.

ASEI-PDSI also encourages teachers to draw content and examples from learners' real life experiences in order to capture their interest and imagination. This is because

many textbooks are written by foreign authors, who may use examples and illustrations that may not apply in the local context of the learner. Sometimes, even a book by a local author may contain examples that are not readily applicable to the learner in certain local contexts. Thus the teacher may have to interpret the content and present it in a way that makes sense to the learner.

ASEI-PDSI also fosters teachers' ability and appreciation for work planning. This is because, under a teacher-centred, rote-learning system, each lesson is essentially the same in format, even though different in substance. This is because learners are supposed to passively listen to the teacher. Under a learner centred approach, where learners learn by doing, there needs to be a schedule of activities for each lesson, procurement of equipment and materials, which necessitates detailed planning, and allows for evaluation of the teaching-learning process against lesson objectives and outcomes.

ASEI enables learners to develop an inquiring mind, to develop the skills of making accurate observations, drawing conclusions, and holding discussions to enhance learning and development of skills (SMASSE Project, 2002). This ensures that the learning process becomes a process of two way traffic between teacher and learner. In addition, an activity based approach provides opportunities for learners to ask questions, something that may be difficult in a teacher centred set up.

These benefits are confirmed by the assertion that meaningful learning only takes place in an environment in which students are actively involved in focused and sequenced activities for acquisition of knowledge and skills. Thus PDSI is a vehicle that carries the ASEI paradigm and involves planning where teachers are encouraged

to take time when planning to reflect on the most appropriate activities that will enhance effective learning using the available resources and improvisation where necessary (SMASSE project, 2001).

The epitome of ASEI-PDSI planning is provided by the teachers of Japan. This is hardly surprising, as the SMASSE initiative, including ASEI-PDSI, was introduced into Kenya by the Japanese (JICA, 2007). Japanese teachers do not merely set out to impart knowledge, but also to transform the preconceived ideas of learners, and to replace them with the correct approach. This is done through a Lesson Study, which is a form of professional development for teachers. Due to the goal of Japanese science teachers of communicating correct scientific concepts, there are certain skills that teachers need to enhance in order to successfully deliver subject content in an activity based classroom. Lesson Study provides teachers with opportunities to improve skills necessary for enhancing such communications during a lesson. Lesson Study provides the foundation of PDSI, with three steps: 'Plan', 'Do', and 'See'. A teacher, often in collaboration with peer teachers, prepares a lesson by conducting a study of instructional materials. The lesson is conducted in front of students in the actual classroom, which is observed by peer teachers. After the lesson, the teacher who has conducted the lesson and the peer teachers who have observed the lesson get together to discuss the lesson delivery regarding, for example, whether the way the teacher encouraged the students to express their opinions was effective, whether all the students understood the key question posed by the teacher, how the students reacted to the key question, how ideas of each student changed, and how effective the measures taken by the teacher were, etc. The advantage of such a peer review is that the teacher can benefit from the experience of other teachers, and minimize the time that he or

she would take learning the same techniques by trial and error. This makes the teaching more efficient, and contributes towards learners' appreciation of science and improves their performance.

Through the reflective discussions in Lesson Study, teachers can learn not only how to improve the particular lesson, but also general instructional skills and knowledge which can be applied to other lessons. It is instructive to note that the full benefits of ASEI-PDSI can only be realized if a teacher has received adequate training. Attempting to carry out a lesson study of a teacher who has not been trained in ASEI-PDSI could result in peer conflict, as nearly all of the teachers classroom practices would meet with the disapproval of the teachers ASEI-PDSI trained peers. This underlines the importance of in service training to the success of ASEI-PDSI and ultimately, of SMASE.

One aspect of lesson study that a Kenyan school could benefit from is that it takes place frequently in both primary and secondary schools. It is widely practiced in Japan, as more than 99% of the elementary schools (Grades 1-6) and 98% of the junior high schools (Grades 7-9) conduct Lesson Study at least once a year, and more than 82% of the elementary schools and 54% of the junior high schools conduct Lesson Study at least five times a year (Chichibu, 2010). It is necessary for each school to determine the frequency of its ASEI-PDSI lesson studies. If it is carried out too often, teachers may not take criticisms kindly. On the other hand, if lesson studies are not done often, each teacher will adopt a personalized teaching method, and there will not be enough opportunities for bad teaching practices to be corrected. Indeed, it has been noted that the tendency of teachers to persist with teacher-centred models of teaching is very strong. Therefore, in order to convince teachers to adopt more

learner-centred models, they should adopt a number of approaches, including making a transition from content-based to activity-based lessons, doing away with a lecture/theory-based model and replacing it with more practice/experience-based lessons, and (where necessary) making a shift from conventional materials to improvised materials. These perspectives are summarized as Activity, Students, Experiment and Improvisation (the first part of the ASEI-PDSI paradigm) and they are embraced in the INSET curriculum (Takemura, 2008, p. 269-274).

Activity calls for teachers to relinquish absolute control of the teaching-learning process, and to let learners play an active part in the process. As many teachers apply a lecture method in their lessons, science lessons under ASEI-PDSI should be activity-based. They should have practical activities that allow students to be engaged in, to think, and to construct knowledge/concepts. Activities do not only refer to practical manipulation of materials and equipment in experiments, but also include the involvement of learners in mental activities that form a link between practical activities and the concepts that under grid them. Such mental activities include predicting, developing strategies for solving a problem, identifying commonalities and/or differences, distinguishing evidence from opinions, identifying relationships between causes and effects, and explaining phenomena scientifically.

The Student aspect of ASEI-PDSI requires learners to construct knowledge by themselves with the guidance of teachers. Teachers should guide learners to arrive at conclusions. The process should be owned by students themselves. Hence, students must be at the centre of lessons. This does not mean that the teacher should leave learners to their own devices; on the contrary, it requires that the teacher sets the agenda for the lesson, and coordinates learners as the conduct the activities. At the

end of the experiments, the teacher summarizes and helps the learners to draw conclusions from what they have found.

Experiment is necessary in a science classroom because scientific knowledge is generated and/or discovered through experiments and observations. An experiment is one of the most effective tools for scientific inquiry. Thus the teacher should set teaching objectives in terms of the experiments that learners will have to do to understand the concepts being taught. This is particularly relevant in Kenya, where the emphasis (in an exam-focused system) is on accumulating as much theoretical knowledge as possible. Thus the poor performance in sciences could be attributed to practical examinations, for which many learners feel they are inadequately prepared. Through experiments and observations, hypotheses are tested to find scientific truths. Thus, science lessons should include experiments where necessary.

Improvisation is important in teaching science, particularly in contexts in which schools do not have the resources to provide fully stocked and equipped science laboratories. Thus improvisation is not recommended on an ad hoc basis, but only based on necessity. Even when conventional science apparatus and/or learning materials are not available, students can still carry out small scale experiments with improvised apparatus and materials that are developed from local materials collected in learners' immediate environment. Another reason is to raise interest and curiosity of students by using materials that are familiar to students. Such improvisation makes science more relevant to learners, as it brings the topic of study out of the abstract realm and into the day to day experience of learners, thus stimulating their interest in the subject.

## **2.4 Effect of SMASE on Teachers Attitudes and Practices**

Training and implementation of SMASE is expected to improve learner performance by increasing teacher interest and enthusiasm for the subject, and using this as a stepping stone to increase learners' own enthusiasm. For this reason, effective professional development for teachers must focus on content, be offered for a sustained duration, involve active learning opportunities for teachers and be coherent with other efforts (Heck et al., 2008). Indeed, the Kenya Education Sector Support Program (KESSP) recognizes the need for sustainable professional development within constrained resources, and outlines other policy measures regarding funding of various education initiatives (Ministry of Education, Science and Technology, 2005).

According to Even (1999), elements of personal development include credits, expectation to be part of leadership to improve mathematics education, desire for continuous learning and willingness to accept challenging leadership. However, the above should be accompanied by the realization that personal ambition alone is no substitute for the dedication necessary to improve learners' performance. Therefore, teachers seeking to adopt the SMASE approach should be willing to make considerable sacrifices to make its goals come true.

These include learning how to plan, conduct and evaluate change initiatives; working with teachers; and an understanding that change in school mathematics is a slow and complicated process. Moreover, the social development skills necessary in SMASE include teamwork, collegiality and collaborative work, learning to work with non-teaching professionals in the educational system, decision making, and assignment of roles and sharing of responsibilities.



A proven method of changing teaching practices is the Japanese lesson study referred to earlier. This is also referred to as lesson actualization or lesson demonstrations. Professional development requires that teachers share their experiences within authentic classroom practices, as reflective practitioners through peer mentoring, autonomy and networking (Krainer, 1999). This suggests alternatives to lesson study. As some teachers may feel it to be intrusive and/or disruptive, science teachers in a school can hold frequent tutorials, during which they assess and critique each other's teaching techniques. Teachers are then free to implement what they have learnt during these tutorials, and to check whether new techniques have any effect on learner performance.

The use of continuous assessment of students is also important in this regard. The SMASE process further requires complementary conception of theory and practice, where teachers use experience-based knowledge, research-based knowledge and theoretical knowledge acquired from literature to arrive at a comprehensive model of science teaching that can be applied in real world situations to enhance performance of science students (Even, 1999). Such an approach has been used in the Department of Mathematics Education in Hiroshima University, through weekly seminars that bring together graduate students, university researchers and practicing teachers to reflect on literature in mathematics education. A similar process, carried out on a smaller scale in schools, could benefit the SMASE process.

Ultimately, science teachers are human beings, and thus the human element must be considered in any program of improving science teaching. According to Albert Bandura's social cognitive theory, much of human learning occurs in a social

environment (Schunk, 2004). This explains why different teachers may have different perceptions on SMASE INSET. Science teachers have different personalities; schools differ in terms of type and category, styles of leadership, environment, and motivation and facility endowment. According to the theory, teachers will seek to control important events of their lives through self-regulation of their thoughts and actions, rejecting the preferences of others. Much of teachers' behaviour is motivated and regulated by internal standards and self-evaluative reactions to their own actions-after adopting ASEI-PDSI pedagogy.

Fairbanks et al. (2010) found that knowledge alone does not lead to the kind of thoughtful teaching everyone strives to maintain, which explains why teachers with similar knowledge levels adapt to new methods at different rates. The authors also found teachers with similar professional knowledge and qualifications had differences in their teaching practices. Thus they emphasized the need to move beyond knowledge in teacher education and to aim at preparing adaptive teachers. SMASSE INSET provides a basis for thoughtful planning for effective teaching of science and mathematics using ASEI-PDSI approach.

The learner centred model of teaching science is supported by the theory of constructivism, in which learners are not passive recipients of knowledge, but construct knowledge by linking new ideas and experiences with what they already know. New knowledge is generated through interactions with the physical and/or social environment (Liang, 2005). Thus learners take responsibility for their own acquisition of knowledge and skills, with the teacher as a guiding influence.

Findings in cognitive science justify the necessity of starting science education at an early age. Children are interested in their environment, and they are eager to understand daily phenomena in their own ways. They construct own 'theories' to make sense of what they see around their environment. Such explanations and 'theories' are called 'children's science' or 'children's scientific ideas' (NCCA 2011). Once these ideas are formed, children tend to keep the idea, which often hampers a proper understanding of scientific concepts. Thus, it is necessary for children to be guided by appropriate persons who can make children aware of these ideas and to have these ideas challenged and examined so that children are helped to modify their ideas to develop more scientific understandings. It should be done at the time when those pre-conceptions are formed (Harlen, 2007).

Thus, one problem that is unique to primary school teachers of science is that they often have to dispel erroneous notions that young children have developed about science. This is done through the conceptual change model, in which children bring 'views' with them to science lessons that are logical and coherent to them. These 'views' are formed through children's experiences even before they learn the concepts in the classroom. These 'views' are called 'children's science' or 'pre-instructional conceptions' (Duit 2003). Children's science or pre-instructional conceptions have a considerable influence on how and what children learn from their classroom experiences (Gilbert et al. 2002).

As young children have no previous science background, teachers have to debunk these subjective notions and replace them with sound scientific principles. In the conceptual change model, learners are allowed to develop scientific concepts by modifying pre- instructional conceptions. In order for conceptual change to occur,

first, learners need to be made aware of existing concepts they have, and then, learners must feel dissatisfaction with their existing concepts. Teachers should make sure that the new concepts they introduce must be intelligible, and that the new concepts must appear initially plausible, and that they should be fruitful, namely, a new concept can resolve the problems that the existing concepts cannot (Read, 2004). Such an approach would go a long way towards eliminating the initial confusion that learners face when they begin taking science lessons.

External supports are essential for conceptual change to occur. This is where teachers can play a critical role in science education, as they must be able to understand what pre-instructional conceptions that learners have and how these misconceptions hamper their understanding of scientific concepts to be taught. This requires a certain degree of empathy and knowledge of child psychology.

Teachers should also provide learners with concrete ideas which allow them to resolve the cognitive conflict. This can be done through experiment. Once children can see for themselves a practical demonstration of the concept being taught, they are more likely to accept it, compared to a mere description of the concept, which is likely to result in resistance from children as they will compare it with what they think they 'know.' Finally, teachers should provide learners with scientific frameworks that can allow them to modify the pre-instructional conceptions to scientific conceptions (Uchida, 2008). Therefore, science teachers must have sufficient science subject knowledge and instructional capacity that is based on cognitive science perspectives.

## **2.5 Effect of Students' Attitude on Achievement**

Although the role of the teacher is important in science instruction, there is little that a teacher can do without the enthusiasm of learners to learn the subject. In some cases, even where there are qualified teachers and adequate equipment and materials, students' achievement in the science subjects has not been necessarily high (Kibe, Odhiambo and Ogwel, 2008). The only factor that could account for such a scenario is the lack of motivation on the part of the learners, something which this section sets out to address.

The SMASSE INSET curriculum focuses on the attitude of teachers and the learners towards the subjects, pedagogy, teaching and learning materials and resources as well as mastery of content. The roles played by teachers and learners in science are interdependent and mutually reinforcing. Although the Working Group on Mathematics and Science Education (WGMSE) holds firmly that teachers are a greater asset in education for dynamic evolution (Ministry of Education, 2007; SMASSE, 2001) the importance of learners cannot be overlooked. This is because a negative attitude towards the subject is likely to hamper even the best efforts of the teacher. It is for this reason that teachers should have a positive attitude towards science, which will influence the learners, whose enthusiasm will be communicated back to the teacher, thus developing a positive spiral which will result in better performance.

Bruce and Beverly, (2002) evaluated several programs on student achievement through staff development and found out that making a difference in student achievement through school and staff improvement programs is hardly routine. This is because the factors which contribute towards student achievement vary from country to country, school to school, and even individual to individual. Further, the number of

reports and variety of highly successful programs suggest that technology exists for making rapid and significant change. However, this suggests that schools should invest in technology as the only way of improving performance. This undermines the importance of human factors in the teaching-learning process. Others include effective implementation of “Mastery Learning” programs (Block, 2008) and Teaching Skills in Mathematics (Good et al., 2003). Levin and Lezotte (2000) discussed the effects of helping schools study demonstrably effective schools. While this is a good idea, it has a major disadvantage, in that model schools tend to continue to do well, but their innovations and good practices rarely, if ever, spread to other schools (Calderon, 2004).

It has been shown that SMASSE has an effect on improving students’ attitude. The SMASSE Project (2002b) carried out a survey on students’ achievement and found that students taught by teachers who attended SMASSE performed better than those taught by teachers who had not undergone SMASSE training. Also, lessons implemented by teachers who had attended the SMASSE in-service education and training were of higher quality than those implemented by teachers who had not participated in the INSET. However, the study focused on the teachers contribution to student achievement, and did not address the importance of student attitudes. Hopefully, other researchers will address the effects of student attitude on achievement, as the majority of studies suggest that higher levels of student achievement are associated with more qualified and experienced teachers (Grayson, 2006).

The challenge in teaching science, according to By bee (2007) is that it is a practical subject and learners should use audio and visual aids as well as make observations

and come up with a scientific explanation. Learners will recall better what they see and do than what they hear (Gilbert et. al., 2003). Indeed, the majority of students would prefer to be engaged in some purposeful, mentally stimulating activity. The problem is that teachers who have not been trained in ASEI-PDSI may view a learner-centred classroom as a disciplinary challenge, and so they persist with the 'chalk and talk' approach. Although science is not all about problem solving skills and experiments but also explaining phenomena and relating them to learners' daily life experiences (Nui and Wahome, 2005). Learners have different levels of skills and experiences depending on where they come from, and so experiments are necessary to ensure that concepts are understood across the board.

A teacher encounters learners from diverse backgrounds who differ in levels of motivation, skills and knowledge. It is the responsibility of the teacher to guide these learners to acquire the necessary attitudes, skills, motivation and knowledge. By simply lecturing in class, a teacher is unlikely to change the attitude of a student towards the subject. However, if students are encouraged to take part in coordinated classroom activities, then they will develop enthusiasm for the subject which will be reflected in their performance. Also teachers have to recognize the differences between opinions of learners and scientific facts so as to guide them. Learners take control of the learning process by actively participating and discovering solutions to the problems with minimum assistance from the teacher. Learners take responsibility for their own learning (Blumberg, 2008).

A learner centred approach emphasizes a variety of different types of strategies that shifts the role of the educators from givers of information to facilitating student learning (Blumberg, 2004). Learner centred approach places the emphasis on the

person who is doing the learning (Weimer, 2002). The benefits of learner centred approach include increased motivation for learning and greater satisfaction with school leading to greater achievement (Maxwell, 2008). The teacher centred model contributes towards boredom and a feeling of detachment from the learning process, which may contribute towards a negative attitude towards the subject. There are a number of teaching approaches that are regarded as learner centred, which have been shown to have effects on student performance, such as ASEI-PDSI, which encourages teachers to improvise, through which they demystify conventional experiments by scaling them down, thereby relating physics to everyday situations (Nui and Wahome, 2005).

The Mastery Learning Approach (MLA) is a teaching method where learners are given opportunities to demonstrate mastery of content which they were taught (Kibler et al., 2001). The advantage of this approach, from a teachers point of view, is that it provides an opportunity for students to show whether they have actually learned anything. However, it might be time consuming, especially in a practical context, because it will require students to replicate experiments that they have previously conducted.

The enquiry-based approach has improved problem solving skills and has been effective at increasing student attitude toward physics (Arion et al., 2000). With this approach the role of the learner is active participation, asking probing questions and learning the concepts by hands-on approach (Luke, 2010). However, this approach sounds almost identical to the ASEI-PDSI approach under SMASE. The crucial difference is that in the enquiry approach, lecturing is minimal, and students are



expected to reach conclusions on their own. This may be appropriate for tertiary level science, but it is doubtful whether it would work in a primary school. Moreover, there are other reasons that support the importance of science education at the basic education level. For instance, students' positive attitudes towards science are clearly evident among children who love science. They can be candidates for future scientists and engineers. Nevertheless, science forms an important part of daily life for everyone, regardless of future profession. Thus, it is important that positive attitudes towards science should be formed at an early age.

Science has its own terminology and modes of thinking which are often referred to as the 'culture' of science. A student's attitude towards science may thus depend on whether the culture of science is similar to the culture of the student. In this explanation, when the culture of learners' life-world and the culture of science are compatible, or when learners can easily adapt themselves to the culture of science, it is not difficult for them to cross the border between the two cultures. However, when the life-world culture of the learners is incompatible with the culture of science, or when the learners cannot easily adapt themselves to the culture of science, they are likely to have difficulties in learning science because of the difficulty in crossing the cultural borders (Aikenhead et al., 1999).

## **2.6 Student and Teacher Centred Aspects of ASEI/PDSI**

There are aspects of ASEI-PDSI which are primarily the domain of teachers, while others are the responsibility of students. For instance, the primary focus of SMASSE INSET is on change of teachers' attitude towards mathematics and sciences, as well as increasing students' participation in mathematics and science classrooms, and

enhanced perception of the role of work-planning for effective classroom practices. The programme emphasizes the importance of teachers' mastery of content and ability to incorporate cross-cutting issues in education. These efforts are similar to the United States National Science Foundation's Projects on Local Systemic Change (Heck et al., 2008).

The in service training in SMASSE curriculum consists of four cycles of 10 days each covering the isolated topics: Cycle one targets attitude change where emphasis is laid on attaining a positive attitude towards mathematics and science education among the stakeholders, especially the teacher and the learner. Thus the teachers first have to be enthusiastic, in order to pass this on to students. Cycle two targets pedagogy: it provides opportunities to put into practice the principles of ASEI movement and PDSI approach. This is exclusively the domain of the teacher. Cycle three focuses on classroom implementation of activities focused on students' learning, mainly, experimental or practical work and improvisation of resources where necessary (ASEI-PDSI). Transforming the concept of ASEI from theory into practice is known as "Actualization of ASEI" in SMASSE. Cycle four targets student growth and impact transfer and it focuses more on the students than on the teacher (SMASSE Project, 2008).

Teacher efficacy is a crucial aspect of the success of the SMASE program. It consists of a number of characteristics such as: teachers' persistence, enthusiasm, commitment, and instructional behaviour as well as students' outcomes, including achievement, motivation and self-efficacy belief (Ross, 2001). Three characteristics of effective teaching under the control of teachers as suggested by McBer (2000) are teaching skills, professional characteristics and classroom climate. Teaching skills and

professional characteristics interacted to create a classroom climate conducive to learning, yet there is was no prescribed combination of skills and characteristics to create a particular classroom environment. Nevertheless, intensive training, including in service training, can contribute to improving teaching skills and professional characteristics. Teachers significantly influence student progress. They should therefore be encouraged to find solutions for all challenges faced in the profession, always plan and set expectations, be flexible to change and to work as a team. Teamwork is especially important, as teachers can use their mutual experience to solve problems that would seem insurmountable to an individual teacher.

Students also have their role to play in the implementation of SMASE. Reform visions advocate for more student-centred instruction (Ottevanger et al., 2005) and involve elements of the constructivist and situated perspectives in education. The authors propose ASEI-PDSI, a paradigm shift towards student-centred learning that also emphasizes practical and contextual aspects of learning, as an appropriate model for students to engage in classroom activities. It is a blend of constructivism in terms of inquiry learning and a situated cognition perspective through emphasis on improvisation of resources.

Learner centeredness as a teaching approach is effective because studies have shown that successful learners are those who are exposed to it (Lambert & McCombs, 2000). When learner-centeredness was used, learners were personally involved, committed and confident in their ability to succeed (Alexander and Murphy, 2000). Such a classroom takes a huge burden off the shoulders of teachers, who may also have administrative duties to take care of. The learner centred approach offers opportunities to recognize that the “conceptual world” that they are exposed to in the classroom is

congruent to “the world of experience” (Touger et al., 1995). Learners should be given a chance to understand science concepts through practical activities and to relate these concepts to their daily life experiences (Park, Khan, and Petrina, 2008). Once learners understand that what they do in the classroom relates to the real world, and may even offer them career opportunities, they will be encouraged to learn more.

The importance of the learner-centred approach is emphasized by the study of Flick and Bell (2000) who have confirmed that many scientifically accepted ideas are not easy for learners to understand due to their complexity, abstract nature and/or contrariness to experience and common sense. For example, learners cannot see the change in the wavelength of a sound wave; this shows the abstract nature of physics where things can only be perceived with the aid of science equipment or inferences (Mbajjorgu and Reid, 2006). Thus, if learners are engaged in practical experiments which they do by themselves, they will be better able to understand scientific concepts, which they will no longer view as abstract.

## **2.7 Constraints Encountered in Implementation of Innovative teaching Approaches**

Studies on implementation of innovative teaching approaches have attempted to identify constraints teachers encounter in the course of implementation. In their study titled *The Impact of In-Service Education and Training (INSET) Programmes in Mathematics and Science on Classroom Interaction: A Case of Primary and Secondary Schools in Kenya*, Sifuna and Kaime (2007) identified large classes, the use of English as second language, and pressure to cover the syllabuses in preparation of the national examinations as the major constraints teachers faced during the

implementation of the ideals of the SMASSE INSET. Other constraints included lack of adequate teaching and learning resources, lack of cooperation from the school administration, heavy teaching load and student absenteeism (Macharia, 2008; Muthemi, 2008; and Oirere, 2008). According to Calder head (2002) teachers are not reflective; they are satisfied with their practices and do not tend to question educational processes. Moreover, they often disregard data that is inconsistent with their beliefs and practice and tend to avoid new experiences. Instead, they prefer to stick to only those practices that match their existing system of beliefs

## **2.8 The ASEI/PDSI Principles**

ASEI is an acronym for activity, learner, experiment and improvisation. The ASEI lesson design considers the quality of classroom activities as critical to achieving effective teaching and learning. SMASE project commonly refers to the conditions prevailing in science and mathematics and classes at the time of 2008 and 2009 baseline studies as the pre-ASEI condition. A condition characterised by:

- Knowledge-based teaching. Teacher-centred teaching where the teacher in the classroom with learners as passive recipients of the activity.
- Lecture method/theoretical approach characterized by traditional chalk and talk (or talk and talk).
- Large scale 'recipe' type experiments (as described in textbooks).

The project aims to attain, through its activities (INSETS, workshops), a situation where the pre-ASEI condition will have been satisfactorily addressed to a condition commonly referred to as the ASEI condition. This shift from the pre-ASEI to the ASEI condition is as illustrated below:

- Knowledge- based teaching to activity teaching.

- Teacher-centred teaching where the teacher is in the classroom with learners as passive recipients of the activity to learners-centred learning.
- Lecture method/theoretical approach characterized by traditional chalk and talk (or talk and talk) to experiment and research based approach.
- Large scale 'recipe' type experiments (as described in textbooks) to small scale experiments and improvisation.

### **2.8.1 Activity**

This implies active, meaningful and constructive participation of the learner in learning situations by way of activities. Students tend to learn a lot more when they are active participants rather than passive recipients of information (Freedman 2007, Hofstein 2003). Retention of what has been learnt depends to a large extent on the approach or combination of approaches used. A lot less is retained when the primary method of learning is hearing. The level of retention increases progressively when hearing is combined with seeing, doing, discussing and presenting reports. Thus explaining why most teachers employ the instructional strategy continuum approaches since classroom activities (lecture, theory lessons, and textbooks) and practical are mutually supportive in terms of learning science and are indistinguishable from each other.

Furthermore, the learner activities here can be hands-on (manipulative), minds-on (intellectual), mouths-on (discussion), hearts-on (activities that stir up the learners interest/feelings about the subject matter, Q/A, assignments, calculations, experiments, project work and role play activities incorporated in the teaching as the situation demands (Bianchini 2007, Kirschner 2002). Activity of ASEI means a bridge between practical activities and the topic concept; in other words it means minds-on

activities. It serves as a bridge to cater for the varied abilities in class and the development of specific skills of:

**Knowledge:** - Facts collection, data collection and observation process

**Comprehension:** - Terminologies, meaning of principles and establishing relationships.

**Analysis:** - Variable control, prediction and data organization.

**Synthesis:** - Generalization, formulating hypothesis and inference.

**Application:** - Problem solving, production of tools and materials.

**Evaluation:** - Approximation and estimation, consistency between evidence and conclusions.

As learners progress, emphasis should increasingly be placed on higher order skills. The intended skills should be captured in the ASEI lesson plan and reflected in the objectives. Thus the choice of learning/teaching activities is guided by:

- i) The lesson objectives
- ii) Key concepts to be learnt
- iii) Skills to be developed level of the learners' entry behavior

### **2.8.2 Student**

A pedagogical shift is advocated so that the main focus of lesson is on the student rather than the teacher. The lesson objectives should be geared to improving the learner academic achievement and his/her quality of learning (Elby 2001, Bianchini 2007). Emphasis should help learners develop critical ability of analysing an argument by reviewing prior knowledge and current understanding of concepts, weighing the evidence and examining the logic, thus revealing which explanations are

better, reasonable and meaningful. Thereby, enabling the students to construct and reconstruct meaning directly from their encounters with the physical world.

### **2.8.3 Experiment**

If education is to serve the future, there is likely to be more educational value from experiments with the objectives of developing cognitive skills than there is in collecting data. The purpose of these problems needs to be identified in terms inquiry processes rather than on the more fragile bases of obtaining information and acquiring technical skills.

Use of experiments, therefore, enhances understanding of scientific/mathematical concepts and principles. The rationale here is the established fact that student working on a laboratory problem will learn far much more than just the answer to the problem (Kinya 2004, Schulz 2004). Experiments here are not limited to laboratory work in the sciences. It includes any activity, even in mathematics, that leads the learner to discover/reinforce new concepts/ideas for herself (Christina 2000, Wellington 2008).

Further, not all experiments are carried out in the laboratory; many are mental experiments in which the experimenter examines an idea by asking herself questions and exploring her own knowledge base for insight in the question solution in terms of data, laws, and theories with which is already knowledgeable. Many educators neglect this interdependency in favour of a primacy of either the theory, poorly related to course objectives, and consists of exercises for developing manipulatory of practical to theory or vice versa, means that successful progress in a science course depends to integrally related to the science concepts within the course. Through experiments, students learn to observe, manipulate, measure, reason and develop skills of gathering



information. For this reason, demonstrations should play a lesser role in science instruction with individual and group investigations receiving top priority.

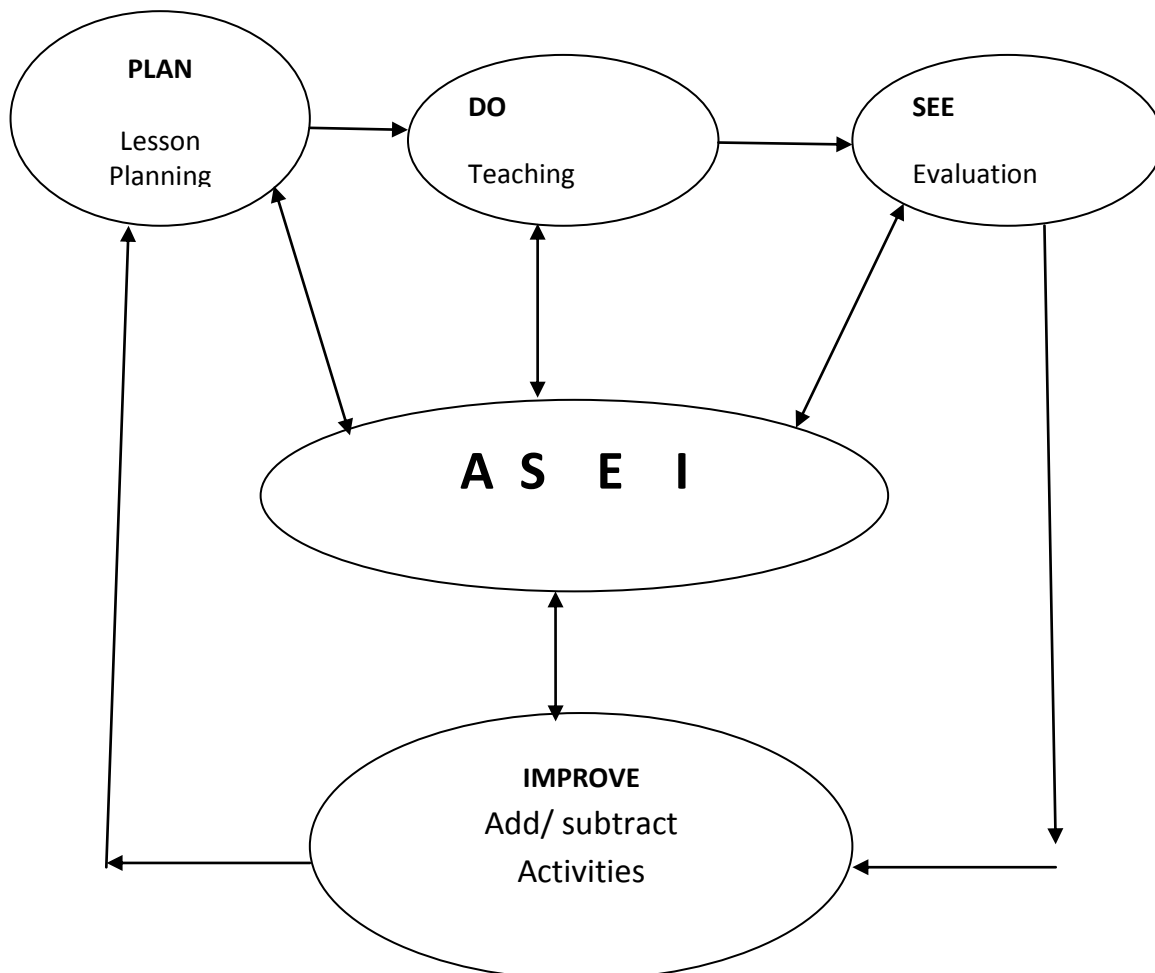
#### **2.8.4 Improvisation**

Most learners that actual objects, models or living specimens make a phenomenon concrete enough to be understood. Improvised materials which are locally available are convenient and economical for utilization. Use of local available materials to improvise where there is a shortage of conventional resources (equipment, apparatus) helps in attaining maximal effect in learners (Meester 2008, Sheila 2000 and Kirschner 2002). Improvisation may also be used when it is necessary to use materials within the learners environment so as to raise his/her interest and curiosity. But it requires skills to construct functional equipment.

#### **2.8.5 PDSI Approach**

Effective practice of ASEI calls for proper planning, Doing (carrying out the planned activity), seeing (evaluating the outcome of activity), followed by improvement; hence the acronym PDSI. PDSI may be defined as a process of checking the progress of an activity against its plan and answering the question of how the activity is being carried out in relation to the intended objectives.

This leads to a cycle relationship of ASEI/PDSI as summarised here



**Figure 2.1 cycle relationship of ASEI/PDSI**

### 2.8.6 Plan

The teacher plans the likely classroom discourse, scripting questions and planning responses to anticipate student comments. Planning is important since it enables the teacher to take into account the following aspects:

- Topic or sub-topic objectives should be SMART (specific, measurable, achievable, realistic and time bound). Plan instruction based on knowledge of subject matter, students, the community and curricular goals.

- Time:- when will the work be covered?
- How much time is available for covering it?
- Level of the learners and their previous knowledge. What is the ability of the learners? Plan instructional opportunities that are adapted to diverse students.
- Teaching/learning resources- what facilities, equipment and materials will be used?
- Are these resources available or can be made available? Can some of the resources be improvised?
- Teaching methods and strategies: - what activities will be involved in the lesson? How will the learners be involved in the activities? Will they do experiments? Will they have discussions? Will there be a demonstration by teacher?

### **2.8.7 Do.**

It is important to keep in mind that during instruction we do have a two way communication between the teacher and the learner. (Jeremy 2003, Ogwel 2007). The learner has every possibility of behaving out of the planned scheme. How well a teacher adjusts to the new events in class is a factor of how well grounded the teacher is in the pedagogy and subject content. Teaching and learning activities should be guided by the objectives and intended outcomes. Therefore a teacher should:

- Use variety of instructional strategies to encourage learners' development of critical and creative thinking, problem solving performance skills.
- Create a learning environment that encourages active engagement in learning, positive intellectual interactions and student ownership of the learning.

- Bring out the key concepts through experiences that make the subject matter meaningful
- Manage classroom resources effectively
- Write and correctly
- Have a clear link between the activities and the lesson content
- Use appropriate strategies to obtain information about learners and their ongoing progress and use the information to make instructional decisions for improvement
- Use the evaluation to reflect on the teaching for improvement.

### **2.8.8 Improve**

Incorporate learner's comments and your own evaluation of the lesson in the teaching of the on-going and subsequent lessons. This helps to enhance teacher performance and improve student learning. To practice the principles of ASEI/PDSI participants are given opportunity to peer teach and later teach in actual classroom situation what is referred to as actualization of ASEI/PDSI. This is preceded by a work planning session, an opportunity to develop ASEI lesson plan based on the PDSI approach peer teaching. This provided for hands- on experience in actual delivery with the peer learner and peer teacher each having specific roles.

## **2.9 Summary**

This review has examined the outcome of SMASE INSET on teaching and learning of science using ASEI-PDSI from the perspective of the influence of SMASE on performance, the effect of ASEI-PDSI on teaching and learning, the effect of SMASE on teachers attitudes and practices towards the teaching of science, the effect of

students' attitude on achievement, student and teacher centred aspects of ASEI-PDSI, and challenges faced by teachers in implementing ASEI-PDSI and ASEI/PDSI principles.

The review emphasizes the crucial value of science education at the basic education level as it effectively fosters core skills such as scientific thinking skills. Science education at the basic education level not only develops core skills but also lay the foundation from which future scientific personnel can be nurtured. In order to improve the teaching and learning approaches in Africa, it is necessary not only to provide teachers with opportunities for continuous professional development including INSET, but also to create environment conducive to concentrating on teaching professions including policies, securing the status, and providing appropriate incentives. As Duit (2003) pointed out, what is difficult is implementation of theories. Thus, it is important to learn from actual practices and experiences in order to bring about actual improvements in teaching and learning in Africa.

## **CHAPTER THREE**

### **RESEARCH DESIGN AND METHODOLOGY**

#### **3.0 Introduction**

This chapter lays out research methodology describing procedures and techniques that were used in carrying out the study. It deals with the following aspects; Area of study, Research design, Target population, Sampling design, Data collecting instruments and procedure, Validity of the instruments, Reliability of the instruments, ethical consideration and data analysis.

#### **3.1 Study Area**

This study was carried out in public primary schools within Baringo Central Sub County, Baringo Central Sub County is situated in Baringo County. Baringo Central Sub County is bordered by five other Sub Counties to the North, Baringo north; to the East, Marigat, to the South, Koibatek and Mogotio; to the West, Keiyo Marakwet County. The County currently has 114 public primary schools, which normally takes part in the Kenya Certificate of Primary School (KCPE). The County currently has four divisions namely: Kabarnet, Sacho, Tenges and Salawa and eight zones namely Tenges, Kabarnet, Senetwo, Ngolong, Chapchap, Sacho, Kabasis and Salawa.

The reason the researcher chose the Sub County is that the Sub County produces poor performance in science despite SMASE INSET compared to other Sub Counties within the County.

### 3.2 Research Design

This study employed descriptive survey design. Research design refers to the procedures selected by the researcher for studying a particular set of questions. Oliver, (2006) defines research design as to all pragmatic aspects of the way the research was carried out. According to Kothari, (2008) the research design is the conceptual structure within which research is conducted, it constitutes blue prints for data collection from respondents, measurement and analysis of collected data.

Descriptive survey research design are used preliminary and exploratory studies which allowed researcher to gather information, summaries present and interpret for the purpose of clarification (Orodho and Kombo,2002) give the purpose of descriptive research as determining and reporting the way things are. Borg & Gall (2009) noted that descriptive survey research is intended to produce the way things are. However it also helps to review characteristics of a population using a sample that is representative and can be used to obtain pertinent and precise information concerning current state of phenomena, notably surveys are dependent on the cooperation of respondents' information unknown to the respondents cannot be tapped in survey and requesting information which is considered secret and personal, encourages incorrect answers. The study provided information about population variables for instance data on distribution that exist by ASEI/PDSI instructional approach. The study also gave a description of factors behind the kind of distribution that were obtained in the study.

### 3.3 Target Population

The target population comprised of public primary schools in Baringo Central Sub County that total to 114 primary schools. The schools have approximate population of 2661 class seven pupils and 228 science teachers and 114 Head teachers. The target population are categorised further as shown in table 3.1.

**Table 3.1: Target Population**

<b>ZONES</b>	<b>NO. OF SCHOOLS</b>	<b>HEAD TEACHERS</b>	<b>PUPILS</b>	<b>SCIENCE TEACHERS</b>
<b>Tenges Zone</b>	18	18	335	36
<b>Kabarnet Zone</b>	21	21	429	42
<b>Senetwo Zone</b>	6	6	262	12
<b>Ngolong Zone</b>	13	13	341	26
<b>Chapchap Zone</b>	12	12	271	24
<b>Sacho Zone</b>	13	13	450	26
<b>Kabasis Zone</b>	15	15	275	30
<b>Salawa Zone</b>	16	16	298	32
<b>TOTAL</b>	<b>114</b>	<b>114</b>	<b>2661</b>	<b>228</b>

**Source: County Education Office. Baringo Central District, (2015)**

### 3.4 Sampling Procedures and Sample Size

According to Mugenda and Mugenda (2003), random sampling subjects are selected in such a way that the existing respondents in the population are represented without



biasness. It is advantageous in that it ensures inclusion in the sample of sub groups which otherwise would be omitted entirely by other sampling methods because of their small numbers. Kothari (2009), also recommends the sampling design used as appropriate according to the laws of statistical regularity. Thus if on average the sample chosen is a random one, it will have the same composition and characteristics as the universe. This would enable the researcher to make generalization of the findings of the study.

For this study 34 schools were sampled from 114 primary schools that registered for Kenya Certificate of Primary School (KCPE) in the Sub County using purposive sampling as they were the only boarding schools in the area. Respondents were head teachers, science teachers and standard seven pupils. Simple random sampling was used to obtain 68 science teachers, one teaching standard seven class and one from any other class and also same procedures to get 266 standard seven pupils who responded to the questionnaires making a total of 368 respondents. Standard sevens pupils' were chosen because they had learned science for the past six years under the ASEI/PDSI approach and they were the incoming candidates.

**Table 3.2 Sampling Frame**

<b>Category of Population</b>	<b>Target Population</b>	<b>Sample Population</b>	<b>Sampling procedure</b>
Head teachers	114	34	Purposive sampling
Science Teachers	228	68	Random sampling
Standard seven pupils	2661	266	Random sampling
<b>Total</b>	<b>3003</b>	<b>368</b>	

### **3.5 Research Instruments**

The researcher used the following instruments to collect the data, namely questionnaires for science teachers and pupils and interview schedule for head teachers.

#### **3.5.1 Questionnaires**

Questionnaires were used to collect data from science teachers and pupils. Kothari (2008) defines a questionnaire as that consisting of a number of questions printed or typed in a definite order on a form or set of forms. The use of questionnaires offers considerable advantages in management as it presents an even stimulus to a large number of people simultaneously and provide investigator with a relatively easy accumulation of data, further the use of questionnaires allows the respondents time on questions that would require reflections to avoid vague responses, however they require a lot of time in traveling hence a lot of expenses that inflate research cost, and some respondents may not answer all the questions. These questionnaires were developed by the researcher by reviewing literature, theoretical framework and the research questions. The questionnaire was designed with questions focusing on facilitation, implementation and the effectiveness of SMASE INSET. The questions included closed-ended and open-ended type for the sake of comprehensive feedback. The structured items required respondents to select one response from the alternatives while open-ended type of items required respondents to express their own views on particular issues as shown by Appendix II and III. The questionnaire was developed to establish the baseline of ASEI/PDSI approach in teaching and learning of science in public primary schools in Baringo Central Sub County

### **3.5.2 Interview schedule**

The interview schedule was used with the Head teachers. Interviews provide in-depth data that is not possible to get using questionnaire alone (Mugenda and Mugenda, 2003). According to Oson and Onen (2005) interview is a method of collecting data that involves presentation of oral verbal stimuli and reply in terms of oral verbal responses. The Study used the interview schedule for gathering data because it permits much greater depth than other methods of data collection. It also provides a true picture of opinions and feelings'; however they are time consuming, expensive to conduct and may have sincere answers to please the interviewer. The research used open-ended questions to elicit verbal responses on the use of ASEI/PDSI instructional approach in schools from the Head teachers.

### **3.6 Reliability and Validity of Research Instruments**

In order to lessen the danger of obtaining inaccurate answer to research questions emphasis on the descriptive research design was considered: reliability and validity (Saunders et al. 2007). Validity is the ability of a chosen instrument to measure what it is suppose to measure. Reliability is the extent to which research results would be stable or consistent if the same technique is repeatedly which was done through pilot study, it was carried out in a school not part of the study this helped to improve face validity of the instrument. Moreover the way the measuring is conducted and how the information is processed affects the outcome of research (Fraenkel and Wallen, 2006).

### **3.6.1 Reliability of Research Instruments**

Reliability is a measure of the degree to which a research instrument yields consistent results or data after repeated trials. The questionnaire was checked for accuracy and consistency using the pilot study. The internal consistence of the questionnaires was tested for reliability using Cronbach Coefficient Alpha to determine the internal consistency of the items. This is a method of estimating reliability of test scores by the use of a single administration of a test.

In the study, the reliability was established through the pilot-test. The questionnaire was pilot tested in one school which was not part of 34 sampled schools. Consequently, it provided good measures of reliability because holding other factors constant, the more similar the test content and conditions of administration are, the greater the internal consistency reliability (Mugenda and Mugenda, 2003). The value of Cronbach Coefficient Alpha is generally required to be over 0.7 a reliability coefficient of both the questionnaires was found to be above 0.80 thus the instrument being reliable.

### **3.6.2 Validity of Research Instruments**

Validity refers to the degree to which an instrument measures what it is supposed to measure. According to Kothari (2009), validity can be determined by using a panel of persons who shall judge how well the measuring instrument meets the standards. For this study validity was tested by discussing the instruments with the supervisors and other specialists in Department of Curriculum, Instruction and Educational Media Moi University. In addition, questionnaire was piloted to check if the instrument is measuring what it is supposed to be measuring, and to determine if the answers to be

given by respondents have any meaning. The instruments were piloted and tested in the field to ensure instrument validity and to check on clarity of instructions and relevance of items (Bless & Higson-Smith, 1995).

Questionnaires were constructed through the study of the literature related to the SMASE INSET. Various text books were read on the SMASE INSET. This was done to make sure that the questionnaires are contextually correct. The questionnaire intended for the science teachers had correct scientific terminology were used to ensure that it is relevant to them.

### **3.7 Data Collection Procedures**

Permission to conduct research was sought from National Commission for Science Technology and Innovation (NACOSTI), through the Department of Curriculum Instruction and Educational Media of Moi University. The permit was used to secure permission from the respondents in the study area to carry out the research in the respective study area. The researcher sought clearance from the Baringo County Director of Education and Baringo Commissioner. The Head teachers and the science teachers of the sampled schools for the study were notified in writing and their cooperation requested before the study. The researcher made two visits to the schools, during the first visit the researcher distributed the questionnaires to the respondents and make arrangements with them on the convenient time to collect the completed questionnaires. In the second visit the researcher collected the filled questionnaires. To ensure that all the questionnaires items are answered, each respondent's questionnaire were cross-checked and where items have been left out the respondents

were requested to respond to them. The filled questionnaires were collected for data analysis.

### **3.8 Data analysis**

The data collected for the purpose of the study was adopted and coded for completeness and accuracy. Statistical Package for Social Science version 20 (SPSS version 20.0) was used for all the data analysis; key points from questionnaires were noted and coded. The data from questionnaires and interview schedule were analyzed using descriptive statistics. Descriptive statistics includes the statistical procedures that produce indices that summarize data and describes the sample; descriptive statistics such as frequency counts of the respondents were done using statistical records. The data was organized and presented in form of tables and a summary of the findings indicated after each table, tabular layout was important to establish the distribution of respondents by performance. The use of tabular layout would enable desired figures to be located more quickly and would make more easily. This layout makes it possible to reveal patterns within figures which cannot be seen in narrative form.

### **3.9 Ethical Considerations**

Ethical considerations protect the rights of participants by ensuring confidentiality. It is unethical for the researcher to share identifying information regarding test scores and school records with anyone not associated with this study. This ethical consideration is necessary to maintain the integrity of the study as well as the integrity of the researcher (Creswell, 2002). The researcher sought permission from the respondents as to get their consent for the research to be carried out. Participants were

given enough information pertaining to the study before the administration of the research instrument. The possible benefits and value of the study were explained to the participants. The nature and the rationale for the study were explained to the respondents by the researcher. The respondents completed the questionnaires voluntarily. To ensure that the learners and their teachers were protected from any victimisation, biases and any infringement of their rights, the information collected in this study was not used to disadvantage the participants in any way. In this study, participants' confidentialities were not compromised, as their names would not be used or appear in the collection of data. No private or secret information was divulged since the right of confidentiality of the participants was respected as they were not to write their names and any private information. Respondents were assured of confidentiality of their response, which was meant for study purposes only.

### **3.10 Summary of the Chapter**

The chapter present a discussion on methodology that guides the preparation of data instruments, data collection and data analysis. As mentioned above the appropriate research design for this study was descriptive research design. Several sub-topics are presented that include research design, target population, sampling procedures, research, validity and reliability and finally ethical issues. The data collected and analysis were discussed in the next chapter in order to answer the research questions.

## **CHAPTER FOUR**

### **DATA PRESENTATION, ANALYSIS AND INTERPRETATION OF RESULTS**

#### **4.0 Introduction**

This chapter deals with data analysis, interpretation and presentation of the study findings. The purpose of the study was an assessment of ASEI/PDSI instructional approach in teaching and learning of sciences in public primary schools in Baringo Central Sub County. This was achieved by the following objectives: To establish the extent to which ASEI/PDSI approach is used in teaching and learning of science. To establish the level of competency among science teachers in using ASEI/ PDSI approach in teaching science. To establish the influence of ASEI/PDSI towards teacher attitudes in teaching science, to establish the pupils attitude towards learning of science using ASEI/PDSI approach and to establish challenges faced by the teachers and pupils while using ASEI/PDSI approach. Result of the data is analysed by use of descriptive statistics. Data is presented in form of tables and charts by use of percentages and frequencies.

#### **4.2 Response Rate**

##### **Teachers**

The study administered 68 questionnaires to the respondents. 8 questionnaires were not returned but 60 were successfully filled and returned. The response rate was therefore 88%.



## Pupils

The study administered 266 questionnaires to the respondents. 16 questionnaires were not returned but 250 were successfully filled and returned. The response rate was 94%.

Before embarking on the main objectives of the study, it was important to find out the background information of the respondents. This was ascertained by looking at the gender of the pupils and work experience of science teachers. Background information was important as it lays a basic foundation on which interpretations of the study are based. Furthermore, background information of the respondents enables both researcher and the reader to have confidence in the study.

### 4.2.1 Gender of Respondents

The study sought to find out the gender of Science teachers and pupils. Results are shown in the table 4.1.

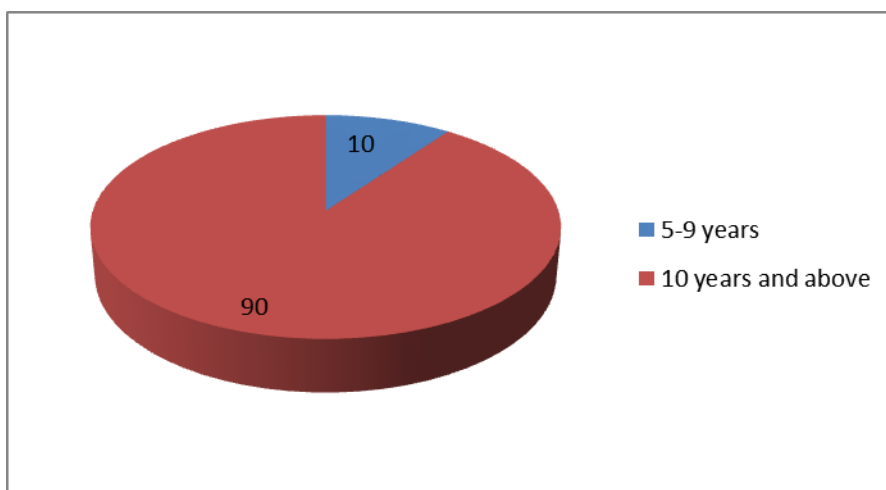
**Table 4.1 Gender of Science Teachers and Pupils**

	Science Teachers		Pupils	
	Frequency	Percent	Frequency	Percent
Male	10	25.0	148	59.2
Female	30	75.0	102	40.8
<b>Total</b>	<b>40</b>	<b>100</b>	<b>250</b>	<b>100</b>

From table 4.1, majority of the science teachers 75.0% were females while 25.0% were males. Most of the pupils 59.2% were males while 40.8% were females.

#### 4.2.2 Science Teachers Work Experience

The figure below shows result on the science teacher's work- experience.



**Fig.4.1 Science Teachers Work Experience**

It is seen that 90.0% of the science teacher had worked for a period of 10 years and above while 10.0% between 5-9 years. Implying that majority of the Science teachers had been in service for a longer period thus giving them an opportunity to have more experience in teaching science.

#### 4.3 Findings on Specific Objectives

##### 4.3.1 Extent in use of ASEI/PDSI approach in teaching and learning of science

Objective one was to establish the extent to which ASEI/PDSI approach is used in teaching and learning of science, to achieve these factors the following were assessed in the table 4.2

**Table 4.2 Extent of Use of ASEI/PDSI Approach in Teaching and Learning of Science**

Statements/variables		Pupils		Science teachers	
		Frequency	Percent	Frequency	Percent
<b>Maximize use of Learning materials within environment</b>	Larger Extent	160	64.0	35	58.3
	Some Extent	70	28.0	23	38.3
	Rarely	20	8.0	2	3.3
	<b>Total</b>	<b>250</b>	<b>100.0</b>	<b>60</b>	<b>100.0</b>
<b>Encourage peer Teaching In my class</b>	Larger Extent	90	36.0	15	25.0
	Some Extent	80	32.0	40	66.7
	Undecided	40	16.0	2	3.3
	Never	40	16.0	3	5
<b>Total</b>	<b>250</b>	<b>100.0</b>	<b>60</b>	<b>100.0</b>	
<b>Encouraging of Group Work</b>	Larger Extent	100	40.0	45	75
	Some Extent	60	24.0	13	21.7
	Undecided	90	36.0	2	3.3
	<b>Total</b>	<b>250</b>	<b>100.0</b>	<b>60</b>	<b>100.0</b>
<b>Use of Experiment during the Science Lessons</b>	Larger Extent	135	54.0	34	56.7
	Some Extent	115	46.0	21	35
	Undecided	0	0	5	8.3
	<b>Total</b>	<b>250</b>	<b>100.0</b>	<b>60</b>	<b>100.0</b>
<b>Involves pupils in their science lessons</b>	Larger Extent	120	48.0	54	90
	Some Extent	130	52.0	6	10.0
	<b>Total</b>	<b>250</b>	<b>100.0</b>	<b>60</b>	<b>100.0</b>

From the results 58.3% of the Science teachers extensively use the learning materials within the environment 38.3% some extent use while 3.3% of the Science teachers rarely use. On finding out if Science teachers were able to encourage peers in teaching their classes, 66.7% extensively encourage peer teaching, 25.0% in some extent encourage, 3.3% undecided, and 5% never encourage peer teaching, implying that majority of the Science teachers encourage peer teaching in their classes.

On finding out if Science teachers encouraged group work in their classes 75% of the Science teachers extensively encouraged group work in their classes, 21.7% in some extent while 3.3% were not sure if they encouraged group work or not. The results reveal that most of the Science teachers encouraged use of group work in their classes.

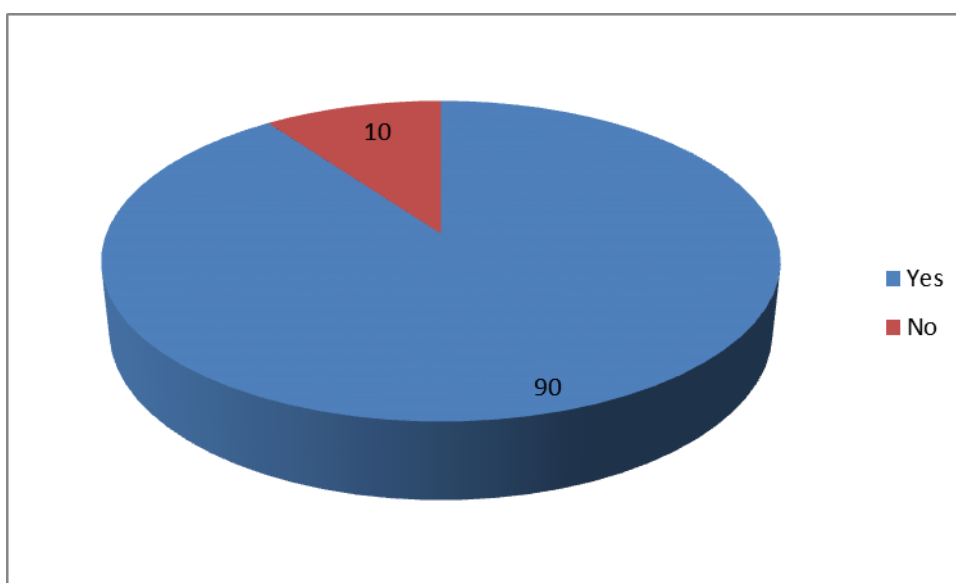
Further, the study sought to find out if the Science teachers used experiment during the science lessons from the table 4.2 56.7% of the respondents extensively use experiments during the science lessons, 35% in some extent while 8.3% were undecided, this reveals that teachers use experiment during science lessons. Also the study sought to find out if Science teachers involve their pupils in science lesson, 90% of the Science teachers extensively involves pupils in their science lessons while 10% in some extent involves pupils, revealing that the entire Science teachers involves their pupils in their science lessons.

During interview schedule, head teachers were interviewed on if the ASEI/PDSI approach enhances the teaching and learning of science in their schools. It was found out that the approach enhanced the teaching and learning of science in their schools.

Both teachers and pupils appreciated the principles of ASEI-PDSI approach in the teaching of science because it is activity oriented, this implies active, meaningful and constructive participation of the learner in learning situations by a way of activity.

#### 4.3.2 Utilization of ASEI/PDSI Approach

This chart below shows results on utilization of ASEI/PDSI approach in teaching of science in the school.



**Figure 4.2 Utilization of ASEI/PDSI Approach**

From the results 90.0% of the science teachers in public primary schools in Baringo Central Sub County agreed that ASEI/PDSI approach has been utilized in teaching of science in school. While 10.0% disagreed that it isn't utilized Science teacher also said that most teachers enjoyed use of ASEI/PDSI approach in teaching of their

pupils. Therefore the findings obtained were relevant as the both the teachers and pupils have experienced the use of ASEI/PDSI approach; also they can identify its positive and negative effects to learning and teaching science in primary schools.

On utilization of ASEI/PDSI by science teachers, head teachers revealed that some components of ASEI/PDSI are well used by the science teachers but other components are not well utilized for example, see (S) and improve (I). Effective teaching requires one to continually improve through reflecting on and refining instructional practices.

#### **4.3.3 Teachers & Pupils response on level of Competence among Science Teachers**

Objective two was to determine the level of competence among science teachers in using ASEI/PDSI approach in teaching science. To achieve this objective the study looked at the following variables, ability to link the class activities and lesson, ability to link class activities and concept taught, ability to guide the class activities according to syllabus and ability to use local environment resources, Results are shown in the table 4.3.

Table 4.3 Teachers &amp; Pupils Response on Level of Competence among Science Teachers

Statements/variables		Science Teachers		Pupils	
		Frequency	Percent	Frequency	Percent
<b>Able to deliver the subject content</b>	Strongly agree	17	67.5	100	40.0
	Agree	28	22.5	110	44.5
	Undecided	10	5.0	10	16.7
	Disagree	5	5.0	30	12.0
	<b>Total</b>	<b>60</b>	<b>100.0</b>	<b>250</b>	<b>100.0</b>
<b>Logical flow of activities during the lesson</b>	Strongly agree	30	50.0	134	53.6
	Agree	20	33.3	105	42.0
	Undecided	1	1.7	10	4.0
	Disagree	9	15	1	.4
	<b>Total</b>	<b>60</b>	<b>100.0</b>	<b>250</b>	<b>100.0</b>
<b>Able to improvise teaching material</b>	Strongly agree	30	50	110	44.0
	Agree	10	5	110	44.5
	Undecided	13	21.7	20	8
	Disagree	7	11.7	10	4

	<b>Total</b>	<b>60</b>	<b>100.0</b>	<b>250</b>	<b>100.0</b>
<b>Link the class activities and lesson</b>	Strongly agree	37	61.7	100	40.0
	Agree	18	30	119	47.5
	Undecided	2	3.3	0	0
	Disagree	3	5.0	31	12.5
	<b>Total</b>	<b>60</b>	<b>100.0</b>	<b>250</b>	<b>100.0</b>
<b>Ability to guide the class activities according to the syllabus,</b>	Strongly agree	33	55.5	156	62.5
	Agree	17	28.3	81	32.5
	Undecided	10	16.7	13	5.0
	<b>Total</b>	<b>60</b>	<b>100.0</b>	<b>250</b>	<b>100</b>
<b>Ability to use local environment resources</b>	Strongly agree	41	68.3	123	49.2
	Agree	10	16.7	119	47.6
	Undecided	9	15	8	3.2
	<b>Total</b>	<b>60</b>	<b>100</b>	<b>250</b>	<b>100</b>



According to ability to deliver the subject content, 67.7% of strongly agreed among the teachers as 40% of the pupils, 22.5% agreed as 44.5% of the pupils, 5% among the teachers were undecided as 16.7% among the pupils and 5% disagreed among the teachers as 12% of the pupils. On logical flow of activities during the lesson, 50% of the science teachers strongly agreed as 53.6% of the pupils, 33.3% of the teachers agreed as 42% of the pupils, 1.7% of the teachers were undecided as 4% of the pupils and 15% of the teachers were undecided as 4% among the pupils. Ability to improvise teaching material, 50% of the science teachers strongly agreed as 44.5% of the pupils, 5% agreed among the teachers as 44.5% of the pupils, 21.7% were undecided among the teachers as 8% of the pupils and 11.7% of the teachers disagreed as 4% of the pupils.

Ability to link the class activities and lesson on finding if their science teachers had the ability to link the class activities and the lesson 61.7% of the science teachers strongly agree to link the class activities and lesson, 30% agree, 3.3% not decided while 5.0% disagree.

The pupils 40.0% said that teachers strongly agreed to link the class activities and the lesson, 47.5% agreed while 12.5% disagreed. From the results it's revealed that science teachers in Baringo Central Sub County were able to link the class activities and the lesson while teaching and learning of science subjects. Ability to guide the class activities according to the syllabus, the study went further to find out the whether science teachers had the ability to guide the class activities according to the syllabus. From the table 4.3 above 62.5% said their teachers strongly agreed to guide

the class activities according to the syllabus, 32.5% agreed, while 5.0% were undecided. Finding from the pupils 53.6% strongly agreed that their teachers guided their class activities according to the syllabus, 42.0% agreed while 5.0% were undecided. The result reveals that Baringo Central Sub County Primary science teacher were guided by the syllabus in teaching of science in their schools.

Ability to use local available resources, Baringo Central Sub County primary science teachers had the ability to use local environment resources with 67.5% of the Science teachers strongly agreed, 22.5% agreed while 10.0% were undecided. Pupils were asked if their science teachers are competent in use of locally available resources. From the findings 49.2% of the pupils said that their science teachers strongly agreed that they were using local available resources, 47.6% undecided while 3.2% disagreed. Results revealed that science teachers in Baringo Central Sub County were using use local available resources in their lessons, thus making the pupils easy to understand.

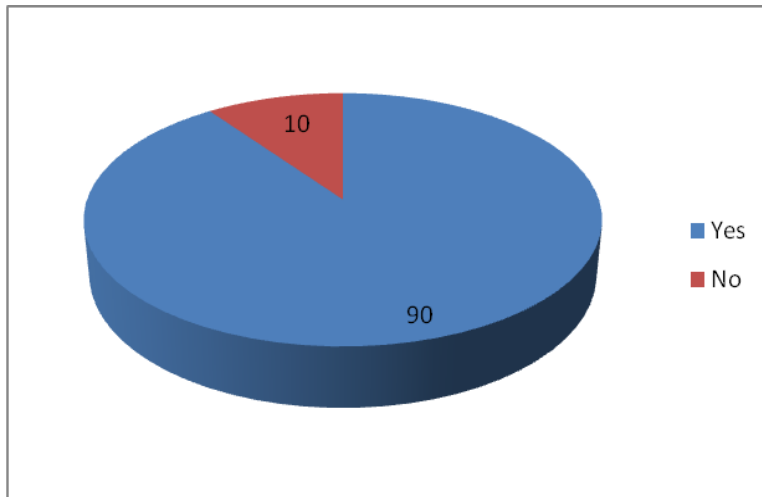
This is in agreement with studies by Adeyanju (2007) which stated that learning and teaching is the concern of the trained teacher. But learning is a complex process. It can however be defined as a change in disposition; a relatively permanent change in behaviour overtime and this is brought about by experience. Learning can occur as a result of newly acquired skill, knowledge, perception, facts, principles, new information at hand etc., Learning can be reinforced with learning aids of different variety because they stimulate, motivate as well as arrest learner's attention for a while during the instructional process. Learning aids are instructional materials and

devices through which teaching and learning are done in schools. Examples of learning aids include visual aids, audio-visual aids, real objects and many others. The visual aids are designed materials that may be locally made or commercially produced. They come in form of wall-charts illustrated pictures, pictorial materials and other two dimensional objects. There are also audio-visual aids. These are teaching machines like radio, television, and all sorts of projectors with sound attributes.

Teacher classroom interactions that aid students learning are often complex process that depends on interpersonal and pedagogical awareness. According to Morrison, Bachman and Connor (2005) the teacher pedagogy, classroom management strategies, and interaction with students at the classroom level can determine how much is learned. Therefore learning is contingent on teachers' ability to create and sustain optimal learning environments. In this study therefore, the finding agrees with the above studies reviewed.

#### **4.3.4 Teachers Response on Competence in Use of ASEI/PDSI Approach in Teaching**

Teachers were asked if they were competent in use of ASEI/PDSI approach in teaching science the figure below shows the results.



**Figure 4.3 Teachers Response on competent in Use of ASEI/PDSI Approach in Teaching**

From the figure results 90.0% of the science teachers said that they were competent in use of ASEI/PDSI approach in teaching of science in public primary school in Baringo Central Sub County primary schools while 10.0% were not competent revealing that teachers in Baringo Central sub county primary schools were competent in using of ASEI/PDSI approach.

This finding is also in line with Moloi, Morobe & Urwick (2008) in the study of free primary education (FPE) which found that teacher's poor knowledge of content and pedagogy surfaced in the teaching of mathematics with the deficiencies attributed partly to their training and partly to the situation in the schools. A teacher needs to have good mastery of the content for enhanced classrooms interaction. Looking at the competence of science teachers in the use of ASEI/PDSI it was found out that most of the science teachers were competent in using ASEI-PDSI approach thus finding the approach to be very helpful and making the understanding of science concepts easy.

#### **4.3.5 Implementation of ASEI/PDSI Approach by teachers in teaching of science.**

Objective three was to find out the influence of teachers attitude towards ASEI/PDSI Approach in teaching of Science in Baringo Central primary school. The study assessed the implementation of ASEI/PDSI approach in teaching science from all pupils and science teachers using of activities during science lessons. The findings are shown in the table 4.4.

Table 4.4 Implementation of ASEI/PDSI Approach by Teachers in Teaching of Science

Statements		Science teachers		Pupils	
		Frequency	%	Frequency	%
<b>Teachers make science interesting by allowing pupils involvement</b>	Strongly agree	25	41.7	125	50.0
	Agree	31	51.7	119	47.6
	Undecided	4	6	0	0
	Disagreed	0	0	6	2.4
	<b>Total</b>	<b>60</b>	<b>100</b>	<b>250</b>	<b>100</b>
<b>Teachers uses guided discussions during science lessons</b>	Strongly agree	25	41.7	110	44
	Agree	20	33.3	120	48
	Undecided	5	8.3	10	4
	Disagreed	10	16.7	10	4
	<b>Total</b>	<b>60</b>	<b>100</b>	<b>250</b>	<b>100</b>
<b>Teachers solicit ideas from all the pupils while teaching science</b>	Strongly agree	28	46.7	127	50.8
	Agree	20	33.3	108	43.2
	Undecided	8	13	5	2.0

	Disagree	2	3.3	10	4.0
	Strongly disagree	2	3.3	0	0
	<b>Total</b>	<b>60</b>	<b>100</b>	<b>250</b>	<b>100</b>
<b>Science teachers uses experiments during science lessons</b>	Strongly agree	32	53.3	97	38.0
	Agree	22	36.7	150	60.0
	Undecided	4	6.7	2	0.8
	Disagree	2	3.3	1	0.4
	<b>Total</b>	<b>60</b>	<b>100</b>	<b>250</b>	<b>100</b>
<b>Science teachers makes full use of science resources by allowing it improvised</b>	Strongly agree	25	41.7	120	48
	Agree	21	35	119	47.6
	Undecided	4	6.7	5	2
	Disagreed	10	16.7	6	2.4
	<b>Total</b>	<b>60</b>	<b>100</b>	<b>250</b>	<b>100</b>

The findings shows that 41.7% of the science teachers strongly agreed that they make science interesting by allowing pupils involvement as 50% of the pupils, 51.7% of them agreed as 47.6% of the pupils, 6% were undecided but none disagreed while 2.4% disagreed among the pupils. The findings indicate that teachers use guided discussions during science lessons as 41.7% strongly agreed together with 44% of the pupils, 33.3% of them agreed as 48% of the pupils, 8.3% were undecided as 4% of the pupils and 16.7% of the teachers disagreed as 4% of the pupils. According to whether teachers solicit ideas from all the pupils while teaching science, 46.7% of the teachers strongly agreed as 50.8% of the pupils, 33.3% of the teachers agreed as 43.2% of the pupils, 13% of the teachers were undecided as 2% of the pupils, 3.3% of them disagreed as 4% of the pupils and 3.3% strongly disagreed but none strongly disagreed among the pupils.

It can be seen that 62.5% of the science teachers strongly agreed that science teachers use experiments during science lessons, 27.5% agreed while 10.0% of the science teachers were undecided. From the pupils 50.0% strongly agreed, 47.2% agreed while 2.4% of the pupils disagreed that there was use of experiments by their science teachers this implies that science teachers welcoming of ideas from all pupils. From the table above 45.0% of the teachers strongly agreed that they solicit ideas from their pupils while teaching science, 35.0% agreed, and 10.0% disagreed while 10.0% were undecided. 5.0% disagreed and 5.0 strongly disagreed.

Finding from pupils shows that 50.8% strongly agreed that science teachers welcomed ideas from all pupils during their teaching, 43.2% agreed 4.0% disagreed while 2.0% were undecided. From this result it is revealed that by teachers welcoming ideas from



all pupils there is good attitude towards use of ASEI/PDSI approach in teaching of science as a subject in primary schools.

Further the study sought to find out involving of pupils in science activities so as to know the attitude of science teachers towards use of ASEI/PDSI approach from the table above 60.0% of the pupils agreed that their science teachers involved them in science teachers during their lessons, 38.8% strongly agreed. 0.8% pupil's undecided while 0.4% disagreed. Finding from the science teachers 80.0% strongly agreed that during their science lessons they involve their pupils in science lessons activities 5.0% agreed, 10.0% were undecided in involving their pupils in class activities showing a positive attitude towards use of ASEI/PDSI in teaching. On desired change, it was found from the head teachers interviewed that ASEI-PDSI approach brought desired changes among science teachers

#### **4.3.5 Teachers Description of learners on ASEI/PDSI Approach in learning Science**

The study sought to establish the attitude of pupils in teaching of science using ASEI/PDSI approach. The researcher considered the following factors; in the side of the teachers; link lesson activities and concept taught, learners participate in science activities, learners express themselves, learners give their own predictions while considering the following in factors in the side of the pupils; participating in science activities, pupils doing experiments during science lessons, group discussion, during class lesson and learners do group work during science lesson and learners do group work during science lesson. Results are shown in table 4.5 and 4.6.

**Table 4.5 Teachers Description of Learners on ASEI/PDSI Approach in Learning Science**

Statements/variables		Science teachers	
		Frequency	Percentage
<b>Learners are able to link lesson activities and concept taught</b>	Strongly agree	<b>30</b>	<b>50.0</b>
	Agreed	20	33.3
	Undecided	10	16.7
	Strongly disagree	0	0
	<b>Total</b>	<b>60</b>	<b>100.0</b>
<b>Learners interact with teaching and learning resources</b>	Strongly agree	<b>20</b>	<b>33.3</b>
	Agreed	25	41.7
	Undecided	5	8.3
	Strongly disagree	5	8.3
	<b>Total</b>	<b>60</b>	<b>100.0</b>
<b>Learners participate in science activities</b>	Strongly agree	40	66.7
	Agree	15	25
	Undecided	0	0

	Strongly disagree	5	8.3
	<b>Total</b>	<b>60</b>	<b>100.0</b>
<b>Learners express themselves as the lesson progress</b>	Strongly agree	50	83.3
	Agree	5	8.3
	Undecided	5	8.3
	Strongly disagree	0	0
	<b>Total</b>	<b>60</b>	<b>100.0</b>
<b>Learners give interactive ideas</b>	Strongly agree	<b>30</b>	<b>50.0</b>
	Agreed	20	33.3
	Undecided	10	16.7
	Strongly disagree	0	0
	<b>Total</b>	<b>60</b>	<b>100.0</b>
<b>Learners give their own prediction</b>	Strongly agree	25	41.7
	Agree	30	50.0
	Undecided	5	8.3
	Strongly disagree	0	0
	<b>Total</b>	<b>60</b>	<b>100.0</b>

<b>Pupils discover information and making learning real</b>	Strongly agree	<b>20</b>	<b>33.3</b>
	Agreed	30	50.0
	Undecided	10	16.7
	Strongly disagree	0	0
	<b>Total</b>	<b>60</b>	<b>100.0</b>

From the table 4.5 50% of the teachers strongly agreed that pupils link lesson activities and concept taught, 33.3% agreed, while 16.7% were undecided. This implies that pupils attitude towards ASEI/PDSI approach was positive. On whether pupils participate in science activities from the findings 33.3% of the teachers strongly agreed while 41.7% agreed revealing that pupils enjoy science lessons 8.3% were undecided and 8.3% strongly disagreed. 66.7% of the teachers strongly agreed that learners participate in science activities, 25% of them agreed and 8.3% strongly disagreed but none was undecided. On whether learners express themselves during science lessons 75.0% strongly agreed, 12.5% agreed and 12.5% were undecided this implies that pupils enjoy very well the science lessons. On whether pupils give their own predictions 50% strongly agreed, 33.3% agreed and 16.7% were undecided implies that pupils can make their own discoveries during science lessons. The study delved further on the pupils' attitude when using the ASEI/PDSI Approach so as to compare with the above finding.

**Table 4.6 Pupils Attitude towards ASEI/PDSI Approach in Pupils and Learning of science**

Statements	Pupils		
	Frequency	Percent	
<b>I like doing practical's during science lessons</b>	Agreed	235	90.0
	Disagreed	15	10.0
	<b>Total</b>	<b>250</b>	<b>100</b>
<b>I enjoy doing experiments during science lessons</b>	Strongly agree	169	67.5
	Agree	57	22.5
	Undecided	12	5.0
	Strongly disagree	12	5.0
	<b>Total</b>	<b>250</b>	<b>100</b>
<b>I like participating in science activities</b>	Strongly agree	132	52.8
	Agree	113	45.2
	Undecided	1	0.4
	Strongly disagree	4	1.6
	<b>Total</b>	<b>250</b>	<b>100</b>

<b>I like group discussions during class lessons</b>	Strongly agree	119	47.6
	Agree	103	41.2
	Undecided	17	6.8
	Disagree	10	4.0
	Strongly disagree	1	0.4
	<b>Total</b>	<b>250</b>	<b>100</b>
<b>I like group work during science lessons</b>	Strongly agree	130	52
	Agree	110	44
	Undecided	6	2.4
	Strongly disagree	4	1.6
	<b>Total</b>	<b>250</b>	<b>100</b>
<b>I like using improvised materials during science lesson</b>	Strongly agree	100	40
	Agree	130	52
	Undecided	10	4.0
	Strongly disagree	10	4.0
	<b>Total</b>	<b>250</b>	<b>100</b>

From the findings 90.0% of the pupils agreed that they enjoyed doing practical's during science lesson while 10.0% disagreed. Implying that pupil's attitude towards ASEI/PDSI approach was positive. The study went further to find out from the pupils if they did experiments during science lesson, from the findings 67.5% of the pupils strongly agreed that they had practical during science lessons, 22.5% agreed while 5.0% disagreed and 5% strongly disagree, revealing that primary schools in Baringo Central Sub County had their practical during science lessons. Good quality practical work can engage pupil's help them develop important skills and develop their understanding concepts.

Looking at pupil's link group discussions 47.6% of the pupils agreed that they liked group discussion during class lessons, 41.2% strongly agreed, 6.8% were undecided while 4% disagreed results that most of the pupils like group discussion in their class lessons. From these results it is implied that most of the pupils have a positive attitude towards the ASEI /PDSI approach. On group work, 52% of the pupils strongly agreed, 44% agreed, 2.4% were undecided, and 1.6 strongly disagreed. This reveals that pupils do group work during science lessons. The findings further showed that pupils enjoyed improvised materials during science lesson as agreed by 40% of the pupils, 52% agreed, 4% were undecided and 4% strongly disagreed.

On pupils attitudes towards ASEI/PDSI head teachers revealed that the pupils attitude towards ASEI/PDSI approach in learning science was positive this is because the approach involved the practical areas which made the pupils see the reality of life situation and enjoys the science lessons. They said pupils like doing experiments. Use of experiments therefore enhances understanding of scientific concepts and principles.



### 4.3.6 Challenges facing Teachers in Use of ASEI/PDSI Approach

Objective five was to find out challenges facing teachers when using ASEI/PDSI Approach. The inadequate usage of the ASEI-PDSI approach may be partly attributed to constraints teachers face in the implementation of the approach. Results are seen in the table 4.7.

**Table 4.7 Challenges facing Teachers in Use of ASEI/PDSI Approach**

Statements	Frequency	Percentage
Pressure to cover the syllabus	10	25.0
Large classes	8	20.0
Inadequate teaching resources	7	17.5
Lack of adequate time	6	15.0
Heavy teaching load	5	12.5
Lack of cooperation from the school administration	4	10.0
<b>Total</b>	<b>40</b>	<b>100</b>

From the table 4.7, challenges facing teachers when using ASEI/PDSI Approach included pressure to cover the syllabus 25.0%, large classes 20.0%, lack of adequate time 15.0%, heavy teaching load 12.5%, inadequate teaching resources 17.5% and lack of cooperation from the school administration 10.0%. This implies that teachers

face a lot of challenges when implementing ASEI/PDSI Approach. On challenges facing teachers while using ASEI/PDSI approach, the head teachers revealed that pressure to cover the syllabus is the major challenge teachers face while using ASEI/PDSI in teaching science, other challenges cited include large classes, lack of time, inadequate teaching resources.

In addition, the study undertook to establish the challenges by the students too.

**Table 4.8 Challenges facing pupils in use of ASEI/PDSI approach**

Statements	Pupils	
	Frequency	Percentage
Pressure to cover the syllabus	120	48.0
Inadequate teaching resources	70	28.0
Large classes	60	24.0
<b>Total</b>	<b>250</b>	<b>100.0</b>

From the table 4.8 on challenges facing pupils while using ASEI/PDSI Approach included pressure to cover syllabus 48.0%, inadequate teaching and learning resources 28.0%, and large classes 24.0%. This implies that pupils face challenges in using ASEI/PDSI, the major challenge as pressure to cover the syllabus.

#### **4.4 Chapter Summary**

This chapter dealt with data analysis, interpretation and presentation of the study findings. Data was analysed in a thematic form based on the following objectives: To establish the extent to which ASEI/PDSI approach is used in teaching and learning of science, To establish the level of competency among science teachers in using ASEI/PDSI approach in teaching science, To establish the influence of ASEI/PDSI towards teacher attitudes in teaching science, to establish the pupils attitude towards learning of science using ASEI/PDSI approach and to establish challenges faced by the teachers and pupils while using ASEI/PDSI approach.

The major findings of the study is that science teachers have a high understanding of the ASEI-PDSI approach and hence well prepared to implement the approach in their lessons. However, teacher's use of the ASEI-PDSI approach in their lessons is inadequate. Also science teachers rarely utilize the ASEI-PDSI approach in science lessons thus impeding effective implementation of the approach hence poor performance in KCPE examinations.

## **CHAPTER FIVE**

### **SUMMARY CONCLUSION AND RECOMMENDATION**

#### **5.1 Introduction**

This chapter gives the summary of the findings, conclusion, recommendations and suggestions for further research. The purpose of the study was an assessment of ASEI/PDSI instructional approach in teaching and learning of sciences in public primary schools in Baringo Central Sub County. The findings presented in chapter four have shed some light regarding the degree of understanding and usage of the ASEI-PDSI approach by science teachers, the degree of supervision of the ASEI-PDSI approach by science teachers, challenges encountered in the implementation of the ASEI-PDSI approach, and suggestions offered by science teachers and Science teachers on ASEI/PDSI instructional approach in teaching and learning of sciences in public primary schools.

#### **5.2 Summary of the Study Findings**

##### **5.2.1 Extent of use of ASEI/PDSI approach in teaching science**

The following is the summary of the study findings 62.5% of the Science teachers extensively use the learning materials within the environment 32.5% some extent use while 5.0% of the Science teachers rarely use. On finding out if Science teachers were able to encourage peers in teaching their classes, 65.0% extensively encourage peer teaching, 25.0% in some extent encourage, 5.0% undecided, and 5% never encourage peer teaching, implying that majority of the Science teachers encourage peer teaching in their classes.

On finding out if Science teachers encouraged group work in their classes 87.5% of the Science teachers extensively encouraged group work in their classes, 7.5% in some extent while 5.0% were not sure if they encouraged group work or not. The results reveal that most of the Science teachers encouraged use of group work in their classes.

Further, the study sought to find out if the Science teachers used experiment during the science lessons from the findings 62.5% of the respondents extensively use experiments during the science lessons, 27.5% in some extent while 10.0% were undecided, this reveals that teachers use experiment during science lessons.

Also the study sought to find out if Science teachers involves their pupils in science lesson, 85.0% of the Science teachers extensively involves pupils in their science lessons while 15.0% in some extent involves pupils, revealing that the entire Science teachers involves their pupils in their science lessons. From the results 90.0% of the science teachers in public primary schools in Baringo Central Sub County agreed that ASEI/PDSI approach has been utilized in teaching of science in school. While 10.0% disagreed that it isn't utilized Science teacher also said that most teachers enjoyed use of ASEI/PDS approach in teaching of their pupils.

### **5.2.2 Level of competence among science teachers in using ASEI/PDSI approach**

Objective two was to determine the level of competence among science teachers in using ASEI/PDSI approach in teaching science. To achieve this objective the study looked at the following variables, ability to link the class activities and lesson, ability to link class activities and concept taught, ability to guide the class activities

according to syllabus and ability to use local environment resources. and ability to improvise use of teaching materials. 62.5% of the science teachers strongly agreed that science teachers were able to improvise the teaching materials while teaching, 32.5% agreed that teachers improvised use teaching materials. Ability to link the class activities and lesson on finding if their science teachers had the ability to link the class activities and the lesson 65.0% of the science teacher strongly agreed that their teachers had the ability to link the class activities and contents taught, 30.0% agreed while 5.0% were undecided. The pupils 42.0% strongly agreed that tier teachers linked the class activities and the concept taught, 46.8% agreed 9.6% strongly disagreed while 0.4% was undecided. From the results it's revealed that science teachers in Baringo Central Sub County were able to link the class activities and content taught while teaching and learning of science subjects.

### **5.2.3 Influence of ASEI/PDSI approach towards teachers attitude in teaching science**

The study went further to find out the whether science teachers had the ability to guide the class activities according to the syllabus. 85.0 % of the pupils agreed that their science teachers had the ability to guide the class activities according to the syllabus, class activities were guided according to the syllabus by teacher 42.0% agreed, Ability to use local environment resources, Baringo Central Sub County primary science teachers had the ability to use local environment resources with 67.5% of the Science teacher strongly agreeing to it, 32.5% agreed while 10.0% were undecided. Science teachers explained the topic in a simple manner in Baringo Central Sub County with 95.8% agreeing to it. It therefore goes without saying that it

is imperative for a school to not only have teaching resources but ensure they are adequate enough so as to enhance effective teaching of Science. Also 90.0% of the science teachers were competent in use of ASEI/PDSI approach in teaching of science in primary school in Baringo Central Sub County primary schools. Science teachers use experiments during science lessons 90.0%, implying that science teachers welcomed of ideas from all pupils.

#### **5.2.4 Influence of pupils attitude towards science learning using ASEI/PDSI approach**

60.0% of the pupils strongly agreed that they liked participating in science activities 36.0% agreed 2.8% were undecided while 1.2% strongly disagreed. On finding out from the teachers if their learners participated in science activities 67.5% of the teachers strongly agreed that pupils participated in science activities, 22.5% were undecided. Implied that pupil's attitude towards ASEI/PDSI approach is positive. 63.2% of the pupils of Baringo Central Sub County primary schools strongly agreed that they liked doing practical during science lessons, Revealing that most of the pupils in the schools liked doing practical during science lessons. Good quality practical work can engage student's help them develop important skills and develop their understanding concepts. Looking at pupil's link group discussions 98.0% of the pupils agreed that they liked group discussion during class lessons. Own prediction during science lessons were practised in Baringo Central Sub County with 95.0% of the teachers strongly agreeing that their learners gave their own predictions during science.

### **5.2.5 Challenges faced by the teachers while using ASEI/PDSI approach**

challenges facing teachers when using ASEI/PDSI Approach included pressure to cover the syllabus 25.0%, large classes 20.0%, lack of adequate time 15.0%, heavy teaching load 12.5%, inadequate teaching resources 17.5% and lack of cooperation from the school administration 10.0%. This implies that teachers face a lot of challenges when implementing ASEI/PDSI Approach. Challenges facing pupils while using ASEI/PDSI Approach included pressure to cover syllabus 48.0%, inadequate teaching and learning resources 28.0%, and large classes 24.0%. This implies that pupils face challenges in using ASEI/PDSI, the major challenge as pressure to cover the syllabus.

## **5.2 Conclusions**

### **Use of ASEI/PDSI approach in teaching and learning of science**

The study further concluded that science teachers in the area were using local available resources in their lessons, thus making the pupils easy to understand. This is in agreement with studies by Adeyanju (2007) which stated that learning and teaching is the concern of the trained teacher. But learning is a complex process. It can however be defined as a change in disposition; a relatively permanent change in behaviour overtime and this is brought about by experience. Learning can occur as a result of newly acquired skill, knowledge, perception, facts, principles, new information at hand etc., Learning can be reinforced with learning aids of different variety because they stimulate, motivate as well as arrest learner's attention for a while during the instructional process. Learning aids are instructional materials and devices through which teaching and learning are done in schools. Examples of



learning aids include visual aids, audio-visual aids, real objects and many others. The visual aids are designed materials that may be locally made or commercially produced. They come in form of wall-charts illustrated pictures, pictorial materials and other two dimensional objects. There are also audio-visual aids. These are teaching machines like radio, television, and all sorts of projectors with sound attributes.

### **Level of Competence among Science Teachers in Utilization of ASEI/PDSI Approach**

From the findings, it can be concluded that science teachers have a high understanding of the ASEI-PDSI approach and hence well prepared to implement the approach in their lessons. The study further concluded that most of the science teachers were competent in using ASEI-PDSI approach thus finding the approach to be very helpful and making the understanding of science concepts easy. This finding were in line with Moloji, Morobe & Urwick (2008) in the study of free primary education (FPE) which found that teacher's poor knowledge of content and pedagogy surfaced in the teaching of mathematics with the deficiencies attributed partly to their training and partly to the situation in the schools. However, teacher's use of the ASEI-PDSI approach in their lessons is inadequate as revealed in this study. It can also be concluded that science teachers rarely utilize the ASEI-PDSI approach in science lessons thus impeding effective implementation of the approach hence poor performance in KCPE examinations.

### **Influence of ASEI/PDSI Approach towards Teachers Attitude in Teaching Science**

Teacher classroom interactions that aid students learning are often complex process that depends on interpersonal and pedagogical awareness. According to Morrison, Bachman and Connor (2005) the teacher pedagogy, classroom management strategies, and interaction with students at the classroom level can determine how much is learned. Therefore learning is contingent on teachers' ability to create and sustain optimal learning environments. In this study therefore, the finding agrees with the above studies reviewed.

### **Influence of Pupils Attitude towards the Use of ASEI/PDSI Approach in Learning Science**

The study concludes that the pupils attitude towards ASEI/PDSI approach in learning science was positive this is because the approach involved the practical areas which made the pupils see the reality of life situation and enjoys the science lessons. They said pupils like doing experiments and with the use of experiments there is improved understanding of scientific concepts and principles

### **Challenges Facing Teachers While Implementing ASEI/PDSI Instructional Approach:**

The study concludes that both the teachers and the pupils face a lot of challenges when it comes to the use of ASEI/PDSI approach in learning science. The study also concludes that implementation of the approach faces some challenges as revealed in this study. Such challenges include pressure to cover the syllabus, large classes, lack of adequate time, heavy teaching load, inadequate teaching resources, and lack of

cooperation from the school administration, student absenteeism, and discouragement from other teachers.

### **5.3 Recommendations**

Based on the findings from this study, the researcher makes the following recommendations in order to address of ASEI/PDSI instructional approach in teaching and learning of sciences in public primary schools in Baringo County, and also in all the schools in the country:

- (i) This study revealed that teachers have a high understanding of the ASEI -PDSI approach. Strengthening of that understanding will therefore be worthwhile. Consequently, this study recommends that follow-up efforts should be made to further improve teachers understanding in using the ASEI-PDSI approach. Follow-up efforts could take various forms, from school-level professional development activities to future nationwide in-service refresher training.
- (ii) As this study revealed, some components of the ASEI-PDSI approach were adequately practiced while others were either inadequately practiced or not practiced at all. It is, therefore, recommended that the Ministry of Education should organize an INSET focusing on components of the ASEI-PDSI approach whose extent of implementation was inadequate.
- (iii) This study identified large classes as a constraint to the implementation of the ASEI- PDSI approach. To address this challenge, it is

recommended that the Teachers Service Commission should recruit more teachers to fill the gaps.

- (iv) This study identified pressure to cover the syllabus as the major constrain. To address this challenge the Kenya Institute of Curriculum Development should introduce double lessons for Maths and Science in schools.

#### **5.4 Suggestions for Further Research**

The following are the researcher's suggestions for further study:

1. Since the study was limited to public primary schools within Baringo Central Sub County there is a need to carry out an extensive similar study for the whole Baringo County.
2. The study used the questionnaire and interview schedules as the main instruments of data collection. Future studies should include other methods of data collection so as to cater for all groups.
3. A further study about the topic to be carried out at higher levels of education, for instance Doctor of Philosophy level by the researcher/other researchers.

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## APPENDICES

### APPENDIX I: INFORMED CONSENT LETTER

Dear Science teacher,

I am a postgraduate student of Moi University carrying out a study on “an assessment of SMASE PROJECT by application of ASEI/PDSI approach in teaching and learning of sciences in public primary schools in Baringo Central District”. I kindly request you to answer the questions below. All responses will be handled confidentially and will be used only for this study. This questionnaire therefore is to help me collect information from you for purely academic purpose.

You are therefore kindly requested to participate and respond as best as you can to items in the questionnaire. The information provided will be treated with utmost confidentiality and will be used only for the purpose of this study.

Let me take this opportunity to thank you in advance for taking part in this study.

Yours sincerely,

**AYABEI JAMES KIPYATOR**

**EDU/PG/EDH/1004/11**

.....

## **APPENDIX II: SCIENCE TEACHERS QUESTIONNAIRE**

I am a Post graduate student of Moi University and carrying out a research study on the “an assessment of ASEI/PDSI approach in teaching and learning of sciences in public primary schools in Baringo Central Sub County” in partial fulfillment for the award of the degree of Masters of philosophy in Early childhood Education, Moi University, Kenya

### **Matters to Note**

The information given on this questionnaire will be held in strict confidence and will be used only for the purpose of study

You are requested to read each question carefully and provide your honest response.

Please tick (√) on your appropriate response or please write your answers in the spaces provided

### **SECTION A: BACKGROUND INFORMATION**

1. Gender:     Male [  ]                             Female [  ]
  
  2. How long have you been in your present institution as teacher?
 

0 - 5years	[ <input type="checkbox"/> ]	6 – 10 years	[ <input type="checkbox"/> ]	11 - 15 years	[ <input type="checkbox"/> ]
16 – 20 years	[ <input type="checkbox"/> ]	Over 20 years	[ <input type="checkbox"/> ]		
  
  3. To establish the extent in the use of ASEI/PDSI approach in teaching and learning of science
- The following are some of the factors indicating the use of ASEI/PDSI in teaching and learning of science.

Please tick inside the box corresponding to your response appropriately

**Extent, some extent, rarely, undecided, never**

<b>Statement</b>	<b>Extent</b>	<b>Some extent</b>	<b>Rarely</b>	<b>Undecided</b>	<b>Never</b>
<b>Maximum use of learning materials within environment</b>					
<b>Encourage peer teaching in the class</b>					
<b>Encourage of group work</b>					
<b>Use of experiment during science lessons</b>					
<b>Involve pupils in their science lessons</b>					

4. (i) Do you think that ASEI/PDSI approach has been well utilised in teaching of Science in your school?

Yes ( ) No ( )

(ii). Please in your own words explain briefly the use of ASEI/PDSI by science teachers in your school.

.....

.....

.....

**4. Level of Competency Among Teachers on the Use of ASEI/PDSI**

**Approach in Teaching of Science**

What levels of competency do teachers have using ASEI/PDSI approach? Tick appropriately in the boxes below to indicate the weight of the response.

**SA-strongly agree, A-agree, U-undecided, D-disagree, SD-strongly disagree.**

<b>Statement</b>	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>
<b>Weighted scale</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Able to deliver the subject content					
Logical flow of activities during the lesson					
Able to improvise teaching material					
Ability to link the class activities and the lesson					
Able guide the class activities according to the syllabus					
Ability to use local environment resources					

6. (i) Are you competent enough in using ASEI/PDSI approach in teaching science?

Yes ( ) No ( )

(ii) Please comment on your answer above.

.....

.....

**7. Influence of ASEI/PDSI approach towards teachers attitude in teaching of science.**

Do you think teachers are positively inclined towards the use of ASEI/PDSI approach in the teaching of Science? Please tick (√) appropriately to show your level agreement.

**SA-strongly agree, A-agree, U-undecided, D-disagree, SD-strongly disagree.**

Statement	SA	A	U	D	SD
<b>Weighted scale</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Science teachers make science interesting by involving the pupils					
Science teachers uses guided discussions during science lessons					
Science teachers solicits ideas from all the pupils					
Science teachers uses experiments during science lesson					
Science teachers makes fully use of science resources by allowing us improvise them					

8. (i) Does ASEI/PDSI approach bring about the desired attitude change in you?

Yes ( ) No ( )



(ii) Please state how this approach has affected you in the teaching of science using ASEI/PDSI approach.

.....

.....

**9. To establish the pupils' attitude towards learning of science using ASEI/PDSI approach.**

The research seeks to establish the attitude of pupils in teaching of science using ASEI/PDSI approach and the following factors were considered. Please tick appropriately

(√).

**SA-strongly agree, A-agree, U-undecided, D-disagree, SD-strongly disagree.**

<b>Statement</b>	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>
<b>Weighted scale</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Learners are able to link lesson activities and concept taught					
Learners interact with teaching and learning resources					
Learners participate in science activities					
Learners express themselves as the lesson progresses					
Learners give interactive ideas					
Learners give their own predictions					
Pupils discover information and making learning real					

10. How do you find the pupils attitude towards the teaching of science using

ASEI/PDSI

approach?.....

.....

11. What are the challenges you face as a teacher while using ASEI/PDSI approach?

### APPENDIX III: PUPIL QUESTIONNAIRE

I am a Post graduate student of Moi University and carrying out a research study on the “an assessment of ASEI/PDSI approach in teaching and learning of sciences in public primary schools in Baringo Central Sub County” in partial fulfillment for the award of the degree of Masters of philosophy in Early childhood Education, Moi University, Kenya

#### Matters to Note

The information given on this questionnaire will be held in strict confidence and will be used only for the purpose of study

You are requested to read each question carefully and provide your honest response.

Please tick (√) on your appropriate response or please write your answers in the spaces provided

#### SECTION A: BACKGROUND INFORMATION

##### Section A: Demographic Profile

1. Gender

Male [ ] Female [ ]

2. Age

Below 7 years [ ] 7-10 years [ ] 11- 15 years [ ] above 15 years [ ]

3. Do teachers in your school involve you in learning of Science subject?

Yes [ ] No [ ]

4. Do you carry practical activities during science lessons?

Yes [ ] No [ ]

5. Do lesson involve improvisation of teaching / learning resources?

Yes [ ] No [ ]

### 6. Extent of use of ASEI/PDSI Approach by science teachers

What extent do your science teachers use ASEI/PDS approach during science lessons? Please tick appropriately in the boxes below

Statement	Extent	Some extent	Rarely	Undecided	Never
Maximum use of learning materials within environment					
Encourage peer teaching in the class					
Encourage of group work					
Use of experiment during science lessons					
Involve pupils in their science lessons					

### 7. Level of competency among teachers on the use of ASEI/PDSI approach in teaching of science

What are your teacher competencies in using ASEI/PDSI approach? Please tick appropriately in the boxes below.

**SA-strongly agree, A-agree, U-undecided, D-disagree, SD-strongly disagree**

<b>Statement</b>	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>
<b>Weighted scale</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Able to deliver the subject content					
Logical flow of activities during the lesson					
Able to improvise teaching material					
Ability to link the class activities and the lesson					
Able guide the class activities according to the syllabus					

8. Do you like how your teacher organises science activities?

.....

.....

**9. Influence of ASEI/PDSI approach towards teacher attitude in teaching of science.**

Do you think teachers are positively inclined towards the use of ASEI/PDSI approach in the teaching of science in the below mention areas? Please tick in the boxes appropriately to show your level agreement to the statements.

**SA-strongly agree, A-agree, U-undecided, D-disagree, SD-strongly disagree**

<b>Statement</b>	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>
<b>Weighted scale</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
Science teachers make science interesting by involving the pupils					
Science teachers uses guided discussions during science lessons					
Science teachers solicits ideas from all the pupils					
Science teachers uses experiments during science lesson					
Science teachers makes fully use of science resources by allowing us improvise them					

10. (i) Do you enjoy science lessons?

Yes ( )                      No ( )

(ii) Please comment on your answer above.

.....

.....

**11. To establish the pupils' attitude towards learning of science using ASEI/PDSI approach.**

The research seeks to establish the attitude of pupils in teaching of science using ASEI/PDSI approach and the following factors were considered. Please tick appropriately (√)

**SA-Strongly agree, A- Agree, U-Undecided, D-Disagree, SD-Strongly disagree.**

<b>Variable</b>	<b>SA</b>	<b>A</b>	<b>U</b>	<b>D</b>	<b>SD</b>
<b>Weighted scale</b>	<b>5</b>	<b>4</b>	<b>3</b>	<b>2</b>	<b>1</b>
I like doing practical's during science lessons					
I enjoy doing experiments during science lessons					
I like participating in science activities					
I like group discussions during class lessons					
I like group work during science lessons					
I like using improvised materials during science lessons					

12. What challenges do you face as a pupil in learning science?

.....

.....

#### **APPENDIX IV: INTERVIEW SCHEDULE FOR HEADTEACHERS**

I am a post graduate student of Moi University and carrying out a research study on the assessment of ASEI/PDSI approach in teaching and learning of science in public primary schools in Baringo Central Sub County in partial fulfilment for the ward of the degree of masters of philosophy in Early Childhood Education Moi University Kenya.

1. Does ASEI/PDSI approach enhance the teaching and learning of science in your school?

Yes ( )      No ( )

Please give reasons for responses above.

.....  
 .....

2. Do you think ASEI/PDSI approach has been well utilized by science teachers in teaching of science in your school?

.....  
 .....

3. Are science teachers competent enough in the use of ASEI/PDSI approach in your school?

.....  
 .....

4. Does ASEI/PDSI approach bring about desired change among science teachers in your school?

.....  
 .....



5. How do you find the pupil's attitude towards ASEI/PDSI approach in your school?

.....  
.....

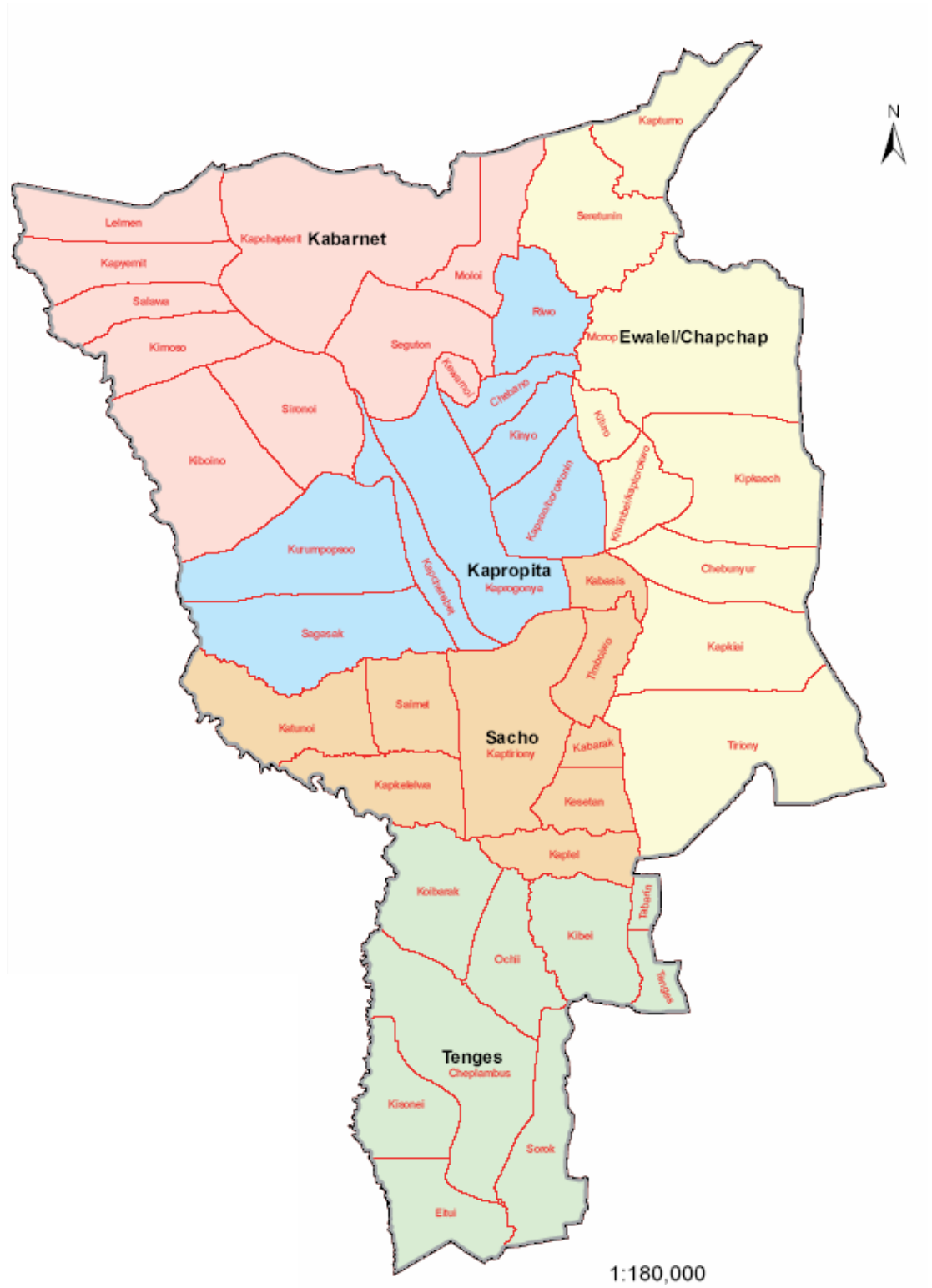
6. What are the challenges teachers faces while using ASEI/PDSI approach in your school?

.....  
.....

## APPENDIX V: LIST OF SCHOOLS IN BARINGO CENTRAL SUB COUNTY

- |                      |                 |                 |
|----------------------|-----------------|-----------------|
| 1. Chebunyur         | 41. Pemwai      | 81. Kiboi       |
| 2. Kingshill         | 42. Mogorwa     | 82. Kapkut      |
| 3. Chemoe            | 43. Kapsigorian | 83. Kaploten    |
| 4. Kaboset           | 44. Kesetan     | 84. Kamgoin     |
| 5. Mumol             | 45. Tilelon     | 85. Kapsogo     |
| 6. A.I.C Visa Oshwal | 46. Ngetmoi     | 86. Kitumbei    |
| 7. Kipkutuny         | 47. Sirwet      | 87. Saimet      |
| 8. Tandui            | 48. Tartar      | 88. Magonoi     |
| 9. Moi-teachers      | 49. Cheplongon  | 89. Kabarbarma  |
| 10. Kaplel           | 50. Kimoso      | 90. Salawa      |
| 11. Moi-Timowo       | 51. Kaptorokwo  | 91. Kabarnet    |
| 12. Sironoi          | 52. Kabasis     | 92. Sesya       |
| 13. Timboiywo        | 53. Kiponjos    | 93. Kaptalam    |
| 14. Lelgut           | 54. Kaptich     | 94. Riwo        |
| 15. Bosin            | 55. Kapkokwon   | 95. Kurumbopsoo |
| 16. Tabarin          | 56. Kituro      | 96. Katunoi     |
| 17. Sigowo           | 57. Kapropita   | 97. Tebei       |
| 18. Emom             | 58. Kabirmoi    | 98. Kapchemon   |
| 19. Kapsoo           | 59. Tereben     | 99. Manach      |
| 20. Bekibon          | 60. Kiptilit    | 100. Kimagok    |
| 21. Ochii            | 61. Sangarau    | 101. Kiplabal   |
| 22. Christ Dominion  | 62. Chesongo    | 102. Senetwo    |
| 23. Eitui            | 63. Kapchomuso  | 103. Lelbatai   |
| 24. Kiboino          | 64. Kisonei     | 104. Kaseret    |
| 25. Kasore           | 65. Kaiso       | 105. Siginwo    |
| 26. Seguton          | 66. Tuluongoi   | 106. Sogon      |
| 27. Buiwo            | 67. Kapkomoi    | 107. Kaptimbor  |
| 28. Koyorus          | 68. Borowonin   | 108. Tinomoi    |
| 29. Tenges           | 69. Rosobet     | 109. Kaptumo    |
| 30. Kapkelelwa       | 70. Kipkaech    | 110. Kabirmet   |
| 31. Orokwo           | 71. Sosion      | 111. Ketindui   |
| 32. Kabochony        | 72. Kamwen      | 112. Kapyemit   |
| 33. Talai            | 73. Kisok       | 113. Illigat    |
| 34. Sorok            | 74. Bokorin     | 114. Kakwane    |
| 35. Ngolong          | 75. Kapkatit    |                 |
| 36. Eron             | 76. Kewamoi     |                 |
| 37. Kipsoit          | 77. Kaptara     |                 |
| 38. Bakwanin         | 78. Konoioyo    |                 |
| 39. Kapngelel        | 79. Sereton     |                 |
| 40. Seretunin        | 80. Turkwo      |                 |

**APPENDIX VI: MAP OF BARINGO CENTRAL DISTRICT**



**APPENDIX VII: SCIENCE PERFORMANCE IN KCPE FOR THE LAST  
FOUR YEARS IN BARINGO COUNTY**

<b>SUB DISTRICTS</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>
ELDAMA RAVINE COUNTY	61.62	59.40	64.56	61.92
MOGOTIO COUNTY	61.40	60.47	63.89	62.91
<b>BARINGO CENTRAL SUB COUNTY</b>	<b>59.64</b>	<b>56.63</b>	<b>60.75</b>	<b>58.50</b>
KABARTONJO COUNTY	59.78	61.79	61.43	59.71
MARIGAT COUNTY	59.85	60.79	60.79	60.00

**Source: County Education Office. Baringo Central Sub County, (2015)**



MOI UNIVERSITY

Tel. Eldoret (053) 43555  
Fax No. (053) 43555

P.O. Box 3900  
Eldoret, Kenya

## SCHOOL OF EDUCATION

REF: MU/SE/PG/54

DATE: 24<sup>th</sup> March, 2014

The Executive Secretary  
National Council for Science and Technology  
P.O. Box 30623-00100  
**NAIROBI**

Dear Sir/Madam,

**RE: RESEARCH PERMIT IN RESPECT OF  
AYABEI JAMES KIPYATOR ~ EDU/PG/EDH/1004/11**

The above named is a 2<sup>nd</sup> year Master of Education (M.Ed) student at Moi University, School of Education, Department of Curriculum, Instruction and Educational Media.

It is a requirement of his M.Ed studies that he conducts research and produces a thesis. His research is entitled:

**“Assessment of SMASE Project by Application of ASEI/PDSI Instructional Approach in Teaching and Learning of Sciences in Public Primary Schools in Baringo Central District.”**

Any assistance given to him to facilitate the successful conduct of his research will be highly appreciated.

Yours faithfully,

**PROF. P. L. BARASA**  
**DEAN, SCHOOL OF EDUCATION**

PLB/d6

**THIS IS TO CERTIFY THAT:**  
**MR. JAMES KIPYATOR AYABEI**  
**of MOI UNIVERSITY SCHOOL OF**  
**EDUCATION, 179-30400 KABARNET,has**  
**been permitted to conduct research in**  
**Baringo County**

**Permit No : NACOSTI/P/14/2562/2303**  
**Date Of Issue : 7th August,2014**  
**Fee Received :Ksh 1,000**

**on the topic: ASSESSMENT OF SMASSE**  
**PROJECT BY APPLICATION OF ASE/PDSI**  
**INSTRUCTIONAL APPROACH IN**  
**TEACHING AND LEARNING IN PUBLIC**  
**PRIMARY SCHOOLS IN BARINGO**  
**CENTRAL DISTRICT**

**for the period ending:**  
**23rd December,2014**

**Applicant's**  
**Signature**

**Secretary**  
**National Commission for Science,**  
**Technology & Innovation**

**CONDITIONS**

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



**REPUBLIC OF KENYA**



**National Commission for Science, Technology and Innovation**

**RESEARCH CLEARANCE PERMIT**

**Serial No. A21476**

**CONDITIONS: see back page**



**NATIONAL COMMISSION FOR SCIENCE,  
TECHNOLOGY AND INNOVATION**

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

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

Ref: No.

Date:

**NACOSTI/P/14/2562/2303**

**7<sup>th</sup> August, 2014**

James Kipyator Ayabei  
Moi University  
P.O. Box 3900-30100  
**ELDORET.**

**RE: RESEARCH AUTHORIZATION**

Following your application for authority to carry out research on "*Assessment of SMASSE project by application of ASE/PDSI instructional approach in teaching and learning in public primary schools in Baringo Central District,*" I am pleased to inform you that you have been authorized to undertake research in **Baringo County** for a period ending **23<sup>rd</sup> December, 2014.**

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

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

  
**SAID HUSSEIN**  
**FOR: SECRETARY/CEO**

Copy to:

The County Commissioner  
The County Director of Education  
Baringo County.





## OFFICE OF THE PRESIDENT

Telephone. 053-21285  
 Fax. (053)-21285  
 E-Mail:  
 baringocountycommissioner@yahoo.com  
 baringocountycommissioner@gmail.com

MINISTRY OF INTERIOR  
 AND CO-ORDINATION  
 OF  
 NATIONAL GOVERNMENT

COUNTY COMMISSIONER'S OFFICE,  
 BARINGO COUNTY,  
 P.O. BOX 1 - 30400  
KABARNET.

When replying please quote:

REF.NO.ADM.18/2 VOL.I/44

11<sup>TH</sup> SEPTEMBER, 2014

**TO WHOM IT MAY CONCERN:**

**RE: RESEARCH AUTHORIZATION**

This is to confirm that **JAMES KIPYATOR AYABEI** of Moi University has been authorized to carry out research on ***"Assessment of SMASE Project by Application of ASEI/PDSI Instructional Approach in Teaching and Learning of Sciences in Public Primary Schools in Baringo Central District"*** for a period ending **23<sup>rd</sup> December, 2014**

Please accord him the necessary assistance during the exercise.

**N.K. TONU**

COUNTY COMMISSIONER  
 BARINGO COUNTY

**For: COUNTY COMMISSIONER  
BARINGO COUNTY**

## REPUBLIC OF KENYA


 MINISTRY OF EDUCATION, SCIENCE & TECHNOLOGY  
 STATE DEPARTMENT OF EDUCATION

 OFFICE OF THE COUNTY DIRECTOR  
 (BARINGO COUNTY).

 Our Email: countyedubaringo@gmail.com  
 Tel / Fax: 053/21282

 P.O. BOX 664  
KABARNET

REF: BAR/CDE/RESEARCH.GEN/VOL.1/NO. 27/88


11/09/2014

 James Kipyator Ayabei  
 Moi University  
 P. O. Box 3900-30100  
Eldoret.
**RE: RESEARCH AUTHORIZATION.**

This office has received a letter Ref: NACOSTI/P/14/2562/2303 dated 7<sup>th</sup> August, 2014 requesting for authority to allow you carry out research on *"Assessment of SMASE project by application of ASEI/PDSI instructional approach in teaching and learning of science in public primary schools in Baringo Central District"*.

We wish to inform you that the request has been granted for a period ending 23<sup>rd</sup> December, 2014. The authorities concerned are therefore requested to give you maximum support.

We take this opportunity to wish you well during this research.

  
 DANIEL K. K. MOSBEI  
 COUNTY DIRECTOR OF EDUCATION  
BARINGO.

CC

- Sub - County Education Officer - Baringo Central