EXTENT AND CHALLENGES OF IMPLEMENTATION OF ASEI-PDSI APPROACH IN TEACHING OF SCIENCE IN PRIMARY SCHOOLS IN EMUHAYA SUB-COUNTY, VIHIGA COUNTY, KENYA

BY

NAMUYENGA WINROSE SARA AMBASA

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MASENO UNIVERSITY

DECLARATION

I confirm that this thesis is my original work and has not been presented for a degree in any university or institution. No part of this work should be reproduced without written permission from either the author or Maseno University.

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Namuyenga Winrose Sara Ambasa Date

ADM NO. PG/MED/00071/2013

This thesis has been submitted for examination under our guidance and approval as university supervisors

_____ _____

Dr. Mildred Ayere Date

Department of Educational Communication, Technology and Curriculum Studies,

Maseno University

_____ _____

Dr. Joseph Rabari Date

Department of Educational Communication, Technology and Curriculum Studies,

Maseno University

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ABSTRACT

Activity, Student, Experiment, Improvisation (ASEI) and Plan, Do, See, Improve (PDSI) is a pedagogical strategy advocated by Strengthening of Mathematics and Science Education (SMASE) program since 2010 to refocus the pedagogical practice of mathematics and science teachers and enhance learner achievement. During the life of SMASE, Sabatia, Vihiga, Kisumu West and Gem Sub-Counties neighboring Emuhaya consistently improved in science (ranging between 55-60%), unlike Emuhaya where performance did not differ from the mean score of 50% registered before the initiation of SMASE. This dismal performance has been blamed on laxity in the implementation of ASEI-PDSI by science teachers in Emuhaya Sub-County. This study investigated the extent and challenges of implementation of ASEI-PDSI in primary school science teaching in Emuhaya Sub-County. The objectives of the study were to determine: the extent of use of ASEI-PDSI approach in teaching of science in primary schools; the extent to which primary school head teachers supervise the implementation of ASEI-PDSI approach in science lessons and the challenges faced by primary school science teachers in implementing ASEI-PDSI. The study was anchored on Vygotsky's postulates of the zone of proximal development. A descriptive survey design was employed. The target population comprised 100 head teachers, 100 science panel heads, 300 classes 6, 7 and 8 science teachers, 1 QASO and 4,959 class 8 learners. Stratified and simple random sampling were used to obtain a sample of 33 head teachers, 100 science teachers, 33 science panel heads and 496 class eight learners. Saturated sampling was used to obtain 1 QASO. Data was collected using questionnaires, interview schedules and document analysis guide. Reliability of the instruments was determined through a pilot study involving 10% of the population using the test-retest method and the instruments appropriately revised to achieve a reliability of .85 for Questionnaire for Science Teachers', .81 for Questionnaire for Head Teachers and .79 for Questionnaire for class 8 learners. Validity of the instruments was ascertained by experts from the Department of Educational Communication, Technology and Curriculum Studies, Maseno University. Qualitative data were summarized in themes and categories based on objectives while quantitative data were analyzed and presented in terms of frequencies, means and percentages. The study revealed that science teachers sometimes used ASEI-PDSI approach in teaching science; the implementation of ASEI-PDSI was sometimes supervised by head teachers, and that science teachers frequently faced a number of challenges like lack of confidence in scientific content and pedagogical knowledge among others. It is hoped that the findings of this study will shed light on the implementation of ASEI-PDSI in science to SMASE, the school administration and the Ministry of Education and provide insight into appropriate improvement of this approach. It is recommended that: QASO, school administration and the science panel heads collaborate to ensure that teachers prepare ASEI lesson plans and use them; head teachers intensify the supervision of the implementation of ASEI-PDSI and give feedback to teachers after supervision and that teachers fully attend and participate in SMASE trainings to gain the scientific skills and confidence in teaching.

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ABBREVIATIONS AND ACRONYMS

ASEI	Activity, Student-centered, Experiment, Improvisation
CEMASTEA	Center for Mathematics, Science and Technology in Africa
ESC	Emuhaya Sub County
HITS	High Impact Teaching Strategies
INSET	In-Service Education and Training
JICA	Japan International Cooperation Agency
KCPE	Kenya Certificate of Primary Education
LCA	Learner Centered Approach
MOE	Ministry of Education
PDSI	Plan, Do, See, Improve
PREMST	Project de Renforcement de l' Enseignement des Mathematiques, des Science et de la Technologie (Strengthening Mathematics, Science and Technology in Education Project).
PTTC	Primary Teacher Training College
PTE	Primary Teacher Examination
QASO	Quality Assurance and Standards Officer
SMART	Specific, Measurable, Achievable, Realistic and Time bound

SMASE	Strengthening of Mathematics and Science Education
SMASSE	Strengthening of Mathematics and Science in Secondary Education
ZPD	Zone of Proximal Development

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CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

Primary science is a subject intended to capture the imagination and curiosity of young children and develop a number of transferable skills including literacy, communication, team work, problem solving and analytical thinking as well as foster a link between children and the world around them (Varley, Murphy & Veale, 2008). Teaching of primary science should engage learners, involving them in questions, puzzles, independent research, investigations, evidence-based debates as well as field trips thus making the subject enjoyable and of fun to young children (Varley, Murphy & Veale, 2008). Primary science teaching therefore ought to embrace learner-centeredness.

Learner-centered approach (LCA) is a learning strategy that puts the pupil at the focal point. In this approach, there is a shift from the teacher to the learner. The learner is at the heart of the learning process and the teacher mainly facilitates the process by guiding. In this scenario, the teacher should consider the varying learning ability among pupils. This LCA ensures pupils independence via active participation (MacHemer,P.L. & Crawford, 2007). LCA gives an intrinsic motivation for learning mainly emphasizing on cooperation rather than competition among learners (Tsui, 2002).

Researchers and policy makers around the world have endorsed the use of learner-centered pedagogies which highlight minimal teacher lectures, multiple small group activities that engage students in discovery learning or problem solving and frequent student questions and discussions (Leu & Price-Rom, 2006). In western societies, teachers and students have been exposed to this

approach through public debates and real life experiences in the classroom. For instance, United States, Canada and European Union spend significant resources to promote Learner-Centered approach at all levels of education (Sablonniere, Taylor & Sadykova, 2009). European education faces major impediments in ensuing opportunities of globalization and accelerated technological developments with new providers, new learners and new types of learning. Leaner-centered approach and mobility will help develop competences they need in the changing labor market and will empower them to become active and responsible citizens (Bologna, 2009). The implementation of learner-centered approach in Europe moves students towards accepting more of the responsibility for their learning, leading to development of greater capabilities for lifelong learning (Bucharest, 2010).

In Central Asia, the spread of LCA among educators is hindered by lack of communication among educators, few conferences and workshops as well as limited professional programs that have the ability to unify representatives of similar pedagogical orientation, (Sablonniere, Taylor & Sadykova, 2009).

Learner-centered teaching has become popular in Sub-Sahara Africa and has received support from the donor community (Schweisfurth, 2011; Sriprakash, 2010). While learner-centered approaches are encouraged by its proponents, implementation of these approaches has mostly failed (Schweisfurth, 2011). In Namibia, a study by Ottevanger (2001) revealed that despite physical science teachers making significant strides towards the use of learner-centered methods of teaching, they used lecture methods in their classrooms. Ottevanger, 2001 reported that teachers preferred methods in which they retained control in the teaching-learning process since methods towards learner-centeredness gave much freedom to learners and therefore less control to the teacher. Teachers preferred learners to sit down quietly in class and listen instead of

making movements in class as they share with each other Ottevanger, 2001). Serbessa (2006) reports that in Ethiopian primary schools, pupils indicated that teaching is the sole responsibility of the teacher and the responsibility for learners is to listen to lecturers, take notes and respond to questions upon request. This was associated to lack of prior experience of active learning, (Serbessa, 2006). Whereas the two studies dwelt on why teachers did not embrace the learner-centered approach in their teaching, this study was keen on investigating the extent and challenges of the implementation of LCA in teaching science in primary schools in Emuhaya Sub-County.in addition to this, Serbessa (2006) associated the classroom practice of teachers to lack of prior experience of active learning which is contrary to this study since the teacher respondents had been initiated on ASEI-PDSI strategy which is a learner-centered method of teaching.

Primary school science is a fundamental aspect in science education since it lays a foundation for all other science subjects. Biology, Physics and Chemistry, all emanate from primary school science. This subject therefore needs to be properly handled by educators at primary level so as to help learners get a smooth transition as they get to the secondary level.

In Kenya, the Strengthening of Mathematics and Science Education (SMASE) program is an In-service Education and Training (INSET) program for science and mathematics teachers in primary schools that aim at improving the quality of teaching and learning to help upgrade the capability of young Kenyans in the fields of mathematics and science, (Center for Mathematics, Science and Technology in Africa [CEMASTEA], 2010). The objectives of SMASE are: to improve pedagogical skills in mathematics and science and to improve the performance of pupils in mathematics and science (SMASE, 2010).

In primary schools, the INSET was commenced in 2010 as one of the components of Strengthening of Mathematics and Science in Secondary Education (SMASSE). Challenges facing the teaching and learning of mathematics and science in secondary schools emanated from the primary level, some of which could be addressed if intervention measures were employed both at primary and secondary level of education. SMASE therefore carried out a needs assessment and chose to address attitude, pedagogy, resource mobilization and management as well as content problems through in-service training for standard 6, 7 and 8 science and mathematics teachers. These classes were targeted due to the presence of difficult topics in their subject curriculum (CEMASTEA, 2009). In Kenya, primary school science aims at helping learners to understand the world around them through acquisition of scientific knowledge, skills and attitudes which enable them realize that problems can be solved. It enhances self-development and provides ways of finding out information, testing ideas and developing a creative mind (K.I.E., 2003).

The objectives of primary science in Kenya are to enable the learner to: develop the ability to observe and explore the environment, develop manual and mental skills for rational decision making, develop creativity and critical thinking in addressing new and emerging challenges, develop and use appropriate skills and technologies for solving problems, develop positive attitudes towards self and the environment, manage and conserve the available resources, improve the body physical fitness and maintain good health, identify and utilize opportunities for productive work in the school, home and community and acquire a basic scientific knowledge and to develop interest in science and science related careers (K.I.E, 2003). This curriculum therefore calls for the teaching of science by doing or carrying out activities using LCA (K.I.E, 2003).

CEMASTEA (2010) realized some laxity in the use of LCA in the teaching of primary school science accounting for poor learner outcome. An INSET for science teachers was therefore formulated to sensitize stakeholders at the national, regional and district levels. Through the INSET, teachers were furnished with better pedagogical skills that would give learners a better opportunity of acquiring the desired knowledge, skills and attitudes to enable them perform better in science. This was believed to appeal and cater for the different individual learning styles, learner interests and abilities that in turn make learners feel involved in class work and eventually raise their performance (CEMASTEA, 2010). The emphasis of these pedagogical skills was made through the Activity, Student, Experiment and Improvisation and Plan, Do, See and Improve (ASEI-PDSI) paradigm (CEMASTEA, 2010).

The ASEI lesson design emphasizes the quality of classroom activities as critical to effective teaching and learning and therefore recommends a shift from teacher-centered instructional methods where learners are passive recipients of activities to learner- centered methods in which the pupils are actively involved in the lesson by carrying out activities (Kibe, Odhiambo & Ogwel, 2008). Between 1998 and 2009, SMASE referred to the conditions prevailing in mathematics and science classes as Pre-ASEI conditions and were characterized by knowledge based teaching, teacher-centeredness, transmission of facts and concepts as well as learning through large scale 'recipe' type experiments described in text books. The program aimed at changing Pre-ASEI conditions to ASEI conditions in which knowledge-based teaching was to be changed to activity-based teaching, teacher-centeredness to learner-centeredness, transmission learning to experiment and research based approach and large scale 'recipe' type experiments to small scale experiments and improvisation.

ASEI lesson therefore advocated for: activity – active, meaningful and constructive participation of the learner in the learning situation through activities so as to gather more (Freedman, 1997; Hofstein, 2003) as reported in (CEMASTEA, 2010), experiments to enhance their understanding of concepts and principles and improvisation to make use of available materials in the learners' immediate environment to raise their interest and curiosity. The effective practice of ASEI requires proper Planning**,** Doing**,** Seeing followed by Improvement - PDSI.

PDSI is 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. The teacher should plan his lesson taking into account the objectives which should be Specific; Measurable; Achievable; Realistic and Time bound (SMART), the level of the learner and their prior knowledge, teaching and learning materials and methods of teaching as well as the criteria of evaluation. During the teaching learning process, the teacher should ensure total involvement of the learner in the lesson and make an evaluation of the lesson verses his plan. Evaluation is vital in reflecting on teaching for improvement and should involve comments from both the teacher and the pupils. This helps to enhance performance and improve learning process (CEMASTEA, 2011).

Benedict (2013) reported inadequate use of ASEI-PDSI approach by teachers in mathematics lessons. He observed that teachers never gave practical work as well as appropriate tasks for discussion to learners. Ndirangu and Nyagah (2013) revealed that a majority of teachers in their study were implementing ASEI-PDSI innovation partially. A study by Odawa, Murundu, Okwara and Bandu (2014) on the impact of biology teachers' perspectives on SMASSE in Emuhaya Sub-County revealed that learner-centered teaching wasn't evident in classrooms even though heads of departments had reported of its use. Sifuna and Kaime (2007) established that

secondary school biology teachers never used the student-centered approach in their classroom practice yet they agreed that the INSET program exposed them to this teaching strategy. Although these studies revealed lack of evidence in the use of LCA in teaching biology, they were not specific on which aspects of LCA were not being implemented according to SMASE and in addition, secondary biology is a level higher than primary science hence their findings can't be generalized to primary science. This study therefore looked at the extent and challenges of implementation of ASEI-PDSI in the teaching of science in primary schools in Emuhaya Sub-County.

Table 1.1 shows the performance of science in KCPE for Emuhaya Sub-County before and after the inception of ASEI-PDSI approach:

Table 1.1: KCPE Sub-County percentage means score for Science examination before and after ASEI-PDSI inception in Emuhaya Sub-County

YEARS BEFORE ASEI-PDSI	PERFORMANCE (%)	YEARS AFTER ASEI-PDSI	PERFORMANCE (%)
2008	50.59	2010	49.69
2009	50.16	2011	49.90
		2012	49.93
		2013	50.41
		2014	50.43
		2015	50.45
		2016	50.23
		2017	50.32
Average mean	50.38		50.17

Source: Sub-County Education Office, Emuhaya (2017)

In Table 1.1, the performance of science in Emuhaya Sub-County eight years after the introduction of teachers to ASEI-PDSI approach, does not actually display a difference

compared to the years before its inception as the mean score for the subject is persistent at 50% compared to its neighboring Sub-Counties where the subject mean score is seen to be on a gradual upward trend. Table 2 displays a comparison between the performance of primary school science in Emuhaya Sub-County and that of its neighboring Sub-Counties; Vihiga, Sabatia, Kisumu West and Gem.

TABLE 1.2: A Comparison of the KCPE percentage mean scores for Science for Emuhaya and its Neighboring Sub-Counties

YEAR	EMUHAYA (%)	SABATIA (%)	VIHIGA (%)	KISUMU WEST (%)	GEM (%)
2010	49.69	55.07	55.00	54.12	55.93
2011	49.90	57.66	57.24	56.07	58.92
2012	49.93	58.76	59.52	58.66	59.74
2013	50.41	59.10	59.60	59.03	60.23
2014	50.43	59.69	60.91	59.95	60.13
2015	50.45	58.09	58.26	57.46	59.66
2016	50.23	59.72	59.87	59.97	60.03
2017	50.32	59.90	60.02	60.21	60.07
Average means score	50.17	58.49	58.80	58.18	59.33

Source: Sub-County Education Offices, Emuhaya, Sabatia, Vihiga, Kisumu West and Gem Sub-Counties (2017)

From Table 1.2, it is evident that the performance of Emuhaya Sub-County in KCPE examination is quite dismal compared to her neighboring Sub-Counties yet the initiation of LCA was done to all the Sub-Counties at the same time. This dismal performance may be as a result of laxity in the implementation of the aspects of LCA by science teachers in Emuhaya Sub-county, CEMASTEA, (2010). It is on this note that this research sought to investigate the Extent and challenges of implementation of ASEI-PDSI in the teaching of science in Emuhaya Sub-County.

Supervision of the implementation of an INSET program is important as it gives regular feedback to the program managers, provides a basis for corrective measures, verifies proper utilization of project resources, ensures that inputs are made available in time and are used to bring the intended outcomes through activities, provides information necessary for implementation of other educational programs and for accountability (SMASE, 2010). Instructional supervision ensures effective implementation of a program and the Teachers' Service Commission (TSC) mandates the school head teacher to carry out supervision on its behalf (Code of Regulation for TSC, 2014).

According to SMASE, the role of head teachers in supervision is to: ensure the implementation of ASEI-PDSI principles through giving essential material; observe the delivery of mathematics and science lessons; advise teachers on the implementation of ASEI-PDSI principles; make follow ups on student achievement progress and give unlimited support for activities aimed at promoting the subjects (SMASSE, 2012). In Koibatek Sub-County, internal supervision of the implementation of SMASSE by the school administration was minimal hence compromising the success of SMASSE in secondary schools (Ngetuny, 2013). Effective supervision of instruction by administrators reinforces and enhances teaching practices that contribute to improved learner outcome (Swartz, 2010). Itolondo (2008) mentioned that observation of teachers during instruction, which is an aspect of supervision, was done in very few schools in his study area hence inadequate use of ASEI-PDSI. Ndirangu and Nyagah (2013) reported that head teachers did not enforce the implementation of ASEI-PDSI in their schools while Benedict (2013) noted that head teachers rarely supervised the implementation of ASEI-PDSI in mathematics lessons in schools in Nyamaiya division. These studies were carried out in secondary schools and were not particular on the extent to which head teachers supervision was not done. This study further

sought to determine the extent to which primary school head teachers supervised the implementation of ASEI-PDSI approach in science lessons in Emuhaya Sub-County.

SMASE trained teachers level of application of SMASE skills had no significant relationship with learner achievement in mathematics and science in primary schools in Murang'a County (Gachahi, Kimani & Ngaruiya, 2013). This was attributed to insufficient period of SMASE training for teachers which could not have given them an opportunity to adopt and apply the SMASE skills in a productive manner. The short period of SMASE training barred educators from proper conception of the ASEI-PDSI principles which they were expected to implement so as to improve learner performance (Gachahi, Kimani & Ngaruiya, 2013). Eight years since the inception of SMASE is a period long enough to spur greater achievements in the performance of science and yet this hasn't been evident in Emuhaya Sub-County. Laidlaw (2009) in his study on challenges facing practicing and pre-service teachers revealed that many primary and pre-service teachers in the New England region are challenged by science due to low levels of confidence in scientific content and pedagogical knowledge, insufficient resources and equipment, time constraints and limited professional development opportunities. In-service teachers involved in the study rated science as their second least preferred subject of the six key learning areas they had in the curriculum. Middleton (2014) while looking at challenges when teaching science in pre-schools adds stress on syllabus coverage and lack of appropriate activities as challenges in science instruction. Conco (2004) mentioned that teachers were unable to implement new teaching procedures championed in the in-set due to lack of understanding. Benedict (2013) observed large classes, inadequate time for preparation, inadequate teaching and learning resources and pressure on syllabus coverage as factors impeding the implementation of ASEI-PDSI.

The aforementioned studies looked at challenges outside Emuhaya Sub-County. The current study aimed at investigating challenges faced by primary school science teachers in the implementation of ASEI-PDSI in Emuhaya Sub-County.

The current study therefore will move further to determine whether understanding of ASEI-PDSI principles by primary school science teachers poses a challenge in its implementation in the teaching of science in primary schools in Emuhaya Sub-County.

1.2 Statement of the Problem

Before the introduction of ASEI-PDSI, the teaching of primary school science was characterized by knowledge based teaching, teacher-centeredness, transmission of facts and concepts as well as learning of science through large scale recipe type experiments described in text books. During this period, the KCPE mean score for science in Emuhaya Sub-County was at an average of 50%.

After the initiation of SMASE, the pre- ASEI conditions were changed to Activity- based teaching, learner-centeredness, experimentation, research based approaches and improvisation aiming at improving the performance of learners in national examinations. Eight years after the introduction of SMASE, Emuhaya Sub-County has consistently posted an average mean score of 50% in KCPE examinations compared to the neighboring Sub-Counties as shown in Table 1.2.

Despite the stagnated performance of learners during the old and new methods of learning, no action has been taken to ensure that learners improve. In addition, various studies that have been carried to guide on this problem do not examine the extent of the implementation of the learner-centered approach. Therefore lack of improvement in learner performance even after the initiation of ASEI-PDSI triggers questions that need a research on the extent and challenges of

implementation of ASEI-PDSI in the teaching of science in primary schools in Emuhaya Sub-County.

1.3 The Purpose of the Study

The purpose of this study was to investigate the extent and challenges of implementation of ASEI-PDSI in the teaching of science in primary school in Emuhaya Sub-County.

1.4 Objectives of the Study

1. To determine the extent of use of ASEI-PDSI approach in teaching of science in primary schools in Emuhaya Sub-County.
2. To determine the extent to which head teachers supervise the implementation of ASEI-PDSI approach in science lessons.
3. To determine the challenges faced by primary school science teachers in implementing ASEI-PDSI.

1.5 Research Questions

To attain these objectives, this study addressed the following research questions;

1. To what extent is ASEI-PDSI approach used in teaching of science in primary schools in Emuhaya Sub County?
2. To what extent do head teachers supervise the implementation of ASEI-PDSI approach in science lessons?
3. What challenges do primary school science teachers face in implementing ASEI-PDSI approach?

1.6 The Scope of the Study

The study on the extent and challenges of implementation of ASEI-PDSI in teaching of science in primary schools in Emuhaya Sub-County was done in 100 primary schools in the Sub-County and involved head teachers, standard 6,7 and 8 science teachers, science panel heads, the Sub-County QASO and class 8 learners to find out whether effective pedagogical skills according to ASEI-PDSI approach were being applied in the teaching of primary school science, the extent to which supervision of the approach was being done by school heads, and the challenges faced by science teachers in implementing the approach.

Standard 6, 7 and 8 teachers were picked on since they had been taken through SMASE training due to the presence of difficult topics in their subject curriculum (CEMASTEA, 2009) and also, due to the problem of understaffing most science teachers handled the subject right from class 6 to 8. Class 8 learners were picked on since they had been taken through ASEI-PDSI principles long enough to give results that could be depended on.

1.7 Limitations of the Study

It was not possible to generalize the study findings to other Sub-Counties in the country since only a small population was included in the study. This researcher recommended for similar studies to be done in other Sub-Counties of the country.

1.8. Assumptions of the Study

The study was based on the following assumptions

1. All teacher respondents were fully equipped with knowledge on implementation of ASEI-PDSI.

2. Achievement in KCPE was a reflection of the extent of implementation of ASEI-PDSI in science by the science teachers.

1.9. Significance of the Study

The findings of this study may provide an appropriate understanding of how ASEI-PDSI is being implemented in the teaching of primary school science to the school administrators and the Ministry of Education and provide insight on the appropriate improvement of the approach so as to ensure effectiveness and success in primary science education.

1.10. Theoretical framework

This study was based on Vygotsky (1962) postulates of the theory of the Zone of Proximal Development (ZPD). Children are seen to work better on their own compared to when working in collaboration with an adult. The adults' role is to help them refine their thinking or performance to make it more effective. The teacher therefore mediates the child's learning activity as they share knowledge through social interaction (Dixon- Krauss, 1996). Brunner (1966) observes that learning is an active process in which learners construct new concepts based upon their current knowledge. The teacher should encourage pupils to discover principles for themselves and together with learners, they should engage in active dialogue. As an instructor, the teacher should translate the information to be learned into a format appropriate to the learners' current state of comprehension (Silver, 2011). The curriculum should be organized in a spiral manner to allow students to continually build upon what they have already learned. The instructor should focus on predisposition towards learning, planning of the body of knowledge to enhance easy grasping by the learners, effective methods of material presentation and the nature of rewarding (Brunner, 1966).

The theoretical framework of this study was relevant since according to Vygostky, learners socially construct knowledge as they work in groups. The use of ASEI-PDSI principles by the science teacher enables him to use the approach effectively in the teaching of science where by learners are actively involved in a series of activities which include experiments, improvisation, asking questions, nature walk etc during the lesson as they work in groups to help them acquire concepts on their own as the teacher guides them in subsequent steps. Learners are also organized in groups to encourage collaboration and sharing of ideas as they undertake various science activities during the lesson. Frequent and strict supervision of the practice of the approach by the school head also helps to ensure its appropriate implementation in the teaching and learning of science in primary schools. Therefore this theory guided the study by linking learner outcome and the use of ASEI-PDSI.

1.11 Operational Definition of Terms

The following terms are used in the study:

ASEI: A pedagogical principle which advocates for active participation of the learner in science lesson activities such as experiments, asking questions, drawing, improvising learning materials etc. It is basically a Learner-Centred Approach (LCA) that emphasizes use activities, and experiments with improvised materials and is specific to science.

ASEI lesson plan: A science lesson design that takes into account the principles of ASEI

EXTENT: Frequency of application of ASEI-PDSI aspects during its implementation in science lessons.

Learner-Centered Approach: ASEI-PDSI approach which ensures that the science teacher actively involves the learner in the science lessons through meaningful activities, experiments and improvisation

PDSI: This is the means of implementing ASEI principles, and involves the planning (P) of a lesson in line with the ASEI principles, implementing the plan by way of learners doing (D) the activities as the teacher evaluates (Sees), and makes necessary improvements (I) as the lesson progresses.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter presents literature for the study organized based on the objectives as sub-themes. The sub-themes are: the extent of use of ASEI-PDSI approach in science teaching, supervision of the implementation of ASEI-PDSI approach and challenges facing the implementation of ASEI-PDSI approach.

2.2 Extent of use of ASEI-PDSI Approach in Teaching of Primary School Science

SMASE (2009) noted that the teaching of science subjects should be learner-centred with the teachers' role being that of a facilitator, a guide, a councillor, motivator, innovator and researcher. During lesson presentation, there must be student-centred activities involving a lot of improvisation in the experiments which helps to demystify science and also assist in changing the attitude of the learner towards the subject (SMASSE, 1999). Using the inquiry based approach makes learning to take a lot of time but it is often effective since learners practice problem solving and critical thinking skills to arrive at conclusions.

Gates (2003) points out that using physical apparatus makes learning easier. Using tangible and visible things helps pupils draw connections more easily and makes learning experience more memorable by relating different sensory areas, Gates (2003). In view of Tsegay Berhane Reda, (2012), teachers should ensure they build self-confidence in their students, apply different active learning strategies so as to increase students' participation, review students' attendance in connection with performance, and advise students about gains of attending classes regularly.

Tsegay Berhane Reda, (2012) further says that involving learners in active learning which is the core emphasises in SMASE training project through ASEI-PDSI cannot be underscored.

According to Mulwa and Nguluu (2003), an evaluation of the extent of usage of an innovative approach is paramount in any program since it facilitates informed decision making that will lead to corrective measures hence improvement. It also attempts to show the cause - effect relationships between the program activities and the changes that may be observed, gives an opportunity for accountability and an educational process which assesses the extent of peoples' understanding, how well the participants are doing and the impact of the program on the intended beneficiaries.

The introduction of science and mathematics teachers to ASEI-PDSI practice was geared towards a shift from their traditional approach of teaching to a learner-centered teaching approach. The focus of ASEI lesson was the learner who was to be fully involved in the lesson through activities, experiments, improvising learning materials etc, the teacher only needed to act as a facilitator or moderator of learning. During the INSET training, teachers were encouraged to foster concept, skills and attitude acquisition by using learner-centered activities, experiments and improvisation where necessary (CEMASTEA, 2012) .Emuhaya Sub-County has consistently posted a means score of 50% which was posted even before the inception of learner-centered strategies through the ASEI-PDSI approach. This therefore triggers a research to investigate the extent of use of ASEI-PDSI in the teaching of science in primary schools of Emuhaya Sub-County.

In a survey by CEMASTEA (2011), 75% of the teachers sampled had schemes of work, 69% had lesson plans. The study revealed that most teachers were not preparing lesson plans for their

lessons. The study also revealed that question and answer-method as well as lecture method of teaching which involved transmission of facts to learners was used to a large extent and the questions mostly used were close-ended. This blocked learners from critical thinking as advocated by ASEI-PDSI. Only 40% of the teachers were found to be practicing ASEI-PDSI practices, 37% of the teachers were observed to be preparing teaching and learning resources which were appropriately and effectively used while only 31% of the teachers improvised teaching and learning resources and used innovative activities in their lessons.

Success of ASEI lessons depends on availability of teaching/ learning material. According to JICA & ROK (2008) in Kenya teaching and learning materials are inadequate and at times not available. However, through improvisation, teaching learning materials can be acquired. According to CEMASTEA (2013a) improvisation is the act of creating something in the absence of the ideal tool. This requires teachers to use resources available in the immediate environment. In a study entitled, "Inside the mathematics classroom", CEMASTEA (2013b) observed that teachers indicated that they often carried materials to class. However, pupils reported little variety in materials used in the class other than geometrical instruments, textbooks and revision texts. In addition teachers, head teachers, quality assurance and standard officers (QASOs), TAC tutor reported that teachers often used improvised resources but lessons observed had minimal use of improvised materials. While CEMASTEA (2013b) looked at the use of improvised materials in the mathematics classroom, the current study went further to investigate the extent of use of all the aspects of ASEI-PDSI in science lessons.

By using the monitoring and evaluation tools developed, Kenya has shown improvements in the quality of lessons delivered by teachers who have used the ASEI-PDSI approach (CEMASTEA, 2009). For instance, the Centre for Mathematics and Science Education in Africa (CEMASTEA)

team carried out a situational analysis on secondary schools and among the objectives of the study was to find out the extent to which ASEI- PDSI approach was being practiced by mathematics and science teachers at secondary school level in Kenya. The study adopted a descriptive design and targeted all the public secondary schools in Kenya. A sample size of 45 schools distributed equally in five provinces (Eastern, Coast, central, Rift valley and Nyanza) were used in the study. The study used questionnaires, interview guides and observation guide to collect the data. The results from the studies showed that, teachers‟ perception of the practice of ASEI- PDSI in the teaching of mathematics and science scores ranged between 49 to 92 percent with a mean of 72.3 percent. The finding implied that the teachers had a high self-perception of their practice of ASEI- PDSI approach. The results on the preparation of ASEI lesson plan showed that only 10.7 percent of the teachers indicated they always prepared a written lesson plan while 72 percent indicated that they sometimes (rarely or never) prepared a written lesson plan. A study on the extent of student involvement in the lesson showed that 59.2 percent of teachers always involved students in predicting outcome. The findings implied that the practice of writing ASEI lesson plan was very low among teachers and students who were averagely involved in the lesson (CEMASTEA, 2010). This was a clear indication that the goals of SMASSE project have not been achieved at the national level. Whereas the study by (CEMASTEA, 2009) used a sample of 45 schools to find out the extent to which ASEI- PDSI approach was being practiced by mathematics and science teachers in secondary schools in Kenya which was a broad study area, the current study used 100 schools from Emuhaya Sub-County which is a smaller area of study. Moreover, the study by (CEMASTEA, 2009) used questionnaires, interviews and observation schedules while the current study, in the place of observation schedules used document analysis guide. The study by (CEMASTEA, 2009) was

also conducted in secondary schools while this study focused on primary schools and was mainly on the science subject.

A report on SMASSE program situational analysis of September, 2010 indicated that teachers of mathematics and science rated their own practice of ASEI-PDSI in teaching high in terms of lesson planning, use of activities in their lesson delivery and involvement of learners. To the contrary, 65% of the principals in the study mentioned that there was a minimal practice of ASEI-PDSI in the classroom. An indication by 67% of the Heads of Departments (HODs) also revealed a low extent of ASEI-PDSI use in classroom practice. Deputy Principals and QASOs reported that the practice of ASEI-PDSI was not satisfactorily used due to a number of challenges including inadequate teaching and learning materials, lack of time and skills to develop activities for use during the lessons. Majority of the observed lessons indicated 51.4% of teachers not embracing the concept of improvisation and the student's participation in practical activities being very low.

Some external studies relating to the usage of ASEI-PDSI approach have been carried out. Sifuna and Kaime (2007) in their study on the impact of in-service education and training programs in mathematics and science on classroom interaction for secondary schools in Kenya revealed that teachers perceive the SMASSE program as having been effective in exposing teachers to a student-centered approach of teaching yet this was not evident in their classroom practice which were largely teacher dominated. They attributed this partly to large classes, use of English as a second language and the pressure to cover the syllabus in preparation for national examinations. Benedict (2013) reported inadequate use of ASEI-PDSI approach by teachers in mathematics lessons. He observed that teachers never gave practical work as well as appropriate tasks for discussion to learners and that mathematics lessons were largely teacher centered.

Ndirangu and Nyagah (2013) revealed that a majority of teachers in their study were implementing ASEI-PDSI innovation partially. Macharia (2008), while looking at the use of ASEI-PDSI approach by mathematics teachers in Murang'a district reported that over 80% of teachers in his study applied the approach in their classroom practice only that the instructional materials used by teachers who underwent the training and those who didn't differed. He mentioned inadequate time and materials for improvisation as some of the impeding factors for the implementation of the approach. While these studies dwelt on the teaching of mathematics in secondary schools, the current study was interested in the implementation of ASEI-PDSI in primary school science; in addition, this study was done in Emuhaya Sub-County

Gachahi, Kimani & Ngaruya, (2014) noted that SMASE trained teachers level of application of the attained skills had no significant relationship with learner achievement in mathematics and science in primary schools. According to them, the SMASE training period was too short to have allowed these teachers adopt and apply the SMASE skills in a meaningful manner to help learners perform better in these subjects. This simply means that teachers had poor implementation of the SMASE skills they had been trained leading to low achievement in mathematics and science. In Emuhaya Sub-County, SMASE training for teachers on the use of ASEI-PDSI up to today has taken a period of eight years. This period is quite sufficient to enable teachers adopt the skills of the program and apply them in a manner that will assist learners perform better hence improving the mean scores in KCPE examination. According to Gachahi *et al*, (2014), teachers had insufficient time to implement the ASEI-PDSI principles yet the period 2010-2013 in which these teachers were trained on SMASE skills is sufficient for them to have adopted the skills as SMASE was only building on the prior knowledge of learner-centered teaching which these teachers already have from their initial teacher training in primary teacher

colleges. Moreover, the study covered the whole County but only 109 respondents were involved which was too few to give data which can be generalized. The current study was carried out only in primary school science and used a total of 662 respondents from Emuhaya Sub-County to help assess the implementation of Learner-centered approach in the teaching of science in primary schools. In addition, Gachahi *et al.*(2014) used correlation research design while this study will use a descriptive survey design. Descriptive survey design was preferred since it provides an easy mechanism for making use of research instruments like questionnaires and interview schedules for collecting data from a cross section of respondents within a short time and without manipulation of variables (Kothari, 2004).

2.3. Supervision of the Implementation of ASEI-PDSI Approach

Supervision tracks the actual performance against what was planned or expected according to predetermined standards and generally involves collecting and analyzing data on program processes and results as well as recommending corrective measures. The purpose of supervision is to: give regular feedback to project managers, provide a basis for corrective measures, verify proper utilization of project resources, ensure that in puts are made available in time and used to bring about the intended outcomes through correct activities, provide information necessary for implementation of other educational programs and for accountability (SMASE, 2010).

The Teacher's Service Commission (TSC) has bestowed school head teachers with the mandate to supervise all that goes on in the school (Code of Regulation for TSC, 2014). As a leader and a pivot of the school, the school head teacher has a major role as an instructional supervisor as well as ensuring supply of learning and teaching materials necessary for the teaching-learning process (Sushila, 2004).

According to Ogwel et al (2008) teachers shift in pedagogical skills in SMASSE depended on principal's support and encouragement. This implied that success of implementation of ASEI-PDSI and how it impacts on performance in KCPE mathematics was influenced by how the head teachers of public primary schools supported teachers of mathematics. According to Bousted (2010) there was need to remake schools as learning communities for staff as well as pupils. This transformation required two things: school leaders who were capable of teaching and learning all provision and school by school, of effective continuing professional development. Involvement of teachers in planning is quite crucial.

Fullan (2001) stressed that, mutual trust between school leaders and teaching staff was the single most important factor within a school's culture that allowed for successful changes for improvement to be made. Without trust, there was no effective communication or collaboration, which hampered the development of commitment to school improvement.

According to CEMASTEA (2010), School Principals played crucial roles Within the SMASSE-INSET System. These roles included: Ensuring mathematics and science teachers attend SMASSE INSET; sensitizing mathematics and science teachers on the importance of INSET and ensuring that they are informed of INSET dates and released promptly to attend; providing necessary support that teachers needed to implement new methodologies, approaches and strategies for ASEI lessons; Monitoring and Evaluation of classroom activities of both District Trainers and teachers who had attended the INSET and Managing the District INSET Centers. Similarly, Wafubwa, (2014) noted that school head teachers as supervisors played an important role within the SMASE project, they ensured that mathematics teachers attended SMASE training, sensitized and stressed on the importance of the INSET, provided the necessary support that teachers needed to implement the strategies and new approaches used during the ASEI-PDSI

lessons, they also monitored and evaluated the classroom activities of the teachers who had attended the SMASE training. it is on this basis that the current study moved further to determine the extent to which primary school head teachers supervise the implementation of ASEI-PDSI approach in science lessons.

Daft, (2004) averred that implementation of change is often the most difficult part of the change process. According to Daft, (2004), teachers who are curriculum implementers need to be supported by the heads of the schools and the QASOs. This could be done through supervision of an innovation and addressing the areas of challenges that teachers faced. To enhance pedagogical leadership in the implementation of SMASE activities at school level, the school head has a very vital role in ensuring that the education curriculum and all other school programs are implemented accordingly. The Head teacher is expected to ensure that the purpose, vision and policies of the ministry are met, co-ordinate and supervise all the activities in the school and be responsible for improving and maintaining high teaching and learning standards, ensure that teachers perform their roles and assist them in working effectively and efficiently. The school head should also provide the necessary support and understanding especially to teachers with emotional needs as well as those who are new in the profession (CEMASTEA, 2012). Whether these roles are being accomplished by the school head teachers in Emuhaya Sub-County is a riddle which needs to be unfolded since no study has been conducted in the region since the inception of ASEI-PDSI approach to establish whether the head teachers' role in supervision of the approach is active.

A situational analysis was carried out in 2009 to help CEMASTEA establish the extent of the practice of ASEI-PDSI approach to teaching and learning. It was also to establish whether there was a system for effective supervision of ASEI-PDSI approach to teaching of mathematics and

science. Based on the findings of the analysis, recommendations were made that would guide the practice regarding district INSET and supervision of ASEI-PDSI approach in the classroom (CEMASTEA, 2009). Following the recommendations of the situational analysis, CEMASTEA held sensitization workshops for QASOs and principals. These workshops were meant to strengthen the supervision of ASEI-PDSI approach in the classroom. Studies have however shown that ASEI-PDSI approach is not being supervised by both QASOs and school principals. For instance a study carried out by Rotich & Mutisya (2013) on an evaluation of capacity development programs in Kenya revealed that ASEIPDSI approach was not supervised by head teachers.

A study conducted by Wambui (2006) found that school head teachers had a significant effect on teachers' teaching practices. ASEI-PDSI approach was not being supervised by both the QASOs and the head teachers which eventually led to poor performance in national examinations. Many head teachers spent more time with finance management than with curriculum and instruction, a factor attributed to lack of effective training in educational administration, thus lacking the expertise to carry out effective supervision and evaluation of the curriculum practice in the schools Wambui (2006). These studies were carried out outside Emuhaya Sub-County but the current study was done in Emuhaya Sub-County to determine the extent to which primary school head teachers supervised the implementation of ASEI-PDSI in teaching science in primary schools.

Benedict (2013) reveals that a majority of aspects of supervision were rarely practiced by school heads leading to inadequate use of ASEI-PDSI in mathematics lessons in Nyamaiya Division, Nyamira County. A study by Ngetuny (2013) in Koibatek Sub-County on the implementation of ASEI-PDSI in the teaching of mathematics in secondary schools revealed that more than half of

the schools in his study area lacked a monitoring mechanism to check whether what is expected by SMASE in the teaching and learning of mathematics was actually done. Among the principals in the study, 35.5% of them agreed to be having the monitoring mechanism, 10.8% were neutral while 53.7% disagreed on this. On whether the school administrators regularly monitor the use of ASEI-PDSI approach, 28.4% agreed, 11.8% were neutral, while 59.8% disagreed. On whether the information obtained from the monitoring process was used to improve on the use of ASEI-PDSI approach, 30.6% agreed, 10.3% were neutral while 59.1% disagreed. Although monitoring and supervision of ASEI-PDSI is quite vital, Ngetuny (2013) noticed that very little was done to address this process. The a fore mentioned studies were carried out in secondary schools, further more they were done in mathematics while this particular study will be carried out in primary schools and in science.

Itolondo (2008) mentioned that observation of teachers during instruction, which is an aspect of supervision, was done in very few schools in his study area hence inadequate use of ASEI-PDSI. Ndirangu and Nyagah (2013) reported that head teachers did not enforce the implementation of ASEI-PDSI in their schools while Ochanda (2010), in his study on mathematics teachers in Emuhaya District reported that teachers level of preparedness before lesson delivery was very low. In another study in the same region by Odawa, Murundu, Okwara, and Bantu (2014), HODs reported that ASEI-PDSI approach was practiced yet this aspect was not evident in the lessons observed in classrooms. The HOSD also reported that learner-centered teaching was practiced yet this was also not evident during classroom observation. HODs assist school principals in supervisory work to ensure that subject teachers are doing what is expected. These studies were carried out in secondary schools and used questionnaires and interview schedules as methods of data collection.

A survey done by (CEMASTEA, 2013b) helped to find the extent of ASEI-PDSI practice in the years 2011 and 2012. The findings of the study reviled that the extent of practice of Activity, Planning, seeing and Improve aspects of ASEI-PDSI had decreased. The extent of practice of learner/student-centeredness, experiment, improvisation/ innovativeness and doing aspects of ASEI-PDSI had improved slightly. According to (CEMASTEA, 2013c), this was possibly attributed to weak practices of ASEI-PDSI at the school level or lack of supervision during instruction.

SMASSE (2010) reported that secondary school principals sampled were aware of general SMASSE activities through payment of levies, releasing teachers to attend the INSET and sensitization during heads association meetings. About 5% of the principals interviewed did not have proper understanding of the INSET content and ASEI-PDSI and about 60% of them were not conversant with the content of the INSET at the district level. Since the onset of SMASE primary program, four head teachers' workshops had been held to sensitize primary school heads on effective implementation of SMASE primary activities for sustainable ASEI-PDSI practice (CEMASTEA, 2013). Primary school head teachers were therefore aware of the ASEI-PDSI content and its implementation and as such, they were to ensure its proper implementation by teachers for better performance to be realized by learners.

In Emuhaya Sub-County, a stagnant mean score of 50% had been realized repeatedly. This study therefore sought to determine the extent to which primary school head teachers supervised the implementation of ASEI-PDSI approach in science lessons in primary schools in Emuhaya Sub-County.

2.4. Challenges Faced in the Implementation of ASEI-PDSI Approach

Through science, learners are expected to acquire scientific knowledge, skills and attitudes to enable them realize that problems can be solved. Primary school science teachers ought to teach science by carrying out activities and making it learner-centered (KIE, 2003). Professional development equips science teachers with better pedagogical skills to help give learners the best in terms of knowledge, skills and attitudes for better achievement yet these teachers still encounter difficulties in their lesson delivery.

A study by Al Shammeri (2013) conducted to explore the views of 136 science teachers who were teaching a reformed science curriculum in Kuwait revealed that these teachers faced a number of challenges. Among them were the difficulties of the content, heavy workload, lack of teaching tools, inadequate professional development, not enough time allocated to teach science and class management issues because of large class sizes. Al Ghamdi and Al Salouli (2012) interviewed science teachers in public and private schools in Al Dammam in the Kingdom of Saudia Arabia and the findings of their study suggest that insufficient instructional time, limited physical space, scarcity of resources, and professional development were barriers that hindered the implementation of the reformed science curricula.

From the study by Probyn's (2005) conducted in the schools of Grahams town in South Africa, it was noted that using the second language in teaching science had created a barrier in the teaching and learning process. For instance, a study by Thomas and Collier on language minority students in U.S public schools (as cited in Othman & Saat, 2009) indicated that those pupils understood concepts better when teachers used the students' native language; this hindered the students' understanding in science subjects.

Thornburg (2009) noted shortage of teachers, transmission learning; where science instruction is based on imparting knowledge to students and having them apply it to some predefined problems instead of giving children chance to explore questions and design projects on their own as challenges in science education. Laidlaw, Tylor & Fletcher (2009) in their study on challenges facing practicing and pre-service teachers revealed that many primary and pre-service teachers in the New England region were challenged by science due to low levels of confidence in scientific content and pedagogical knowledge, insufficient resources and equipment, time constraints and limited professional development opportunities. In-service teachers involved in the study rated science as their second least preferred subject of the six key learning areas they had in the curriculum. Middleton (2014) while looking at challenges when teaching science in pre-schools added stress on syllabus coverage and lack of appropriate activities as challenges in science instruction.

Sengul, Letin, & Gur (2008) observed the primary school syllabus to be too comprehensive for the teacher making them lag behind, overcrowded classrooms, lack of enough equipments in laboratories leading to teacher demonstrations, insufficient course materials and the use of tests and oral exams in evaluation of the subject leading to memorization of knowledge by learners as some of the problems facing primary school science teachers in Turkey. Similar findings were expressed by Oluwadere and Julius (2011) in Nigeria and in addition to these Albert, Leona, Tafara and Jingu (2010) mentioned that parents were not collaborative in that they never monitored school work for their pupils as these to them was the teachers responsibility despite pupils erratic attendance which made them miss some concepts while absent.

Sua & Raman (2007) observed the use of a second language in the teaching of mathematics and science in Malaysian primary schools posing a major issue to teachers. Sua & Raman (2007)

mentioned that English being a weaker language of most pupils made it difficult for them to follow the science course since inadequate grasp of language media by students led to serious retardation in the learning of the subject matter. Understanding of a given learning strategy was also vital and posed great challenges to the teacher. Teachers who misunderstood, misinterpreted or misused the model of learning strategy often failed to construct the concept and ended up transmitting facts to learners (Australian Academy of Science, 2011).

Ombaso D. (2008) identified the following as hindering the inclusion of carefully selected activities in SMASSE: lack of sufficient time for preparation, inadequate resource, lack of support from administration and large class sizes that made it hard for teacher to give individual attention to students. Hindrances to focusing on students and involving them in learning included large class sizes, pressure to cover syllabus, inadequate teaching resources and lack of adequate time and lack of laboratory assistants, low morale due to low pay and lack of promotion even with completion of SMASSE cycles. Another hindrance was low entry behaviour of learners. With regard to improvisation in the absence of conventional equipment or apparatus, the following hindrances were identified: limited time for improvisation, discouragement from other teachers, laziness or laxity on the part of the teachers and unmotivated learners leading to low morale by teachers and heavy workload leading to lack of time (Ombaso D. 2008).

Waititu and Orado (2009) identified some challenges beyond the scope of SMASSE but which affect the implementation of the project; unfair transfer of teachers by Teachers Service Commission, interruption of school programme by issues such as fee collection, stagnation in one job which demoralizes teachers thus lowering their effectiveness in delivery to the learner, understaffing in some areas of curriculum, poor communication and funding of school activities and programmes, food, child labour and the other family problems, teachers‟ poor working

conditions and terms of service including incentives, overloaded syllabus and time, heavy workload and Provision of infrastructure and instructional material and equipment to schools.

Chepkwony (2011) conducted a study on the challenges facing the implementation of SMASSE project in Kericho district, Kericho County, Kenya. The study found out that first Students‟ attitude was generally negative due to low entry behaviour, the belief that these subjects are hard, peer pressure, lack of proper learning facilities, teachers' absenteeism and theoretical approach to teaching science and mathematics. Chepkwony (2011) also discovered that teachers were reluctant to perform experiments especially the dangerous ones and the fear that the experiments could fail and therefore most teachers preferred carrying out teacher demonstrations.

Furthermore, there was lack of interest by most parents in their children performance. This was especially in sciences and mathematics where some felt that their role was only fees payment. Other factors included lack of adequate teacher preparation hence poor mastery of content, expenses needed for training SMASSE personnel and expenses needed to dispatch them for exchange visits and technical advice to other member countries, expenses necessary for holding regional and international conferences. SMASSE delegates meetings, Sciences and mathematics teachers were given little opportunities to interact amongst themselves and exchange ideas since they were most held in school during the term and communities lacked information about schools (Chepkwony, 2011).

According to the SMASSE Project (2008) report, challenges experienced by teachers in the implementation of ASEI-PDSI practice included time constrains in the preparation of ASEI lessons hence slow syllabus coverage, inadequate teaching and learning resources; lack of skills to improve teaching and learning materials; absenteeism in class attendance by students; poor

attitude of the students towards the subjects; heavy workloads; inability of some students to communicate in English; different learner abilities and large classes among others.

Agatha (2009) reported that understanding of underlying premises of new pedagogy during in-service training by teachers' impacts positively on learner achievement. Gachahi *et al.,* (2013) established that SMASE trained teachers level of application of SMASE skills had no significant relationship with pupils achievement in mathematics and science in Murang'a County. To them, this was due to insufficient period of SMASE training for teachers which could not have given them an opportunity to adopt and apply the SMASE skills in classroom in a manner that could have any meaningful effect on pupils' achievement. Benedict (2013) observed large classes, inadequate time for preparation, inadequate teaching and learning resources and pressure on syllabus coverage as factors impeding the implementation of ASEI-PDSI. The aforementioned studies established challenges faced by LCA in other countries, counties and Sub-Counties but not in Emuhaya Sub County. This current study therefore looked at challenges faced by primary school science teachers in the implementation of ASEI-PDSI in Emuhaya Sub-County.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents research methodology that were used in this study under the following sub sections: research design, area of study, the target population, sample and sampling techniques, research instruments, reliability and validity of research instruments, data collection procedures and data analysis.

3.2 Research Design

This study adopted a descriptive survey design. Descriptive survey entails' collection of data from all or a selected number of respondents of the concern universe in an attempt to describe as accurate as possible respondents' perceptions, behavior or attitude so as to determine what presently exists with regard to an activity such as pedagogical practice (Walingo & Ngaira, 2008). Survey design was preferred since it provides an easy mechanism for making use of research instruments like questionnaires and interview schedules for collecting data from a cross section of respondents within a short time and without manipulation of variables (Kothari, 2004). The study was descriptive since it assessed, analyzed and interpreted various aspects of ASEI-PDSI in the teaching of science in primary schools

3.3 Area of Study

The study was carried out in Emuhaya Sub-County in Vihiga County. This Sub-County boarders Vihiga Sub-County to the East, Kisumu West Sub-County to the South and Gem Sub-County to the West and Sabatia to the North. The area lies on latitude 0^{o} and between longitude 34^{o} 33^{o} E

and 34^{o} 40^{o} E. The Sub-County is inhabited by Banyore Sub-Tribe of the Luhyia Community. The economic activities of the region include small scale farming of sugarcane, maize and bananas. Poverty level in this area is quite high. Greater achievement in education by learners in this region through proper implementation of learner-centered approach in the Sub-County may help reverse this situation. CEMASTEA (2010) realized some laxity in the use of ASEI-PDSI in the teaching of science accounting to poor learner outcome. it is for this reason that this study sought to investigate the extent and challenges of implementation of ASEI-PDSI in the teaching of science in primary schools in Emuhaya Sub-County.

Administratively, the Sub-County is subdivided into two constituencies; Emuhaya and Luanda constituency. The 2009 National population projections revealed that the area had a population of 300,000 persons (Republic of Kenya, 2009). The region covers 173 km^{2} with a population of about 1,735 persons per km^{2} hence is among the most densely populated regions in the country. In this Sub-County there are 222 Early Childhood Development Centers (ECDE), 100 primary schools, 38 secondary schools and 3 technical institutes (Republic of Kenya, MoE, 2013).

3.4 Target Population

Mugenda and Mugenda (1999) describe a population as the entire group of individuals, events and objects with common observable characteristics. The target population for the study comprised 100 head teachers of the primary schools, 100 science panel heads, 300 primary school SMASE trained science teachers of std 6,7 and 8, 1 QASO and 4, 959 class 8 learners from Emuhaya Sub-County (MOE Emuhaya Sub-County, 2017)

3.5 Sample and Sampling Procedure

The researcher employed a stratified random sampling to stratify head teachers, science panel heads, primary science teachers and class eight pupils into four zones: Luanda East 24 head teachers and panel heads, Luanda West 17 head teachers and panel heads, Emuhaya South 32 head teachers and panel heads and Emuhaya North 27 head teachers and panel heads. For the teachers' population, Luanda East had 87, Luanda West had 75, Emuhaya South had 60 and Emuhaya North had 78 teachers. For class eight pupils population, Luanda East 1203, Luanda West 1369, Emuhaya South 1386 and Emuhaya North 1001. Simple random sampling technique was then used in each zone to select 8 head teachers and panel heads in Luanda East, 5 head teachers and panel heads in Luanda West, 11 head teachers and panel heads in Emuhaya South and 9 head teachers and panel heads in Emuhaya North. For the teachers, simple random sampling was also used to select 29 teachers in Luanda East, 25 teachers in Luanda West, 26 teachers in Emuhaya North and 20 teachers in Emuhaya South. The sample size for teachers, head teachers and panel heads was 33% of the study population drawn from 100 schools in Emuhaya Sub-County. A sample size of 33% is a convenient sample size for survey study (Mugenda & Mugenda, 2011). Simple random sampling gave 496 learners from the four zones (Luanda East- 120, Luanda West- 137, Emuhaya south 139 and Emuhaya North-100) which were 10% of the total study population. 10% of a target population was considered large enough to allow for reliable data analysis (Kirlinger, 2009) giving a sample size of 496 learners. Simple random sampling technique was used since it eliminates chances of biasness in selecting study samples. Saturated sampling was used to select 1 QASO. Saturated sampling is a non-probability sampling procedure in which all members of the target population are selected because they are

too few to make a sample out of them (Borg & Gall, 1996). In total 662 respondents were selected for the study. The study population and sample are shown in Table 3.

Table 3.1 Sampling Frame

Category of respondents	Target population	Sample size	Percentage (%)
Head teachers	100	33	33
Panel Heads	100	33	33
Science teachers	300	100	33
Sub-County QASO	1	1	100
Totals	501	167	33

Source: Sub-County Education Office, Emuhaya (2017)

Table 3.2 Sampling Frame for Learners

Zones in Emuhaya Sub-County	Target population	Sample size	Percentage (%)
Luanda East	1203	120	10
Luanda West	1369	137	10
Emuhaya South	1386	139	10
Emuhaya North	1001	100	10
Totals	4959	496	10

Source: Sub-County Education Office, Emuhaya (2017)

3.6 Research Instruments

This study made use of questionnaire, interview schedules and document analysis guide for data collection.

3.6.1 Questionnaire

Three questionnaires were used in this study. They included: questionnaire for science teachers, questionnaire for head teachers and questionnaire for class 8 learners.

3.6.1.1 Questionnaire for Science Teachers (QST)

This was used to collect data that helped establish the extent of use of learner-centered approach in teaching primary school science and to determine the challenges faced by primary school science teachers in implementing ASEI-PDSI approach in teaching primary school science (Appendix IV).

3.6.1.2 Questionnaire for Head Teachers (QHT)

Questionnaire for head teachers was used to establish the extent of use of the ASEI-PDSI approach in teaching primary school science, determine the challenges faced by primary school science teachers in implementing ASEI-PDSI approach in teaching primary school science and to determine the extent to which primary school head teachers supervised the implementation of ASEI-PDSI approach in science (Appendix V).

3.6.1.3 Questionnaire for class 8 learners

Questionnaire for class 8 learners was used to establish the extent of use of the ASEI-PDSI approach in teaching primary school science, determine the challenges faced by primary school science teachers in implementing ASEI-PDSI approach in teaching primary school science and to determine the extent to which primary school head teachers supervised the implementation of ASEI-PDSI approach in science (Appendix VI). This was for the purpose of triangulation.

3.6.2 Interview Schedule

Two interview schedules were used for this study. They include: interview schedule for science panel heads and interview schedule for the sub-county QASO

3.6.2.1 Interview Schedule for Science Panel Heads (ISPH)

This was used to verify the data obtained through QST and QHT (Appendix VII).

3.6.2.2 Interview Schedule for Sub-County Quality Assurance Officer (ISQASO)

This was used to establish the extent of use of ASEI-PDSI approach in teaching primary school science and to determine the challenges faced by primary school science teachers in implementing ASEI-PDSI approach in teaching primary school science (Appendix VIII).

3.6.3 Document Analysis Guide

The documents analyzed were teachers' professional documents, learners' notebooks as well as teaching and learning materials. These were used to find out the extent of use and supervision of ASEI-PDSI approach in teaching primary school science (Appendix XI).

3.7 Validity of Research Instruments

Expert review method of validity was ensured. The construction of questionnaires was done with close consultation with the supervisors and thereafter submitted to experts in the school of Education; Maseno University for verification. For the interview schedule and the interviewing process, face validity was obtained by the researcher accessing the department of Education Communication Technology and Curriculum studies where the interviewing process was demonstrated and judged by the specialists in the department as a practice before doing it in the field.

3.8 Reliability of the Research Instruments

To establish the reliability of the research instruments, a pilot study was conducted and a test re-test method used which involved 10 head teachers, 10 science panel heads, 30 science teachers and 50 class 8 learners which is 10% of the study population (Kirlinger, 2009). This was randomly selected from public primary schools in Emuhaya Sub-County. It is vital to note that the participants of the pilot study were selected not from the sample size of the study; they therefore did not participate in the final study. The two tests were administered on the same respondents at an interval of two weeks (Mugenda & Mugenda, 2003).

Pearson *r* was used to determine correlation of the instruments which was judged to be reliable at a value of a magnitude of relationship of .85 for questionnaires for science teachers, .81 for questionnaire for head teachers and .79 for questionnaire for class 8 learners. A reliability value of 0.7 was considered suitable to make group inferences that were accurate enough (Fraenkel & Wallen, 2011). Results from the two tests were used to revise instruments before use in the actual study.

The researcher also investigated whether the terms used in the instruments resonated with the terms which were familiar to head teachers, science panel heads and the science teachers. The researcher also verified the instruments content for accuracy, consistency and ensured that ambiguous information was removed while deficiencies were noted and corrected before the instruments were used in the final study (Joppe, 2000; Creswell & Miller 2000).

3.9 Data Collection and storage Procedure

The researcher sought permission from the Dean, School of Graduate Studies (DSGS) Maseno University to collect data and the MUERC permit was also given. A copy of this permission was

availed to the Sub-County education officer; Emuhaya Sub-County and the area education officers in charge of the two divisions. The researcher then contacted head teachers of the selected schools in writing after permission being granted and inform them of her intension to visit their schools for data collection. The researcher then visited schools to administer questionnaires to respondents; the head teacher, science teachers and class 8 learners and collected them the same day. The researcher also analyzed various documents in the school such as science scheme of work, lesson plans, progress records, learners note books, and charts. The researcher also conducted a face to face interview with science panel heads and the Sub-county QASO concerning the enlisted items in the interview schedule on separate days.

Data collected in questionnaires was stored under key and lock. Information on all the data variables was coded and entered into a data base in a well protected computer machine prior to analysis.

3.10 Data Analysis

Data was analyzed objectively using descriptive statistics. To establish the extent of use of ASEI-PDSI approach in teaching of science, frequency counts and percentages were used to give an overview of the responses. A four point likert scale was used where; never / rarely=1, sometimes=2, frequently=3, always=4. The points of the likert scale were further used to find the mean ($\bar{x}$) which was then converted to percentages to reveal the extent. According to Yaghi (2008), once the meaning of each percentage category is identified, the analysis is correct. Spicy (2008) came up with a five point likert scale and converted it into percentages as follows: $\frac{x}{5}\times 100$, i.e. 1 represented 1-20%, 2 represented 21-40%, 3 represented 41-60%, 4 represented 61-80% while 5 represented 81-100%. The current study used a four point likert scale

which was converted into percentages as follows: $\frac{x}{4}\times 100,$ i.e 1 represents 1-25% 2 represents 26-50%, 3 represent 51-75% and 4 represents 76-100%. The means of each findings were converted into percentages to give the specific values of extent as: $\frac{\bar{x}}{4}\times 100$.

The second objective also employed descriptive statistics in order to determine the extent to which primary school head teachers supervised the implementation of ASEI-PDSI approach in science lessons. Descriptive statistics that entailed frequency counts, percentages, means and standard deviation were also used in the third objective to determine the challenges faced by primary school science teachers in implementing ASEI-PDSI.

Standard deviation measures how concentrated the data are around the mean; the more concentrated the data is, the smaller the standard deviation and the more varied the data is, the bigger the standard deviation. A large standard deviation indicates a large amount of variation in the group being studied; a small standard deviation means the values in a statistical data set are close to the mean.

Scale for standard deviation: below 1=agreement or lack of variations in the values in a statistical data, above 1=variations in the values in a statistical data.

Qualitative data were summarized in themes and categories based on the study objectives.

3.12 Ethical Considerations

This study was approved by the School of Graduate Studies (SGS) Maseno University and Maseno University ethical Review Committee (MUERC). Each selected pupil from the different schools was issued with two copies of consent form to present to their parents or guardians for signing and approval to participate. Parents retained one signed copy and the other copy was

handed back by the pupil. The study utilized appropriate procedures to ensure appropriate ethical standards. The researcher also sought verbal and written permission for participation of all participants in the study. The participants were treated with respect and dignity. All interview respondents were furnished with copies of interview schedules prior to the commencement of interviews. The identity of all participants was protected all through and those who needed copies of their interviewed transcripts were given. Furthermore, all opinions and information investigated, obtained or reported was treated confidentially. The collected data was also coded during processing to ensure that the respondents were represented using codes only with utmost confidentiality and there after stored by the researcher without access to any intruder except for academic purpose. Any undue influence on giving feedback was avoided by giving the respondents enough time to give their feedback under the researchers watch.

CHAPTER FOUR

RESULTS AND DISCUSION

4.1 Introduction

This chapter presents the findings and discussion of the assessment that was undertaken with respect to the objectives and research questions raised in chapter one. The objectives of the study were; to establish the extent of use of ASEI-PDSI approach in teaching of science in primary schools, to determine the extent to which primary school head teachers supervise the implementation of ASEI-PDSI approach in science lessons and to determine the challenges faced by primary school science teachers in implementing ASEI-PDSI. Frequency counts, means and standard deviations were used to present the results. The findings were presented in tables as detailed subsequently starting with response return rate, demographic characteristics of respondents, and finally as per the objectives of the study. The following sub-sections present the results and discussion of the results.

4.1.1 Response return rate

It was vital to know the response return rate for the respondents who participated in the study. Table 4.1 below shows the distribution of the return rate as per the categories of the respondents.

Table 4.1 Response Return Rate

Respondent	Sample size	Frequency	Percentage
Head teacher	33	32	96.97%
Teacher	100	98	98%
Student	496	471	94.96%
Total	629	601	95.54%

From the results in table 4.1, it is evident that from the 629 questionnaires that were issued to teachers, head teachers and pupils, only 601 questionnaires were fully filled and returned. The remaining 28 questionnaires were inadequately filled and therefore discarded by the researcher. Table 4.1 indicates that there was a generally high response rate for all the respondents. The highest response rate was for the teachers who had a 98% response return rate, next were the head teachers with a response return rate of 96.97% and finally the pupils with a response rate of 95%. The overall return rate was adequate to make conclusion of the findings because it was 95.54%. This means that the data obtained was adequate to achieve the required findings.

4.1.2 Demographic Characteristics of Respondents

It was necessary to find out the background characteristics of the respondents who gave their feedback as stipulated by the study. These included learners' class for the learners that were in class eight, purposively picked because they had stayed in school enough to participate in the research. The other respondents were teachers and head teachers. The study established their level of training, which was important to the study period of teaching among other characters. The results are presented in frequency counts, and percentages as shown in table 4.2 on page 39

Table 4.2 Demographic Characteristics of Respondents

Characteristics	Pupils *f*(%)	Head teachers *f* (%)	Teachers *f* (%)
Level of training			
Degree		13(40.6)	5(5.1)
Diploma		19(59.4)	57(58.2)
Certificate		0(0.0)	25(25.5)
Others		0(0.0)	11(11.2)
Total		**32(100.0)**	**98(100.0)**
Period teaching			
less than 5 years		13(40.6)	11(11.2)
5 years		12(37.5)	19(19.4)
6-10 years		4(12.5)	48(49.0)
above 10 years		3(9.4)	20(20.4)
Class of learners (class 8)	471(100.0)		
Total	**471(100.0)**	**32(100.0)**	**98(100.0)**

Table 4.2 on demographic characteristics of the respondents indicates that 19(59.4%) of the head teachers had attained their education up to a diploma level, followed by 13(40.6%) who attained up to a degree level. The results also indicated that 57(58.2%) of the teachers, had attained up to a diploma level while 25(25.5%) had attained up to a certificate level and 5(5.1%) had attained their education up to a degree level. The results further indicated that 13(40.6%) of the head teachers had an experience of less than five years followed by 12 (37.5%) who had an experience of 5 years, 4 who had an experience of 6-10 years and 3 who have an experience of over 10 years. For teachers, 48(49.0%) of them had an experience of 6-10 years followed by 20(20.4%) who had an experience of over 10 years and 19(19.4%) who had an experience of 5 years. Lastly, 11(11.2%) of the teachers had an experience of less than 5 years in teaching.

4.2 Extent of use of ASEI-PDSI Approach in Teaching of Science in Primary Schools in Emuhaya Sub-County

The first objective of the study was to determine the extent of use of ASEI-PDSI approach in teaching of science in primary schools in Emuhaya Sub-County. To achieve this, various aspects that formed ASEI-PDSI were measured using teachers' response on a 4 point Likert scale where 1=never, 2=sometimes, 3=frequently and 4=always. These included allowing pupils to carry out hands on activities, involving pupils in group discussions, using examples from pupils in daily lives, allowing pupils to ask questions where they don't understand among other aspects. A total of 98 teachers were involved. The results of the findings are presented as shown in table 4.3 using frequency counts, percentages and standard deviations.

Table 4.3 Teacher Response on- Extent of Use of ASEI-PDSI Approach in Teaching. (n=98)

	Classroom Practice	Never	Sometimes	Frequently	Always	Mean	Std dev
A	I allow pupils to carry out hands-on activities	23(23.5)	29(29.6)	30(30.6)	16(16.3)	2.40	.95
	I involve pupils in group discussion	16(16.3)	19(19.4)	28(28.6)	35(35.7)	2.83	1.00
S	I use examples from pupils daily life	34(34.7)	37(37.8)	13(13.3)	14(14.3)	2.07	.96
	I allow pupils to ask questions where they don't understand	20(20.4)	22(22.4)	34(34.7)	22(22.4)	2.59	1.56
E	I allow pupils to explain their ideas on the chalk board	38(38.8)	37(37.8)	16(16.3)	7(7.1)	1.91	.91
I	I encourage pupils to carry out experiments and report their observations in class	32(32.7)	21(21.4)	26(26.5)	19(19.4)	2.32	1.14
	I allow pupils to make creative things for use in science lessons	44(44.9)	25(25.5)	23(23.5)	6(6.1)	1.90	.948
	I bring interesting learning materials in class	29(29.6)	27(27.6)	34(34.7)	8(8.2)	2.21	1.18
P	I use teaching materials from the local environment.	20(20.4)	22(22.4)	28(28.6)	28(28.6)	2.65	1.43
	I prepare science lesson plans daily	11(11.2)	25(25.5)	31(31.6)	31(31.6)	2.83	.784
D	I prepare teaching and learning materials for my lessons	11(11.2)	23(23.5)	38(38.8)	26(26.5)	2.80	.923
	I take learners outside the classroom for nature walk	28(28.6)	30(30.6)	26(26.5)	14(14.3)	2.26	1.32
S	I give pupils assignments	13(13.3)	23(23.5)	31(31.6)	31(31.6)	2.81	.726
	I go round in class marking and correcting pupils' work	28(28.6)	34(34.7)	26(26.5)	10(10.2)	2.18	1.24
	I check assignments given to pupils in time	11(11.2)	18(18.4)	40(40.8)	29(29.6	2.88	.95
I	I assist learners to correct their assignments	43(43.9)	27(27.6)	23(23.5)	5(5.1)	1.89	.925
	I complete science syllabus in time	14(14.3)	20(20.4)	37(37.8)	27(27.6)	2.78	.819
	I allow other science teachers to observe my lesson delivery	41(41.8)	23(23.5)	23(23.5)	11(11.2)	1.92	.792

I reflect on how to improve my lesson after teaching	24(24.5)	26(26.5)	28(28.6)	20(20.4)	2.44	1.42
I test learners on what i have taught to gauge their understanding	19(19.4)	24(24.5)	34(34.7)	21(21.4)	2.58	.84
Overall mean and Std deviation					**2.41**	**1.04**

From the findings in table 4.3, an overall mean of 2.41 according to teachers' supports that implementation of ASEI-PDSI in teaching primary science in Emuhaya Sub-County was carried out sometimes. This is supported by the responses from the teachers as discussed subsequently. It is evident from the table that 30(30.6) of the teachers, frequently allowed pupils to carry out hands on activities followed by 29(29.6%) who sometimes carried out this practice. A mean of 2.40 and Std deviation of .95 indicates that this practice was done sometimes by most teachers. Use of examples among the teachers was minimal as indicated by 34(34.7%) of them who never used the examples at all and 37(37.8%) who used the examples sometimes; a mean of 2.07 supports the idea that most teachers used examples just sometimes. The findings further indicate that 34(34.7%) of the teachers also allowed pupils to ask questions where they didn't understand but rarely allowed pupils to explain their ideas on the chalk board as revealed by 38(38.8%).

Experiment is part of learning that is very important to the schools. However, the findings from 32(32.7%) of the teachers indicate that they did not encourage pupils to carry out experiments and report their observations in class; a mean of 2.32 supports that teachers sometimes allowed pupils to carry out experiments and report their observations though there were variations in the teachers' opinions as shown by a standard deviation of 1.14 which is slightly above 1.00. This is an expression of lack of practice in this area. In the sense of creativity, the findings revealed that 44(44.9%) of the teachers never allowed pupils to make creative things for use in science

lessons. It was however clear from the findings that teachers frequently brought interesting learning materials in class in order to enable learners to learn effectively. This practice was however never carried out by 29(29.6%) of the teachers while 27(27.6%) did it sometimes. The variations in the ideas of the teachers concerning the statement are evident by a standard deviation of 1.18 which is slightly above 1.00. In addition, it emerged that 28(28.6%) of the teachers always used teaching materials from local environment as also supported by 28(28.6%) of them who frequently used teaching materials from the local environment.

It is evident from the findings that there were efforts by teachers to improve learning by preparing teaching and learning materials for their lessons as revealed by 38(38.8%) who were almost equal to 31(31.6%) of the teachers who also prepared science lesson plans daily. This means that when it comes to lesson preparation and teaching materials, teachers were aggressive and capable of handling this practice unlike other areas that they were completely unable. A mean of 2.80 supports that they prepared them frequently, and a Std deviation of .923 indicates that the ideas of the teachers were in agreement concerning preparation of teaching and learning materials for their lessons.

On the other hand, it is clear from the findings that 28(28.6%) of the teachers never took learners outside the classroom for nature walk while 30(30.6%) took them sometimes. Teachers however gave the children assignments to do at home as indicated by 31(31.6%) who always did it and 31(31.6%) who frequently practiced the same. This practice of giving assignments was carried out by most teachers as evidenced by a mean of 2.81. As a result, 40(40.8%) of the teachers frequently checked these assignments and 29(29.6%) always checked the same assignments, implying that teachers understood the importance of monitoring the learners assignment. However, it was difficult for teachers to go around the class ,marking and correcting pupils work

as indicated by 28(28.6%) who never marked in this way and 34(34.7%) who sometimes could go round the class marking and correcting students work. This means that it was not a common practice among the teachers to go round the class marking for the students and correcting them. Perhaps they found it a waste of time or were not well endowed with the skills on its importance and how it could help learners. This practice was done minimally as shown by an overall mean of 2.18 supporting that many teachers sometimes carried it out; however there were variations in the teachers' opinions concerning the practice as indicated by a std deviation of 1.24. Furthermore 43(43.9%) of the teachers never assisted the learners to correct their assignments while 27(27.6%) only carried out this practice sometimes.

The findings also revealed that 37(37.8%) of the teachers, frequently completed their science syllabus in time and 27(27.6%) always completed in time as well. This means that syllabus completion was teacher's routine and therefore it is an effort that is aimed at ensuring that learners learnt effectively; a mean of 2.74 supports that majority of teachers valued syllabus completion on time. Furthermore, the findings indicated that 41(41.8%) of the teachers never allowed other science teachers to observe their lesson delivery as they taught, but 28(28.6%) reflected on how to improve their lesson after teaching. This means that it was not very necessary for other teachers to watch them since they could still reflect on what they taught the learners and improve in areas of weaknesses. The same teachers were also able to test learners on what they had $_{\text{taught}}$ to gauge their understanding as indicated by 34(34.7%) of them.

Generally, it can be noted from the findings that ASEI-PDSI was practiced in the teaching of science in primary schools in Emuhaya Sub-County sometimes. An overall mean of 2.41 according to teachers supports that implementation of ASEI-PDSI in teaching primary science in Emuhaya Sub-County was carried out sometimes; which according to the four point likert scale

was averagely done; 50%. This is in line with the results of science as shown by the ministry of Education Emuhaya Sub-County, that the mean score had stagnated at 50% before and after the LCA was initiated. The stagnation in the mean score therefore may be as a result of these teachers not applying the ASEI-PDSI principles appropriately as shown in table 4.3 in which only a few teachers always and frequently used ASEI-PDSI principles while majority sometimes used the ASEI-PDSI principles.

These findings are similar to those in a survey by CEMASTEA (2011), which revealed that only 40% of the teachers were found to be using ASEI-PDSI practices. In addition, SMASSE 2010 reported that 51.4% of the teachers didn't embrace the concept of improvisation and that students' participation in practicals was very low. The findings contrast with those of Imanda (2013) and Ochanda (2010) who found that learner-centered teaching was not evident during classroom observation conducted by SMASSE trained Biology teachers as most lessons were teacher dominated. Nonetheless, these two later studies did not give the percentage of lessons which were learner dominated and the extent to which these teachers applied the ASE-PDSI principles which the current study has addressed.

The study also sought head teachers views on the extent of use of ASEI-PDSI approach in teaching of science. This was done in order to establish whether what teachers had accomplished was a true reflection of what head teachers were aware of. It was also a gauge measure to establish the true situations in schools in terms of using ASEI-PDSI, as supported by teachers. Head teachers were therefore asked to share their views on a number of aspects of ASEI-PDSI, which were specified but not linked to the practice directly. These aspects included giving hands on activity to learners, involving learner in group discussion, which is described as activity 'A', their observation on how teachers took pupils outside classroom for nature walk, 'D', preparing

lesson plans for their lessons, Preparing teaching and learning materials for their lessons, giving pupils assignments, checking and correcting work, and allowing other science teachers to observe their lessons. This involved 32 head teachers. The study findings are presented as shown in table 4.4 using frequency counts, percentages, means and standard deviations for the respective statements on a four point scale.

Table 4.4 Head teacher's views on extent of use of ASEI-PDSI approach in teaching among Teachers (n=32)

Classroom practice	Never *f*(%)	Sometimes *f*(%)	Frequently *f*(%)	Always *f*(%)	Mean	Std dev
Give hands-on activities to learners	4(12.5)	6(18.8)	13(40.6)	9(28.1)	2.84	.987
Involve learners in group discussion	8(25.0)	11(34.4)	8(25.0)	5(15.6)	2.31	1.030
Take pupils outside classroom for nature walk	7(21.9)	11(34.4)	8(25.0)	6(18.8)	2.41	1.043
Prepare lesson plans for their lessons	6(18.8)	11(34.4)	7(21.9)	8(25.0)	2.53	1.077
Prepare teaching and learning materials for their lessons	11(34.4)	10(31.3)	9(28.1)	2(6.3)	2.06	.948
Give pupils assignments	6(18.8)	14(43.8)	7(21.9)	5(15.6)	2.34	.971
Check and correct pupils work	6(18.8)	13(40.6)	7(21.9)	6(18.8)	2.41	1.012
Allow other science teachers to observe their lessons	9(28.1)	10(31.3)	11(34.4)	2(6.3)	2.19	1.06
Overall mean and standard deviation					2.39	1.016

Key N-Never, S-Sometimes, F-Frequently, A-Always std. dev-standard deviation

From the overall mean of 2.39 and a standard deviation of 1.016, it is clear that according to head teachers, teachers practiced LCA approach in teaching of primary science in Emuhaya Sub-

County sometimes. The following tabulated responses agree with this overall mean and standard deviation: The study findings in table 4.4 indicate that teachers' classroom practice on giving hands-on activities to learners was frequently done according to 13(40.6%) of the head teachers, and 9(28.1%) of them who perceived the practice as done always. The overall mean indicated that this classroom practice was done frequently (Mean=2.84, std. dev=0.987). The standard deviation meant that there was no much variation among the head teacher's views on this statement since it was within one standard deviation. This further means that they all agreed on the same findings. The findings further indicated that teachers allowed other science teachers to observe their lessons as perceived by 11(34.4%) of the head teachers, contrary to teachers views which revealed that they rarely carried out this practice. Other aspects of ASEI-PDSI approach were perceived as poorly practiced by teachers as indicated by head teachers. These included, Involvement of learners in group discussion, which was perceived as a practice that was carried out sometimes or never at all as indicated by 11(34.4%) and 8(25.0%) of the head teachers respectively. It was also clear from 11(34.4%) of the head teachers views that teachers sometimes took pupils outside the classroom for nature walk, but 7(21.9%) of them observed that teachers never practiced this. An overall mean of 2.41 for taking pupils for nature walk and 2.31 for involvement of learners in group discussion, implied that these practices were not fully carried out; they were only carried out sometimes. The findings further indicate that teachers sometimes prepared lesson plans for their lessons as indicated by 11(34.4%) of the head teachers, even though 6(18.8%) of them concluded that teachers never did this practice. Preparation of teaching materials for lessons among teachers was also a practice that was under graded by majority, 11(34.4%) of the head teachers who concluded that it was never done. However, 10(31.3%) of the head teachers claimed that teachers sometimes prepared lesson plan for their

lessons. Giving pupils assignment and checking and correcting pupils work were practices that were also underscored by majority of the teachers, 14(43.8%) and 13(40.6%) of head teachers viewed that teachers practiced these aspects sometimes while 6(18.8%) viewed that teachers never carried out these practices in both cases. The means for these statements were 2.34 and 2.41 respectively meaning that teachers did perhaps practice to a very low extent; sometimes.

The overall mean of 2.39 and standard deviation of 1.016 indicate that according to the head teachers, teachers practiced LCA approach in teaching of primary science in Emuhaya Sub-County sometimes. The findings from the head teachers' responses contradict what the teachers said about implementation of ASEI-PDSI. While the teachers felt that they practiced ASE-PDSI above average, according to the head teachers, that was not the case. Head teachers of schools in Emuhaya Sub-County felt that teachers were not practicing ASEI-PDSI adequately. Even though the findings imply disagreement between the views of the teachers and the head teachers, the head teachers seem right since the findings from document analysis concerning the extent of implementation of ASEI-PDSI approach in teaching primary science in schools indicated that LCA was not fully embraced in most primary schools of Emuhaya Sub-County as follows:

From the 98 teachers who participated in the study, the researcher sampled and reviewed their teaching documents. Out of the 98 teachers, 53 had no schemes of work, 62 had no ASEI-PDSI lesson plans but 78 of them had records of work covered. All the 98 teachers had progress record for pupils.

The findings from document analysis of learners' exercise books also supported the head teachers as indicated below;

The researcher went round the 100 schools that participated in the study and looked at the pupils' exercise books. 4-5pupils in each school were considered and this is what transpired:

Out of the 471 pupils, all of them had science notes, from their exercise books the researcher also discovered that they frequently wrote assignment and did science quizzes as well as having science diagrams but rarely did they do or observe experiments. Few pupils, 3-4 had their assignments checked by their science teachers and also only few of them, 2-4 had their assignments corrected by their teachers.

In addition, a look at the teaching and learning materials also revealed that teachers did not fully implement ASEI-PDSI as they lacked enough teaching and learning materials as indicated by the observations below:

Only 11 schools had breathing system and human heart models, 47 schools had science rooms with real objects like soil, tins, wires and bottles, but on the other hand all schools had wall charts. 57 schools had improvised teaching materials like weather instruments and only 38 had nature corners. No school had a laboratory and neither of them had equipment.

Furthermore, the qualitative data from some respondents indicated that teachers still embrace the lecture method of teaching science as highlighted below:

> *"LCA is a very good practice if implemented appropriately by science teachers. It gives learners a different approach of learning where they also participate rather than just being recipients. But this practice ever since it was initiated; very few teachers embraced it in my school. In fact, it is rarely used in teaching." Panel head 3*

"I have been teaching science for the last 12 years. I was appointed a panel head for the last five years. I have attended SMASE in-service trainings severally and on almost all occasions I have given a chance to my teachers to attend. But the ironical situation remains the fact that even after training; very few implement the practice in teaching. Many teachers still embrace lecture method of teaching where pupils are not given a chance to express their way of understanding in class." Panel head 16

"ASEI-PDSI approach in teaching has not satisfactorily been implemented in teaching science in many primary schools in Emuhaya Sub County. Teachers claim they use it but in the real sense, they don't. What is still embraced in many schools is the lecture method of teaching where pupils don't participate fully in class but are just recipients of knowledge." (QASO)

These findings are very similar to those revealed by the report on SMASSE program situational analysis of September, 2010 which indicated that teachers of mathematics and science rated their own practice of ASEI-PDSI in teaching high in terms of lesson planning, use of activities in their lesson delivery and involvement of learners. But to the contrary, 65% of the principals in the study mentioned that there was a minimal practice of ASEI-PDSI in the classroom. An indication by 67% of the Heads of Departments (HODs) also revealed a low extent of ASEI-PDSI use in classroom practice. Similarly, Sifuna and Kaime (2007) in their study on the impact of in-service education and training programs in mathematics and science on classroom interaction for secondary schools in Kenya revealed that teachers perceive the SMASSE program as having been effective in exposing teachers to a student-centered approach of teaching yet this was not evident in their classroom practice which were largely teacher dominated.

The study further sought response from learners on the extent to which teachers practiced ASEI-PDSI implementation on them. Several statements were therefore given to the learners to do their rating. These were whether they observed, felt and touched materials, discussed what they were learning with their friends in class, carried out experiments, made things for use during science lessons among other aspects. This included 471 pupils. The results are presented as shown in table 4.5 using frequency counts, percentages, means and standard deviations.

Table 4.5 Learners Response on Implementation of ASEI-PDSI (n=471)

Activity	Never	Sometimes	Frequently	Always	Mean	Std dev
Observe, feel and touch materials in class	211(44.8)	236(50.1)	24(5.1)	0(0.0)	1.60	.85
Discuss what you are learning with your friends in class	186(39.5)	12(2.5)	273(57.9)	0(0.0)	2.18	.96
Tell about some science things that happen outside school, at home or in your daily life	149(31.6)	298(63.2)	12(2.6)	12(2.6)	1.76	.85
Allow you to write on the chalk board while explaining something to your classmates	260(55.2)	211(44.8)	0(0.0)	0(0.0)	1.45	.89
Carry out experiments and report your findings to your classmates in class	112(23.8)	322(68.4)	37(7.9)	0(0.0)	1.84	.94
Make things for use during science Lessons	149(31.6)	198(42.0)	49(10.4)	75(15.9)	2.11	.98
Ask you to bring things like animals, stones, feathers, tins to use in science lessons	87(18.4)	198(42.0)	99(21.1)	87(18.4)	2.39	.971
Go outside with him/her to learn on things found outside the classroom	124(26.3)	149(31.6)	136(28.9)	62(13.2)	2.29	.89
Give you work during lessons	62(13.2)	384(81.6)	25(5.3)	0(0.0)	1.92	1.04
Check and mark the work he/she has given you	25(5.3)	99(21.1)	124(26.3	223(47.3)	3.16	.962
Help you correct the work you've done	149(31.6)	198(42.0)	75(15.9)	49(10.4)	2.05	.86
Give you assignments at the end of each lesson	49(10.4)	62(13.2)	273(57.9)	87(18.4)	2.85	.974
Overall mean and std deviation					2.13	.93

The findings on the extent to which teachers implemented ASEI-PDSI in classroom according to the learners are also presented in table 4.5. According to the learners' views, teachers sometimes

implemented ASEI-PDSI as supported by a mean of 2.13 and a standard deviation of .93; the learners perceived implementation of ASEI-PDSI to be practiced sometimes basing on the four point likert scale.

From the findings 236(50.1%) of the learners indicated that they sometimes observed, felt and touched materials in class while 211(44.8%) of them never carried out this practice. Having a mean of 1.60 supports the statement that learners either never observed, touched, felt materials in class or they did so just sometimes. Moreover, 273(57.9%) of the learners also discussed what they learnt with their friends in class frequently, however 186(39.5%) said they never discussed. The findings further indicated that 298(63.2%) of the learners could sometimes tell about some science facts that happened outside school, at home or in their daily life while 260(55.2%) revealed that teachers never allowed them to write on the chalk board while explaining something to their classmates. A mean of 1.45 indicates that in most schools pupils were not allowed to write on the chalkboard while explaining something to their classmates. From the findings, 322(68.4%) of learners reported that they only carried out experiments and reported their findings to classmates in class sometimes and 198(42.0%) were sometimes allowed by teachers to make things for use during science lessons. It was also evident from 198(42.0%) of the learners that teachers sometimes asked them to brig things like animals, stones feathers, tins to use in science lessons. It was however clear from the findings that teachers always checked and marked the work that they had given as revealed by 223(47.3%) of the learners. This was the most considered practice in most schools as it had the highest mean of 3.16. It was also shown by majority 273(57.9%) of the learners that teachers frequently gave them assignments at the end of the lesson.

It can be generalized from the findings that according to the learners view, teachers sometimes implemented ASEI-PDSI as supported by a mean of 2.13 and a standard deviation of .93.

Table 4.6: Overall mean and Std deviation for implementation of LCA approach in teaching primary science

Respondents	Mean	Std deviation
Teachers, head teachers and learners	2.31	.995

From the general mean of 2.31 of teachers who practiced the use of LCA approach in teaching primary school science in Emuhaya Sub-County, it can be depicted that on a four point likert scale, teachers sometimes used LCA in teaching science in primary schools of Emuhaya Sub-County. The stagnation in the mean score therefore is as a result of these teachers not applying the ASEI-PDSI principles appropriately as shown in table 4.3 in which most aspects of ASEI-PDSI were practiced sometimes and frequently but not always.

These findings are similar to those in a survey by CEMASTEA (2011), which revealed that only 40% of the teachers were found to be using ASEI-PDSI practices. However, these study findings contradict those by SMASSE 2010 which reported that 51.4% of the teachers didn't embrace the concept of improvisation and that students' participation in practicals was very low. In addition, the findings contrast with those of Imanda (2013) and Ochanda (2010) who found that learner-centered teaching was not evident during classroom observation conducted by SMASSE trained Biology teachers as most lessons were teacher dominated; in this study learner-centered teaching was practiced to some extent Nonetheless, these two later studies did not give the aspects of ASEI-PDSI in which the lessons were not learner dominated and the extent to which these teachers did not apply the ASEI-PDSI principles which the current study has

addressed. Benedict (2013) also revealed that teachers in his study failed to give practical work and appropriate tasks for discussion hence lessons were largely teacher centered. This has been addressed in this study.

In the theory of Zone of Proximal Development (ZPD) by Vygotsky (1962), children are seen to work better on their own compared to when working in collaboration with an adult. The adults' role is to help them refine their thinking or performance to make it more effective. The teacher therefore mediates the child's learning activity as they share knowledge through social interaction (Dixon- Krauss, 1996). According to Vygostky, learners socially construct knowledge as they work in groups. The inception and use of ASEI-PDSI principles by the science teacher enables him to actively involve learners in a series of activities which include experiments, improvisation, asking questions, nature walk etc. during the lesson as they work in groups to help them acquire concepts on their own as the teacher guides them in subsequent steps. In relation to the study findings, the implementation of ASEI-PDSI was done sometimes; this means that the pupils in Emuhaya Sub-County primary schools were sometimes allowed to work on their own through groups, improvisation, and experiments etc. under the guidance of their teachers. No wonder the performance in the science subjects was stagnant at 50%, which according to the four point Likert scale of the study falls on 2, which implies that ASEI-PDSI by science teachers was only carried out sometimes.

4.3 Head Teachers Supervision of the Implementation of ASEI-PDSI Approach

The main objective of this section was to determine the extent to which primary school head teachers supervise the implementation of ASEI-PDSI approach in science lessons. In order to achieve this objective, the researcher sought views from the head teachers on the extent to which they carried out this supervision.

Several aspect that were associated or deemed to compose supervision included provision of support materials for teachers, ensuring that materials given were used in science lessons, ensuring that science teachers prepared ASEI lesson plans, observing science teachers deliver their lessons, sharing experiences with teachers after lesson observations and advising teachers on better ways of handling their lessons. The findings are presented as shown in table 4.7 using frequency counts, percentages, means and standard deviations.

Table 4.7 Head teachers Views on Supervision of ASEI-PDSI Approach (n=32)

Supervision practice	Never	Sometimes	Frequently	Always	Mean	Std dev
Provide support materials to teachers	5(15.6)	13(40.6)	8(25.0)	6(18.8)	2.47	0.98
Ensure that materials given are used in science lessons	7(21.9)	10(31.3)	10(31.3)	5(15.6)	2.40	1.01
Ensure that science teachers prepare ASEI lesson plans	7(21.9)	13(40.6)	9(28.1)	3(9.4)	2.12	0.92
Observe science teachers deliver their lessons	8(25.0)	9(28.1)	8(25.0)	7(21.9)	2.43	1.11
Share experiences with teachers after lesson observation	13(40.6)	6(18.8)	6(18.6)	7(21.9)	2.21	1.21
Advice teachers on better ways of handling their lessons	9(28.1)	8(25.0)	9(28.1)	6(18.8)	2.38	1.10
Encourage teachers to use ASEI-PDSI practice in teaching science	13(40.6)	12(37.5)	3(9.4)	4(12.5)	1.93	0.98
Overall mean and std deviation					2.27	1.04

The study finding in table 4.7 reveals head teachers' views on supervision of ASEI-PDSI approach in teaching of primary science in Emuhaya Sub-County. An overall mean of 2.27 and a standard deviation of 1.04 indicate that supervision of the use of ASEI-PDSI by head teachers in teaching of primary science in schools of Emuhaya Sub-County was sometimes done. This can

be seen from the individual responses from the head teachers. The findings as indicated in table 4.7 revealed that 13(40.6%) of the head teachers only provided support materials to teach sometimes and also sometimes ensured that these materials were used in science lessons. Means of 2.47 and 2.40 also confirmed these findings by supporting the head teachers who said so. Implying that head teachers were not seriously engaged in supervision under these selected aspects. The findings further indicated that 9(28.1%) of the head teachers observed science teachers deliver their lessons sometimes while 8(25.0%) which is a quarter of them, never observed teachers at all. This statement constituted a mean of 2.43 implying that it was a rare practice among the head teachers. Furthermore, it is clear from the findings that 13(40.6%) of the head teachers never shared experiences with teachers after lesson observation amounting to a mean of 2.21 and a standard deviation of 1.21, while 9(28.1%) never advised teachers on better ways of handling their lessons. At least 8(25.0%) of the head teachers advised teachers on better ways of handling lessons thus leading to a mean of 2.38, implying that the practice was carried out sometimes. Teachers were also sometimes encouraged to use ASEI-PDSI practice in teaching science as indicated by a mean of 1.93.

In addition to these findings, teachers were asked to indicate whether they had ever been supervised by their school head teacher during their lesson delivery.

Several aspects were rated to indicate if teachers were supervised by their head teachers during lessons. These included being provided for support materials for teaching science, ensuring that the teachers prepared ASEI lesson plans, being observed when they deliver their lessons, being advised on better ways of handling their lessons among others. The findings were presented as shown in table 4.8 using frequency counts, percentages, means and standard deviations.

Table 4.8 Teachers' Views on being supervised by head teachers on ASEI-PDSI Approach (n=98)

Supervision practice	Never	Sometimes	Frequently	Always	Mean	Std dev
Head teacher provides science support materials	33(33.7)	41(41.8)	8(8.2)	16(16.3)	2.07	0.95
Ensures that science teachers prepare ASEI lesson plans	37(37.8)	36(36.7)	7(7.1)	18(18.4)	2.06	0.91
Observed when we deliver our lessons	31(31.6)	28(28.6)	12(12.2)	27(27.6)	2.36	1.00
Encouraged to use ASEI-PDSI practice in teaching science	35(35.7)	39(39.8)	19(19.4)	5(5.1)	1.94	0.89
Overall mean and standard deviation					2.11	.94

The study findings in table 4.8 with an overall mean of 2.11 indicate that majority of the teachers were supervised just sometimes when it comes to implementation of LCA in teaching of science in primary schools in Emuhaya Sub-County. A standard deviation of .92 shows that there was agreement in the statements of teachers concerning them being supervised by head teachers. This mean and standard deviation is supported by the responses from teachers as follows:

From the findings in table 4.8, it can be depicted that 41(41.8%) of the teachers said that their head teachers only provided science support materials sometimes, 33(33.7%) said they were never provided with science support materials by their head teachers. A mean of 2.07 and standard deviation of 0.95 supports what teachers said. It is also clear from the findings that most head teachers never ensured that science teachers prepared ASEI-PDSI lesson plans. This is supported by 37(37.8%) of the teachers who said so and 36(36.7%) of the teachers said head teachers only sometimes ensured that science teachers prepared ASEI-PDSI lesson plans. Having

a mean of 2.06 and standard deviation of 0.91 supports the idea that head teachers either never ensured or only ensured that science teachers prepared ASEI-PDSI lesson plans sometimes. Furthermore, 31(31.6%) of the teachers were never observed when delivering lessons while only 28(28.6%) were observed sometimes, only 27(27.6%) responded positively. This means that majority of the head teachers were not concerned in the supervision of the implementation of ASEI-PDSI. In addition to that, 35(35.7%) said they were never encouraged to use the ASEI-PDSI practice in teaching science while 39(39.8%) were encouraged to use the approach. A mean of 1.94 and standard deviation of 0.89 support that the head teachers encouraged teachers to use the ASEI-PDSI approach just sometimes in teaching science. It can be depicted from the findings that head teachers' supervised LCA practice by science teachers in primary schools of Emuhaya Sub County just on some occasions.

In addition to the quantitative findings, some panel heads and the QASO had the following remarks about the head teachers' supervision of LCA implementation:

> *"Supervision by head teachers is rarely done in these schools. In fact, most head teachers are too busy to go round classes to see if this practice is used in teaching." Panel head 25*

> *"Supervision of the implementation of LCA approach in teaching in my school by the head teacher is only done sometimes. In a whole term he supervises the use of the practice like only twice and sometimes he doesn't." Panel head 29*

> *"I have never seen my head teacher come to class to observe me when am teaching. So, whether I implemented LCA in teaching or not, the head teacher has no idea." Panel head 8*

In line with these findings, learners were also asked to indicate whether they were supervised by school head teachers during lesson delivery in class. The response on the question was either yes or no. The results are presented as shown in the bar chart in figure 4.1 that follows.

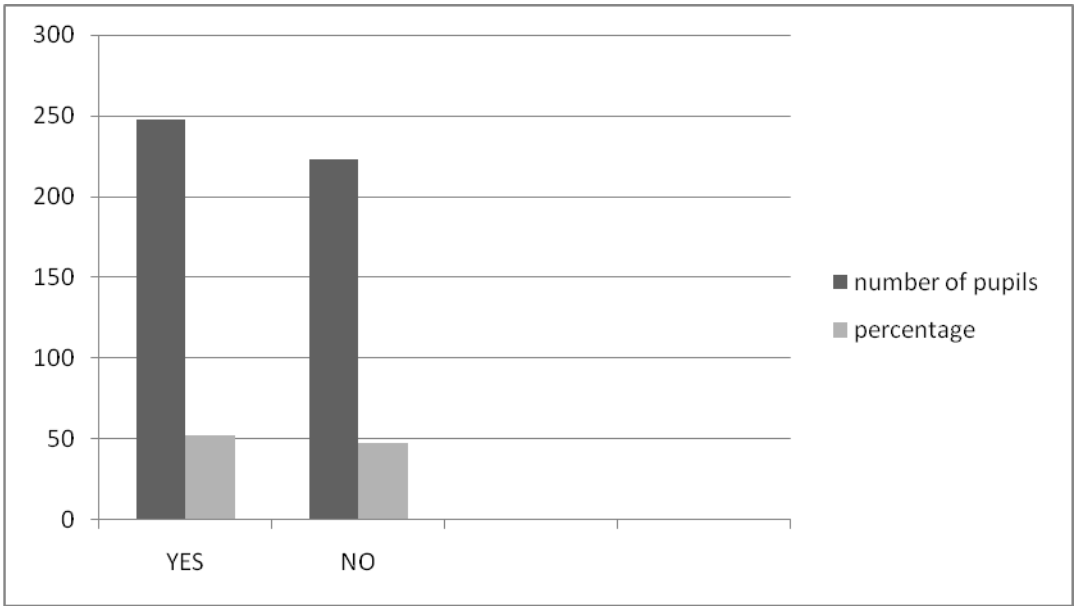


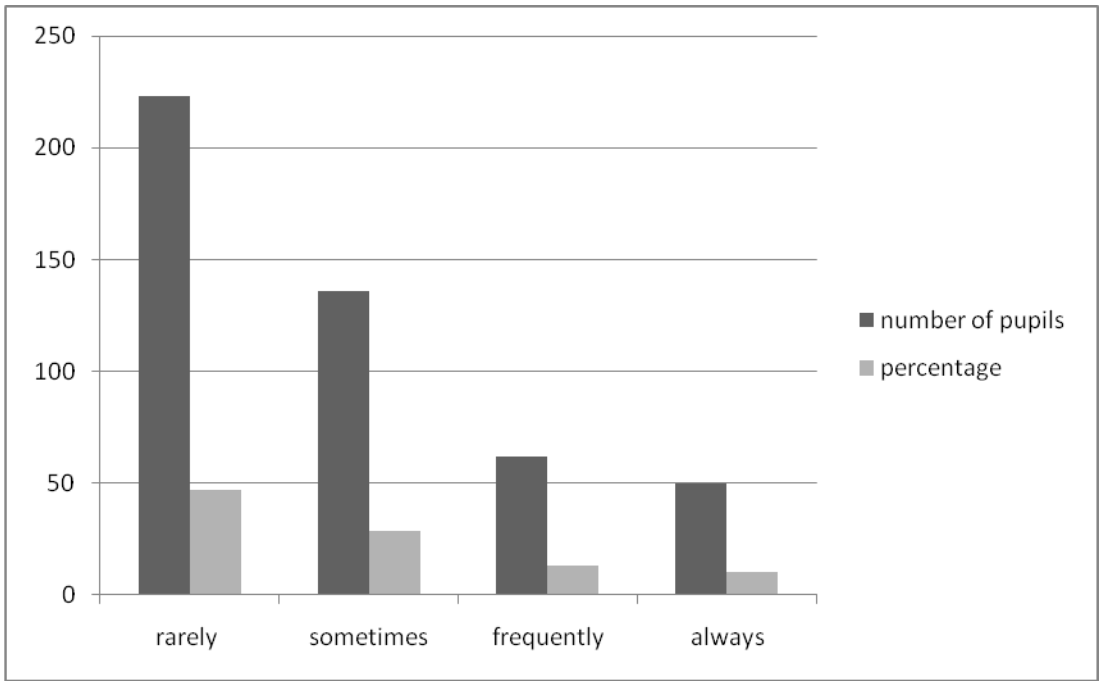
Fig 4.1: Learners' views on supervision by the head teachers during lessons. (n=471)

Key: black-number of learners, grey- respective percentage of the learners who responded.

The findings in figure 4.1 indicated that some head teachers did carry out supervision during science lessons. This is evident from the chart as indicated by 248(52.7%) of the learners who indicated that they were not supervised while the remaining 223(47.3%) indicated that they were supervised. This means that this practice of supervision is carried out in some schools by some head teachers in Emuhaya sub-county.

Learners were also asked to indicate the frequency of supervision if they were supervised by the head teachers during science lessons in classroom. They were therefore asked on a four point

Likert scale to indicate how often the head teachers supervised them during classrooms. The results are presented as shown in chart in figure 4.2 that follows.



Key: black-number of students, grey: respective percentage of the learners who responded.

Fig 4.2: Frequency of learners' supervision by head teachers during lessons

The results in figure 4.2 indicates that 223(47.3%) of the learners were rarely supervised by the head teachers while 136(28.9%) indicated that they were sometimes supervised by the head teachers. The findings further indicate that 62(13.2%) of the learners were frequently supervised while 50(10.6%) were always supervised by the head teachers during science lessons. An overall mean of 1.53 indicate that head teachers carried out the supervision of science lessons even though sometimes implying that they were not completely instrumental to the implementation of ASEI-PDSI among schools in Emuhaya sub-county. A standard deviation of 0.89 shows that there was an agreement in the learners' views concerning supervision by the head teachers.

Table 4.9: overall mean and Std deviation for head teachers' supervision of LCA approach in teaching primary science

Respondents	Mean	Std deviation
Teachers, head teachers and learners.	1.97	0.96

The findings revealed that supervision of the implementation of ASEI-PDSI by head teachers in Emuhaya Sub-County was sometimes done as indicated by a mean of 1.97 on a 4 point likert scale. Since the initiation of LCA in schools in Emuhaya Sub-County, the science mean score has stagnated at 50.0%. The stagnation in the mean score may be as a result of failure of head teachers to supervise and give feedback, encouragement and motivation to these teachers after their supervision hence laxity. In table 4.7, 40.6% of head teachers never shared experiences with teachers after lesson observation nor encouraged them to use ASEI-PDSI. Furthermore, 28.1% of head teachers didn't advise teachers on better ways of handling their lessons as expected by SMASE.

Generally, these findings differ with those of Benedict (2013) who revealed that a majority of aspects of supervision were rarely practiced by school heads leading to inadequate use of ASEI-PDSI in mathematics lessons in Nyamaiya Division, Nyamira County. However, Benedict (2013) studies concentrated on mathematics but also revealed much on head teacher supervision. Benedict did not also give the aspects of ASEI-PDSI and extent of supervision by school heads which this study has addressed. A study by Ngetuny (2013) in Koibatek Sub-County on the implementation of ASEI-PDSI in the teaching of mathematics in secondary schools also contradict the present study findings, it revealed that more than half of the schools in his study area lacked a monitoring mechanism to check whether what is expected by SMASE in the

teaching and learning of mathematics is actually done. But Ngetuny (2013), only looked at whether the head teachers had a monitoring tool for supervising the teachers. The current study came up with its own monitoring tool to investigate the extent of head teachers' supervision of the implementation of ASEI-PDSI. Ndirangu and Nyagah (2013) mentioned that head teachers did not enforce the implementation of ASEI-PDSI in their schools as their supervision of implementation of the approach in classroom practices was limited. This study concentrated on the implementation of SMASSE in secondary schools while the current study was done in primary schools.

The findings from document analysis were also presented concerning extent of supervision of the use of ASEI-PDSI approach in teaching. In this case learners' notebooks and teachers' professional documents were analyzed. From the 98 teachers who participated in the study, 53 had no schemes of work, 62 had no ASEI-PDSI lesson plans. This clearly indicated that most head teachers did not check the teachers' documents to see if they implemented LCA approach in teaching science. Learners' notebooks were analyzed for the head teachers' signature, date and stamp to show whether the head teachers checked what learners did in class. Of all the books checked, none of them had the stamp, signature or date from the head teacher implying that this was never done.

The quantitative findings indicate that supervision of the implementation of LCA in teaching of primary science in Emuhaya Sub-County was done by the head teachers. However, the qualitative findings from the document analysis and interviews clearly indicated that supervision of the implementation of LCA in teaching of primary science in Emuhaya Sub-County was not done by head teachers.

4.4. Challenges faced by Primary school science teachers in implementing ASEI-PDSI

The study sought to determine the challenges that were faced by primary school science teachers in the implementation of ASEI-PDSI. Some statements that were deemed to be indicators of these challenges were therefore rated on a four point likert scale for teacher response. These were; workload due to shortage of teachers, transmission as a way of teaching, confidence in science content, time constraints, limited professional development, stress on syllabus coverage, among other challenges. The findings are presented in table 4.10 using means and standard deviations.

Table 4.10:Teachers responses on the challenges they faced in Implementation of ASEI-PDSI(n=98)

Challenges	Never	Sometimes	Frequently	Always	Mean	Std. dev
Work load due to shortage of teachers	24(24.5)	18(18.4)	27(27.6)	29(29.6)	2.62	1.15
Lack of confidence in scientific content and pedagogical knowledge	5(5.1)	19(19.4)	35(35.7)	39(39.8)	3.10	.89
insufficient resources and equipment	8(8.2)	16(16.3)	33(33.7)	41(41.8)	3.09	.95
Time constraints	8(8.2)	19(19.4)	32(32.7)	39(39.8)	3.04	.96
Limited professional development opportunities	20(20.4)	36(36.7)	25(25.5)	17(17.3)	2.40	1.00
Stress on syllabus coverage among teachers	7(7.1)	18(18.4)	37(37.8)	36(36.7)	3.04	.91
Lack of appropriate activities as challenges in science instruction	12(12.2)	26(26.5)	31(31.6)	29(29.6)	2.79	1.01
Insufficient course materials	12(12.2)	27(27.6)	31(31.6)	28(28.6)	2.77	1.00
Overcrowded classrooms	5(5.1)	26(26.5)	34(34.7)	33(33.7)	2.97	.90
Lack of enough equipment in laboratories	9(9.2)	18(18.4)	34(34.7)	37(37.8)	3.01	.96
Lack of cooperation from parents	13(13.3)	22(22.4)	29(29.6)	34(34.7)	2.86	1.04
use of tests and oral exams in evaluation of the subject leading to memorization of knowledge by learners	16(16.3)	21(21.4)	28(28.6)	33(33.7)	2.80	1.08
Overall mean and std deviation					2.87	.891

The findings as shown in table 4.10 revealed that there were challenges that face the implementation of ASEI-PDSI in schools under study. With an overall mean of 2.87 (71.75%), teachers frequently faced challenges in the implementation of LCA approach in teaching of primary schools under study. First, there is a challenge of lack of confidence in scientific content and pedagogical knowledge among teachers as revealed by 39(39.8%) of the teachers, with a mean of 3.10. This means that teachers are not able to implement the ASEI-PDSI in schools due to lack of confidence in the subject itself.

There is also a challenge in schools as a result of insufficient resources and equipment as indicated by 41(41.8%) of the teachers who indicated that it was always a problem, with a mean of 3.09 and a standard deviation of 0.95. This implies that schools do not have enough resources and equipment to enable teachers carry out the necessary implementation of ASEI-PDSI. Furthermore, the findings revealed that implementation of ASEI-PDSI needed a lot of time in response to 39(39.8%) of the teachers who indicated that they always faced a challenge of time constraints. This means that the process of implementation of ASEI-PDSI was time consuming and therefore schools did not have a proper schedule of ensuring that teachers had enough time to facilitate the implementation of ASEI-PDSI.

Another challenge was lack of equipment in the laboratories (mean=3.01, SD=.96) and stress on syllabus coverage among teachers (mean=3.04, SD=0.91). The mentioned challenges were the major challenges identified in the study as indicated by teachers. However, there are other minor challenges based on the teacher rating of the challenges that they encountered. These were overcrowded classrooms as indicated by 34(34.7%) of the teachers, with a mean of 2.97 said it was a frequent challenge, lack of cooperation from parents (mean=2.86, SD=1.04) with 34(34.7%) of the teachers saying so; use of tests and oral exams in evaluation of the subject

leading to memorization of knowledge by learners (mean=2.80, SD=1.08) and finally insufficient course materials as indicated by 31(31.6%) of the teachers who frequently encountered this challenge among others such as lack of appropriate activities as challenges in science instruction and work load due to shortage of teachers. It is therefore clear that teachers encountered these challenges thus hindering their ability to successfully carry out the implementation of ASEI-PDSI among schools.

With an overall mean of 2.87 (71.75%), teachers frequently faced challenges in the implementation of LCA approach in teaching of primary schools under study. The key challenge among others was lack of confidence in scientific content and pedagogical knowledge. Perhaps, this is the reason as to why there is stagnation in learner achievement in science. It is important to note that for learners to understand the concepts and be able to apply them appropriately so as to perform better in exams, the subject teacher ought to first understand the concept, skills and principles of the subject. This will give the teacher the confidence of pedagogical practice. A teacher who lacks confidence in the content will therefore not relay well the to the learners and this is a reflection of Emuhaya sub-county, where the science mean score has stagnated at 50% although the earlier findings showed that the use and supervision of ASEI-PDSI are being done.

This findings deviated from the findings by Wambui (2006) and Benedict (2013) who noted that teachers had a high understanding of the ASEI-PDSI approach although the two went ahead to mention that, teachers didn't embrace the approach in their classroom practice. In this study, primary school science teachers embraced the aspects of ASEI-PDSI only that they lacked confidence in scientific content and pedagogical knowledge.

Qualitatively, some typical responses from the QASO and panel heads indicated that teachers were faced with challenges such as lack of equipment and resources, understaffing, and overcrowded classrooms among others as shown from the quotes below:

> *"The most challenging issue about LCA implementation in teaching science in primary schools in Emuhaya Sub County is ignorance by many teachers who claim the practice is time consuming. In some cases there are no equipment and resources and in many cases I have discovered understaffing being an issue. But all in all, teachers should attend more in-service trainings concerning LCA approach in teaching and school heads should endeavor to provide their teachers with necessary science materials for teaching." Panel head 10*

> *"Most teachers rush to finish the syllabus due to the much work load they have because of understaffing, some teachers say they have overcrowded classrooms and some say it is better to feed pupils with knowledge than give them a chance to express their views because that would drag them in syllabus coverage. These challenges have prevented implementation of LCA in my school" Panel head 2*

> *"I have gone around some schools in the Sub-County and have come to discover that in as much as LCA is stressed to be implemented in teaching of science in primary schools, there are several challenges that teachers face in this Sub-County. Some of them are overcrowded classrooms which deprive teachers the chance to freely move in class when they deliver their lessons. In some cases I have also encountered teachers who were not fully trained on LCA because of time, while in some other places I have encountered cases of work load due to understaffing , Lack of science learning material including real*

objects, no science rooms for storing any available teaching and learning materials and many more. But these challenges can be attended to by giving the teachers more training on LCA approach of teaching, having small classes that are manageable by teachers so that they can fully implement LCA approach in teaching and by employing more staff in schools." QASO

These findings are in line with those of Laidlaw (2009) in his study on challenges facing practicing and pre-service teachers, he revealed that many primary and pre-service teachers in the New England region were challenged by science due to low levels of confidence in scientific content and pedagogical knowledge, insufficient resources and equipment, time constraints and limited professional development opportunities. In addition, Tynjala & Heikkinen (2011) as well as Boakye & Ampiah (2017) noticed deficiency in skills and content knowledge, lack of resources for teaching and learning and time management as some of the challenges impeding the teaching of science by newly qualified science teachers. This later studies differ from the current study in the sense that they looked at challenges faced by newly employed science teachers' in their classroom practice while this study addresses challenges faced by teachers' who have taught long enough and have even undergone professional development through the SMASE inset.

Furthermore, Thornburg (2009) outlined some challenges in science education. He noted that, shortage of teachers, transmission learning; where science instruction is based on imparting knowledge to students and having them apply it to some predefined problems instead of giving children chance to explore questions and design projects on their own as challenges in science education.

Document analysis was also done by the researcher. The documents that were analyzed in this case were the teaching, learning materials and the learners' science notebooks and the findings were presented as follows:

Of the 100 schools visited by the researcher, only 11 schools had breathing system and human heart models, 47 schools had science rooms with real objects like soil, tins, wires and bottles, but on the other hand all schools had wall charts. 57 schools had improvised teaching materials like weather instruments and only 38 had nature corners. No school had a laboratory or equipment. In all the schools, not even one learner's notebook had been checked and stamped by the school head teacher as required by the TSC.

Results from the document analysis were also in line with qualitative data from the QASO and the panel heads who reported the absence of teaching and learning resources, lack of equipment and very little improvisation among the challenges that faced primary school science teachers in the implementation of ASEI-PDSI in Emuhaya Sub-County.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Introduction

This chapter presents the summary of findings, conclusions and recommendations of the study based on the three objectives. Suggestions of the study are also given on what the study did not accomplish and timely studies that could complement the current study.

5.2 Summary of Findings

This section summarizes the research findings based on research questions thus:-

i. To what extent is ASEI-PDSI approach used in the teaching of science in primary schools in Emuhaya Sub County?

   In response to this question, a general mean of 2.31 on a four point likert scale depicted that ASE-PDSI was sometimes used in teaching science most schools of Emuhaya Sub-County. Science teachers only implemented LCA in their lessons sometimes but not always as expected. A standard deviation of 0.995 showed that most respondents were in agreement concerning the extent of use of LCA approach in teaching primary science in the schools under study, i.e. they all agreed that ASEI-PDSI was being used sometimes.

ii. To what extent do primary school head teachers supervise the implementation of ASEI-PDSI approach in science lessons?

   To answer this question, the findings revealed that the use of LCA approach in teaching primary science in schools of Emuhaya Sub-County was sometimes supervised by the head teachers. A general mean of 1.97 on a four point Likert scale indicated that supervision was sometimes done by head teachers. A standard deviation of 0.96 showed

that the respondents' views (teachers, head teachers and learners), were in agreement. Meaning all agreed that supervision of the use of LCA in teaching science was only done sometimes.

iii. What challenges do primary school science teachers face in implementing ASEI-PDSI approach?

The major challenges that teachers faced during the implementation of ASEI-PDSI were Lack of confidence in scientific content and pedagogical knowledge, insufficient resources and equipment, time constraints, stress on syllabus coverage among teachers and lack of enough equipment in laboratories. A mean of 2.87 translating to 71.75% was achieved indicating that teachers frequently faced challenges during the implementation of SEI-PDSI approach in teaching primary science in schools of Emuhaya Sub-County.

5.3 Conclusions

Based on the findings of the study, the following conclusions were made,

i. Learner-centered approach was sometimes used in teaching science in primary schools of Emuhaya Sub-County. The dismal performance of learners in the subject therefore was as a result of ASEI-PDSI not adequately applied in science lessons by teachers during their classroom practice and the challenges that teachers faced in the attempt to implement LCA approach in teaching science lessons.

ii. Head teachers sometimes carried out supervision of the implementation of ASEI-PDSI approach in teaching of science; therefore supervision of the implementation of Learner-centered approach in teaching science in the primary schools of Emuhaya Sub-County was only done sometimes and not always as expected.

iii. Science teachers frequently faced challenges in the implementation of ASEI-PDSI approach in teaching. The main challenges were: lack of confidence in scientific content and pedagogical knowledge, insufficient resources and equipment, time constraints, stress on syllabus coverage among teachers, overcrowded classrooms and lack of enough equipment in laboratories. It can be concluded that the stagnated outcome by the learners was as a result of these challenges.

5.4 Recommendations

Based on the conclusion of the study, the following recommendations have been made:

1. There's need for science teachers to always prepare ASEI lesson plans for their lessons and use them to ensure that all the aspects of ASEI-PDSI are implemented effectively.

2. Head teachers should intensify the supervision of the implementation of ASEI-PDSI and give timely feedback as well as encouragement to these teachers after supervision. Further, head teachers should also ensure that they check, sign and stamp learners' exercise books to help them monitor the implementation of the approach.

3. Most of the challenges were associated with incompetency of the science teachers in ASEI-PDSI and lack of enough learning resources in the schools. To curb the continuity of these challenges, the researcher recommended that ASEI-PDSI competency based challenges among teachers be overcome by encouraging them to fully attend and participate in the SMASE trainings so as to gain the scientific skills and confidence needed for classroom delivery and that challenges to do with equipment and teaching resources be addressed by the schools' administration to help the science teachers be in a position to fully implement and use LCA in teaching.

5.5 Suggestions for Further Studies

The study recommends that more studies be carried out in the following areas

i. More studies on the implementation of ASEI-PDSI on academic performance of learners in primary schools in other Sub-Counties in Kenya.
ii. Studies to be done on the impact of supervision of ASEI-PDSI implementation on learner outcome in Emuhaya Sub-County.
iii. Studies on the influence of challenges facing implementation of ASEI-PDSI approach on performance of learners could also be timely in Emuhaya Sub-County.

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APPENDICES

Appendix I: Ethics approval

MASENO UNIVERSITY ETHICS REVIEW COMMITTEE

Tel: +254 057 351 622 Ext: 3050
Fax: +254 057 351 221

Private Bag – 40105, Maseno, Kenya
Email: muerc-secretariate@maseno.ac.ke

FROM: Secretary - MUERC

DATE: 28th May, 2018

TO: Winrose Sara Ambasa Namuyenga
PG/MED/00071/2013
Department of Educational Communication
Technology and Curriculum Studies
School of Education, Maseno University
P. O. Box, Private Bag, Maseno, Kenya

REF: MSU/DRPI/MUERC/00494/17

RE: Proposal Reference Number MSU/DRPI/MUERC/00494/17 Assessment of the Implementation of Learner-Centered Approach in Teaching Primary Science in Emuhaya Sub County, Kenya

This is to inform you that the Maseno University Ethics Review Committee (MUERC) determined that the ethics issues raised at the initial review were adequately addressed in the revised proposal. Consequently, the study is granted approval for implementation effective this 28th day of May, 2018 for a period of one (1) year.

Please note that authorization to conduct this study will automatically expire on 27th May, 2019. If you plan to continue with the study beyond this date, please submit an application for continuation approval to the MUERC Secretariat by 15th April, 2019.

Approval for continuation of the study will be subject to successful submission of an annual progress report that is to reach the MUERC Secretariat by 15th April, 2019.

Please note that any unanticipated problems resulting from the conduct of this study must be reported to MUERC. You are required to submit any proposed changes to this study to MUERC for review and approval prior to initiation. Please advice MUERC when the study is completed or discontinued.

DIRECTORATE OF RESEARCH PUBLICATION & CONSULTANCIES 28 MAY 2018 MASENO UNIVERSITY

Thank you.

Dr. Bonuke Anyona,
Secretary,
Maseno University Ethics Review Committee

Cc: Chairman,
Maseno University Ethics Review Committee.

MASENO UNIVERSITY IS ISO 9001:2008 CERTIFIED

Appendix II: Informed Consent Form for School Heads, Science Teachers, Science Panel Heads and the Sub-County QASO

Consent for Human Investigational Studies

Investigators Name: Namuyenga Winrose Sara Ambasa

Study Title: Assessment of the Implementation of a Learner Centered Approach in the teaching of Primary school Science

Purpose: To assess the implementation of ASEI-PDSI in teaching primary school science in Emuhaya Sub-County.

Procedure: In order to know how aspects of ASEI-PDSI are used in science lessons by science teachers, their supervision by school heads as well as the Sub-County QASO and the challenges faced by science teachers in applying these aspects, we shall request you to fill in a questionnaire by either ticking yes or no or giving short answer responses in the spaces provided.

The data you give will be treated with utmost confidentiality and will be used only for the purpose of the study by the researcher. It is important that if you agree to participate in this study, you will give responses that are sincere and true. Your participation in this study is voluntary. Refusing to participate will not involve any penalty or loss of benefits to which you are otherwise entitled. If information generated from this study will be published or presented, your identity will not be revealed.

Signature: Signing below indicates that you have been informed about the research study in which you voluntarily agree to participate; that you have asked any questions about the study; and that the information given to you has permitted you to make a fully informed and free decision about your participation in the study.

By signing this consent form you do not waiver any legal rights, and the investigator is not relieved of any liability she may have. You can withdraw from this study at any time. A copy of this consent letter will be provided to you.

Name…… Signature…… Date……..…

Appendix III: Informed Consent Form for Minors (Pupils in the Study)

Consent for Human Investigational Studies

Investigators Name: Namuyenga Winrose Sara Ambasa

Study Title: Assessment of the Implementation of a Learner Centered Approach in the teaching of Primary school Science

Purpose: To assess the implementation of ASEI-PDSI in teaching primary school science in Emuhaya Sub-County.

Procedure: In order to know how pupils learn science in their school we shall require them to fill in a questionnaire to help us know how various aspects of ASEI-PDSI are applied in the teaching of science, and whether these aspects are being supervised by school heads while learning science lessons. As a parent, you will be required to sign this consent form on behalf of your child since they are minors in the study.
The information they will give towards this study will be treated with utmost confidence and will only be used for the purpose of this study by the researcher. Their participation in this study will be voluntary and in case the information generated from the study will be published or presented, the identity will not be revealed.

Signature: Signing below indicates that as a parent to the learners you have been informed about the research study in which your learners will participate voluntarily; that you have asked questions about the study; and that the information given to you has permitted you to make a fully informed and free decision on behalf of your child participating in the study.
By signing this consent form, you do not waive any legal rights, and the investigator is not relived of any liability she may have. You can withdraw your child from this study at any time. A copy of this consent letter will be provided to you.

Name …… Signature…… Date……

Appendix IV: Questionnaire for Science Teachers

This questionnaire is designed to gather information on assessment of the implementation of learner-centered approach in the teaching of primary science in Emuhaya Sub-County, Vihiga County. The data obtained will be used for the purpose of research only and will be treated with utmost confidence. Please, respond to all the items as honestly as possible.

(Fill in or Tick appropriately)

Demographic Data

1. School _____.

2. Level of training (a) Degree ( ) (b) Diploma ( ) (c) Certificate ( ) (d) Others_____.

3. For how long have you been a teacher?

(a) Less than 5 years ( ) (b) 5 years ( )

(c) 6 -10years ( ) (d) above 10 years ( )

The use of ASEI-PDSI Approach in Teaching

1. Are you a trained science teacher? (a)Yes ( ) (b)No ( )

2. What is your teaching experience as a science teacher?

(a) Less than 5 years ( ) (b) 5 years ( )

(c) 6 -10years (d) above 10 years

3. a) Have you undergone any in-service training on SMASE?

(a) Yes ( ) (b) No ( )

If your answer for question 3(a) is yes, answer question 3(b)

(b) How many SMASE cycles have you attended?

(a) 1 ( ) (b) 2 ( ) (c) 3 ( ) (d) 4 ( )

1. Do you integrate ASEI-PDSI approach in your teaching of science

(a) Yes ( ) (b) No ( )

If your answer to question 4 is yes answer question 5

2. To what extent do you integrate the following in your teaching of science?

Aspects of ASEI-PDSI	**Classroom Practice**	**Never**	**Sometimes**	**Frequently**	**Always**
A	I allow pupils to carry out hands-on activities				
	I involve pupils in group discussion				
S	I use examples from pupils daily life				
	I allow pupils to ask questions where they don't understand				
	I allow pupils to explain their ideas on the chalk board				
E	I encourage pupils to carry out experiments and report their observations in class				
I	I allow pupils to make creative things for use in science lessons				
	I bring interesting learning materials in class				
	I use teaching materials from the local environment.				
P	I prepare science lesson plans daily				
	I prepare teaching and learning				

	materials for my lessons				
D	I take learners outside the classroom for nature walk				
	I give pupils assignments				
	I go round in class marking and correcting pupils' work				
S	I check assignments given to pupils in time				
	I assist learners to correct their assignments				
	I complete science syllabus in time				
I	I allow other science teachers to observe my lesson delivery				
	I reflect on how to improve my lesson after teaching I test learners on what i have taught to gauge their understanding				

Supervision of the implementation of ASEI-PDSI

3. Have you ever been observed by your school head teacher during your lesson delivery?

   (a) Yes( ) (b) No ( )

Challenges Faced in the Implementation of ASEI-PDSI

Teacher Rating on Challenges Facing Teachers

Challenges	Never	Sometimes	Frequently	Always
Work load due to shortage of teachers				
Lack of confidence in scientific content and pedagogical knowledge				
insufficient resources and equipment				
Time constraints				
Limited professional development opportunities				
Stress on syllabus coverage among teachers				
Lack of appropriate activities as challenges in science instruction				
Insufficient course materials				
Overcrowded classrooms				
Lack of enough equipment in laboratories				
Lack of cooperation from parents				
use of tests and oral exams in evaluation of the subject leading to memorization of knowledge by learners				

THANK YOU

Appendix V: Questionnaire for Head Teachers

This questionnaire is designed to gather information on assessment of the implementation of learner-centered approach in the teaching of primary school science in Emuhaya Sub-County, Vihiga. The data obtained will be used for the purpose of research only and will be treated with utmost confidence. Please, respond to all the items as honestly as possible.

(Fill in or tick appropriately)

Demographic Data

1. School _____.

2. Level of training (a) Degree ( ) (b) Diploma ( ) (c) Certificate ( ) (d) Others _____.

3. For how long have you been a head teacher?

(a) Less than 5 years ( ) (b) 5 years ( )

(c) 6 -10years ( ) (d) above 10 years ( )

The use of ASEI-PDSI in Teaching

1. Are you a trained science teacher? (a) Yes ( ) (b) No ( )

   If yes answer question 2.

2. What is your teaching experience as a science teacher?

   (a) Less than 5 years ( ) (b) 5 years ( )

   (c) 6 -10year ( ) (d) above 10 years ( )

3. (a) Have you undergone any in-service training on SMASE?

   (a) Yes ( ) (b) No ( )

If your answer for question 3(a) is yes, answer question 3(b)

(b) How many SMASE cycles have you attended?

(a) 1 ( ) (b) 2 ( ) (c) 3 ( ) (d) 4 ( )

4. How often do your teachers integrate the following in their teaching of science?

Classroom practice	**Never**	**Sometimes**	**Frequently**	**Always**
Give hands-on activities to learners				
Involve learners in group discussion				
Take pupils outside classroom for nature walk				
Prepare lesson plans for their lessons				
Prepare teaching and learning materials for their lessons				
Give pupils assignments				
Check and correct pupils work				
Allow other science teachers to observe their lessons				

Supervision of the implementation of ASEI-PDSI in science

6. As a head teacher, do you ever supervise the implementation of ASEI-PDSI in science lessons in your school? (a) Yes ( ) (b) No. ( )

If your answer to question 6 is yes, how often do you ensure that you do the following?

Supervision practice	**Never**	**Sometimes**	**Frequently**	**Always**
Provide support materials to teachers				
Ensure that materials given are used in science lessons				
Ensure that science teachers prepare ASEI lesson plans				
Observe science teachers deliver their lessons				
Share experiences with teachers after				

lesson observation				
Advice teachers on better ways of handling their lessons				
Encourage teachers to use ASEI-PDSI practice in teaching science				

THANK YOU

Appendix VI: Questionnaire for Class 8 Learners

This questionnaire is for collecting information on the way you learn Science in your school. The information you give will not be shared but will be confidential. Please answer all the questions given honestly.

(Fill or tick in the spaces provided)

1. Class_____
2. How often does your Science teacher allow you to do what is in the table below during Science lessons?

Activity	**Never**	**Sometimes**	**Frequently**	**Always**
Observe, feel and touch materials in class				
Discuss what you are learning with your friends in class				
Tell about some science things that happen outside school, at home or in your daily life				
Allow you to write on the chalk board while explaining something to your classmates				
Carry out experiments and report your findings to your classmates in class				
Make things for use during science Lessons				
Ask you to bring things like animals, stones, feathers, tins to use in science lessons				
Go outside with him/her to learn on things found outside the classroom				
Give you work during lessons				
Check and mark the work he/she has given you				
Help you correct the work you've done				
Give you assignments at the end of each lesson				

3. How often does your head teacher come to your class to find out whether you learn science?
   Never ( ) Sometimes ( ) Frequently ( ) Always ( )

THANK YOU

Appendix VII: Interview Schedule for Science Panel Heads

The purpose of this study is to assess the implementation of learner-centered approach in the teaching of primary school science in Emuhaya Sub-County. The information obtained will be treated with utmost confidentiality and only used for analytical purpose of the study. Kindly be honest in your response.

1. Are you a trained science teacher?
2. For how long have you been teaching science?
3. For how long have you been a science panel head?
4. Have you attended any in–service training in SMASE?
5. Have members of your panel had an opportunity to attend the in-service training on SMASE?
6. How often is ASEI-PDSI used in the teaching of science in your school?
7. In your own opinion, what major challenges do teachers in your panel face while implementing ASEI-PDSI in their science lessons?
8. How do you think these challenges can be minimized for effective implementation of ASEI-PDSI approach?
9. In your own opinion, how do you think the implementation of ASEI-PDSI can be improved to better the teaching of science and the achievement of learners in the subject?

THANK YOU

Appendix VIII: Interview Schedule for the Sub-County QASO

The purpose of this study is to examine the implementation of learner-centered approach in the teaching of primary school science in Emuhaya Sub-County. The information obtained will be treated with utmost confidentiality and only used for analytical purpose of the study. Kindly be honest in your response.

1. Are you a trained science teacher?
2. For how long have you been a Quality Assurance and standards Officer?
3. Have you attended any in-service training on SMASE?
4. Do you ever conduct supervision of the implementation of ASEI-PDSI approach by primary school science teachers in their lessons?
5. How often do you conduct this supervision?
6. In your own opinion, what can you say about the implementation of ASEI-PDSI by primary school science teachers? Are they doing it correctly?
7. What major challenges do primary school science teachers face in their implementation of ASEI-PDSI?
8. As a Sub-county QASO, what do you think can be done to curb these challenges?

THANK YOU

Appendix XI: Document Analysis Guide

1. Professional Records

a) Do science teachers have the following records for use in their classroom delivery

Record	**Available**	**Not available**	**Remarks on its condition**
Scheme of work			
Lesson plan			
Record of work covered			
Progress record for pupils			

b) Do science teachers make ASEI-PDSI lesson plans for their lessons?

Never ( ) Sometimes ( ) Frequently ( ) Always ( )

2. **Teaching and Learning Materials**

a) Comment on the availability of the following learning materials in classrooms

Material	**Available**	**Not available**	**Remarks on their suitability**
Wall charts			
Models like breathing system, human heart			
Real objects			
Nature corners			
Improvised materials			

3. Pupils Science Exercise Books

a) How often do learners write the following information about science in their science exercise books?

Science Information	**Never**	**Sometimes**	**Frequently**	**Always**
Written assignments				

Observations from experiments				
Science notes endorsed by the Head Teacher				
Science quizzes				
Science diagrams				

(b) How often are the assignments given checked by the science teacher?

Never ( ) Sometimes ( ) Frequently ( ) Always ( )

(c) How often are the assignments given corrected?

Never ( ) Sometimes ( ) Frequently ( ) Always ( )

(d) How often does the head teacher check and stamp the learners' notebooks?

Never ( ) Sometimes ( ) Frequently ( ) Always ( )