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EXTENT OF USE OF ASEI-PDSI APPROACH IN TEACHING OF SCIENCE IN PRIMARY SCHOOLS INEMUHAYA SUB-COUNTY, VIHIGA COUNTY, KENYA

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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 neighbouring 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 of use of ASEI-PDSI approach in teaching of science in primary schools in Emuhaya sub-county, Vihiga County, Kenya. 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

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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 dismal performance of learners in the subject was therefore as a result of ASEI-PDSI not always being applied in science lessons by teachers during their classroom practice. 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 science teachers should always prepare ASEI lesson plans for their lessons and use them to ensure that all the aspects of ASEI-PDSI are implemented effectively.

Keywords: ASEI-PDSI, extent of use of ASEI-PDSI approach

1. Introduction

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).

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.

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).

2. Problem Statement

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.

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

2.1 Purpose of the Study

The purpose of this study was to determine the extent of use of ASEI-PDSI approach in teaching of science in primary schools in Emuhaya Sub-County.

3. Literature Review

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

Gates (2003) points out that using physical apparatus helps learning easier. He also notes that using tangible and visible things helps pupils draw connections more easily and makes learning experience more memorable by relating different sensory areas. 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.

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.

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 the descriptive study 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 is 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, the current study used 100 schools. 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.

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).

4. Methodology

4.1 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.

4.2 Target population

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).

4.3 Sampling technique

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.

4.4 Data collection tools

The researcher used questionnaires, interview schedules and document analysis guide for data collection.

4.5 Questionnaire

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

4.6 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.

4.7 Document analysis guide

The documents analysed were teachers' professional documents, learners' notebooks as well as teaching and learning materials.

4.8 Data collection procedures

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.

4.9 Validity of the 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.

4.10 Reliability of the study instruments

Reliability was ascertained through test re-test technique on 10 head teachers, 10 science panel heads, 30 science teachers and 50 class 8 learners i.e. 10% of the study population (Kirlinger, 2009). The two tests were administered on the same respondents at an interval of two weeks (Mugenda & Mugenda, 2003) and the results from the two

different test periods were compared and correlated; a Pearson r coefficient of .85 for questionnaires for science teachers, .81 for questionnaire for head teachers and .79 for questionnaire for class 8 learners was obtained.

Data analysis and management- Data was analyzed using descriptive statistics via SPSS where 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 ( ) which was helped to discuss the extent of use of ASEI-PDSI approach in teaching primary science.

5. Results

5.1 The extent of use of ASEI-PDSI approach in teaching of science in primary schools in Emuhaya Sub-County

This study sought 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 were presented as shown in table 1 using frequency counts, percentages, means and standard deviations.

Table 1: 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
	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
E	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	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
	I use teaching materials from the local environment.	20 (20.4)	22 (22.4)	28 (28.6)	28 (28.6)	2.65	1.43

P D S I	I prepare science lesson plans daily	11 (11.2)	25 (25.5)	31 (31.6)	31 (31.6)	2.83	.784
	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
	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 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 1, 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 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 1 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 extent to which these teachers applied the ASE-PDSI principles which the current study has addressed.

5.2 Head Teachers' Views

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 2 using frequency counts, percentages, means and standard deviations for the respective statements on a four point scale.

Table 2: 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

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 2 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. 4-5 pupils 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.

5.3 Learners' Views

The study further sought the 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 3 using frequency counts, percentages, means and standard deviations.

Table 3: 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

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: 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.

6. Conclusions

The dismal performance of learners in the subject therefore was as a result of ASEI-PDSI not always being applied in science lessons by teachers during their classroom practice.

6.1 Recommendations

Science teachers should always prepare ASEI lesson plans for their lessons and use them to ensure that all the aspects of ASEI-PDSI are implemented effectively.

Conflict of Interest

There is no conflict of interest among the authors of this study.

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