IMPLEMENTATION OF ASEI-PDSI APPROACH IN
MATHEMATICS LESSONS IN NYAMAIYA DIVISION, NYAMIRA
COUNTY, KENYA.

BY:

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DECLARATION

Declaration by Candidate
This thesis is my original work and has not been submitted for a degree in any other
University or any other award.

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DEDICATION

This work is dedicated to my late father, Thomas Obonyo, my mother, Koresta Nyang’ara, my dear wife Nevency Kwamboka, sons Beavon Obonyo and Clifford Ateka, and daughter, Ruth Kerubo.
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ABBREVIATIONS AND ACRONYMS

AIR: American Institutes for Research
ASEI: Activity, Student, Experiment, and Improvisation
INSET: In-Service Education and Training
JICA: Japanese International Cooperation Agency
KESSP: Kenya Education Sector Support Programme
MOEST: Ministry of Education Science and Technology
MoHEST: Ministry of Higher Education Science & Technology
SMASSE: Strengthening of Mathematics and Science in Secondary Education
TELL: Teaching English for Life Learning
TIQET: Totally Integrated Quality Education and Training
USAID: United States Agency for International Development
M.T.E.F: Medium Term Expenditure Framework
M.P.E.T: Master Plan on Education and Training
P.D.S.I: Plan, Do, See, and Improve
P.R.S.P: Poverty Reduction Strategy Paper
T.S.C: Teachers Service Commission
ABSTRACT

Strengthening of Mathematics and Sciences in Secondary Education (SMASSE) training is an educational innovation and an initiative of the government of Kenya with support of the Japanese International Cooperation Agency (JICA). It was launched in 1998 out of the need to improve performance in mathematics and science subjects. This study assessed the implementation of the Activity, Student, Experiment, Improvisation- Plan, Do, See, Improve (ASEI-PDSI) approach in mathematics lessons in secondary schools of Nyamaiya Division, Nyamira District. The ASEI-PDSI approach is an innovative approach of teaching and learning mathematics and sciences championed by the Strengthening of Mathematics and Science in Secondary Education (SMASSE) In-Service Education and Training (InSET) Programme. The specific objectives of the study were: to establish the extent to which mathematics understand the ASEI-PDSI approach; establish the extent to which mathematics use the ASEI-PDSI approach; to determine the extent to which secondary school head teachers supervise the implementation of the ASEI-PDSI approach; and to establish the constraints encountered during implementation of the ASEI-PDSI approach. The study adopted a descriptive survey design. The location of the study was Nyamaiya Division, Nyamira District. The study population consisted of secondary school mathematics teachers who had completed the four cycles of the SMASSE InSET, and all secondary school head teachers of Nyamaiya Division. This yielded a target population of 36 subjects. The study sample comprised 20 mathematics teachers who had completed the four cycles of the SMASSE InSET, and 14 head teachers of secondary schools of Nyamaiya Division. This yielded a study sample of 34 respondents, representing 94.4 % of the target population. A questionnaire for mathematics teachers and head teachers, and a lesson observation rating scale were used to collect data. Piloting was done in one of the schools randomly selected in Nyamaiya Division. The test-retest method was used to test the reliability of the research instruments while the researcher’s supervisors were requested to determine the validity of the research instruments. Data was analyzed descriptively using means, averages, percentages and frequencies. The major findings of the study were: mathematics teachers have a high understanding of the ASEI-PDSI approach; the teachers’ use of the ASEI-PDSI approach in their lessons is inadequate; head teachers rarely supervise the implementation of the ASEI-PDSI approach in mathematics lessons; and implementation of the approach faces constraints such as pressure to cover the syllabus and lack of adequate time for lesson preparation. The conclusion of the study was that the implementation of the ASEI-PDSI approach in mathematics lessons is inadequate. The major recommendations of the study were: follow-up efforts should be made to further improve teachers’ understanding in using the ASEI-PDSI approach; the Ministry of Education should organize an INSET focusing on components of the ASEI-PDSI approach whose extent of implementation was inadequate; and an INSET should be organized for secondary school headteachers so that they could be taken through the requirements of supervision with regard to the implementation of the ASEI-PDSI approach.
CHAPTER ONE

Introduction

1.1 Introduction

This chapter presents the background to the problem under study, statement of the problem, the purpose of the study, objectives of the study, the research questions, the significance of the study, the limitations, the delimitations, the assumptions, the theoretical framework, the conceptual framework, and definitions of terms. The study assessed the implementation of the Activity, Student, Experiment, Improvisation- Plan, Do, See, Improve (ASEI-PDSI) approach in mathematics lessons in secondary schools of Nyamaiya Division, Nyamira District.

1.2 Background to the Study

1.2.1 Role and Importance of Teaching and Learning Mathematics

Mathematics is taught because it is regarded by most people as being essential as they make use of it in their everyday lives. It provides a means of communication which is powerful, concise and unambiguous; it can be used to present information in many ways, not only by means of figures and letters but also through the use of tables, charts and diagrams as well as of graphs and geometrical or technical drawings; it is important and useful in the study of other fields such as engineering, medicine, geography, economics and business; it develops powers of logical thinking, accuracy and spatial awareness; and finally, the inherent interest mathematics can have for many children and adults provides yet another reason for teaching mathematics in schools.
Despite the significance attached to mathematics, performance in the subject has been worrying in many countries. According to Costello (1991), there has been anxiety about the standards of achievement in school mathematics in Britain for many years. He observes that complaints of declining standards have been regularly made in the press and by government organizations.

The situation in Kenya has not been any different. Students have been performing poorly in mathematics, scoring an average of less than 20% in the Kenya Certificate of Secondary Education (KCSE) examination thus causing concern among members of the public (http:www.smasse.org/E/indexe.html)( Retrieved on 17th February, 2013).

1.2.2 Professional Development and In-Service Education and Training

According to the Organization for Economic Cooperation and Development (1998), professional development signifies any activity that develops an individual’s skills, expertise and other characteristics as a teacher. Development is achieved through a set of planned activities that are aimed at moving teachers to more responsible positions within the school system (Parker & Harley, 1999).

In-service education and training is any vocational training acquired during employment (Carl, 1995). It is meant to enhance the skills, knowledge and understanding of teachers for effective classroom practices (Republic of Tanzania, 2010). It further provides
opportunity for professional development to teachers in order to raise their academic qualifications to competently address the educational challenges and compete effectively in the open labour market. From this perspective INSET of teacher is a life long learning process which begins with the initial preparation that a teacher receives at a teachers’ college and continues until retirement. It is an ongoing process of education, training, learning, and support activities that takes place in either external or work-based settings (school-based) of the teacher.

As Carl (1995) observes, in-service education and training helps teachers to expand their current knowledge of a subject, develop new knowledge and engage with colleagues at their current school and other schools. Furthermore, it helps them to plan and develop their own work thoroughly. They may also become more conscious of strategies for change and curriculum development trends. In addition, teachers may acquire skills in research and decision making at various levels.

In-service education supports the professional development of teachers throughout their working lives (Joan, 1991). It is provided to serving teachers and may take place at any time either as a full time study or as a part time study. Full time study takes place when one seeks a study leave to pursue some training on a regular semester basis (Ibid). In Kenya, the Teachers Service Commission (TSC), the body that employs teachers, grants study leave to teachers who intend to pursue further studies on full time basis. On the other hand, part time study takes the form of single lectures, conferences, short weekend
courses, short evening courses, short courses in school time or vacation courses. In Kenya, the SMASSE INSET is undertaken on a part time basis and teachers attend the training during holidays.

According to Johnson (2009), the purposes of in-service education and training can be summarized as being: extension of knowledge; consolidation and reaffirmation of knowledge; regular acquisition of new knowledge; acquaintance with curricular developments; acquaintance with the psychological developments; acquaintance with the sociological basis of education; acquaintance with the principles of organization and administration; repetition or extension of original pre-service teacher education after intervals; acquaintance with new teaching and learning resources; introduction of new methods of teaching; understanding new relationships between teachers and learners; development of teaching and evaluation techniques; and acquaintance with and participation in educational research.

As Burges (1993) observes, in-service education and training may be taken since knowledge changes and this necessitates the need for teachers to be updated. Secondly, techniques of teaching change. If new tools are devised for teachers it is vital that they should be given really wisely planned courses on their value and their limitations. Thirdly, the society changes with time. The growth of technology produces new problems and if our citizens are to be aware of them and be prepared to cope with them, then fresh demands are inevitably placed on those who teach. Fourthly, teachers themselves change.
With experience some teachers develop new interests in special fields, for instance the teaching of handicapped children of various kinds, or counselling demand for special skills and it is one of the functions of in-service education to provide them. In addition, schools themselves change. For instance, a teacher faced with the challenges of a widely mixed ability group will require in-service training for him or her to cope. Finally, in-service education and training can do much to bridge the gap in communication which tends to develop in our educational system. The gulf between knowledge generated through research and practice can only be bridged through in-service training (Ibid).

It should be noted that INSET programmes give teachers an opportunity to reformulate their own philosophies of education and re-appraise their work in schools (www.amazon.com). In addition, the programmes enable teachers to be put in touch with current trends, literature, experiments, aids, equipment and ideas.

Shiundu and Omulando (1992) argue that no teacher can claim to be fully equipped with knowledge sufficient to last him/her throughout his/her teaching career; in-service education and training is therefore a necessary part of a teacher’s teaching career.

However, warns that in-service training for teachers has its own problems (www.abebooks.com) The failure to relate in-service to pre-service training is one of the most significant problems. A closely related problem is that of the relationship between
teacher preparation programmes and actual practice. The reason for this unfortunate condition, he argues, is that in-service and pre-service education programmes have worked separately rather than together.

In Kenya, the Ministry of Education, Science and Technology (MoEST) has a framework for INSET. This is based on the recommendations of the Master Plan on Education and Training (MPET), Kenya, 1997-2000 which states that among other things, teaching and learning transactions will be made more learner-centred through development of focused in-service courses for teachers. It is for this reason that MoEST has made the SMASSE INSET one of the investment programmes in the Kenya Education Sector Support Programme (KESSP 2005-2010).

1.2.3 The SMASSE INSET Programme

Strengthening of Mathematics and Science in Secondary Education (SMASSE) is a joint venture between the Government of Kenya, through the Ministry of Education, Science and Technology (MoEST), and the Government of Japan, through the Japanese International Cooperation Agency (JICA) (SMASSE, http://www.SMASSE.org/E/index.html). It was started on 1st July, 1998 as a pilot project in nine districts, namely: Kisii, Gucha, Butere-Mumias, Kakamega, Lugari, Makueni, Maragwa, Murang’a and Kajiado. The pilot phase ended in May 2002. This was followed by a five-year nationwide implementation phase as from July 2003. The overall goal of the project was to upgrade the capability of young Kenyans in mathematics and science.
Strengthening of Mathematics and Science in Secondary Education programme came into being when the consistently poor performance in mathematics and science became a matter of serious concern (Njuguna, 1999). The programme involves equipping teachers with new skills for teaching mathematics and sciences and assisting them to develop improvised teaching and learning materials, with all these geared toward improving performance and giving learners a positive attitude to the subjects (SMASSE, http://www.SMASSE.org/E/index.html). It is also worth noting that the Government of Kenya considers mathematics and science education as a key factor to industrialization. According to the Republic of Kenya (2002), Kenya aims at industrialization by the year 2020. One of the means and ways of achieving this is by putting emphasis on the strengthening of mathematics and science education as a key factor to industrialization. Equally, the Japanese Government puts high priority on mathematics and science education in its aid policy for the Republic of Kenya. According to JICA (http://www.jica.go.jp), the birth of SMASSE is also envisioned in the Master Plan on Education and Training (MPET, 1997-2010), Poverty Reduction Strategy Paper (PRSP), and the Medium Term Expenditure Framework (MTEF, 2000-2003) as part of human resource development.

The SMASSE INSET programme has the following objectives: to inculcate a positive attitude in the teachers teaching mathematics and science subjects; to encourage teachers
to change from the teacher-centred (didactic) approach of teaching to the child-centred approach (heuristic approach); and to encourage teachers to improvise teaching resources and materials from cheap and locally available materials (SMASSE, www.SMASSE.org/E/indexe.html).

The SMASSE INSET consists of four cycles, each with a specific theme to focus on. According to SMASSE Project (2009), the theme of Cycle One is attitude change, in which focus is on development of positive attitude as a pre-requisite for quality teaching and learning of mathematics and science. Cycle Two deals with activity-oriented teaching and learning and emphasis is on creating and providing opportunities for learners to actively engage in the teaching and learning process. The Third Cycle of the INSET deals with actualization of the ASEI-PDSI approach in which course participants develop ASEI lessons which they first try out on their peers, and later go out to schools to teach actual students. The Fourth Cycle, which is the last, deals with enhancement and sustenance of the ASEI-PDSI approach. Here, participants learn monitoring and evaluation skills to ensure quality teaching and learning. Each cycle of training takes 10 working days. The project adopted a ‘cascade’ system of training the teachers; a gradual training system from central to regional teachers. Under the cascade system, national trainers train district trainers and the district trainers in turn train school teachers in the district.

To understand the exact nature of problems causing poor performance in mathematics
and sciences, the SMASSE project team decided to conduct a baseline survey at the onset of the project. As SMASSE (2004) points out, the baseline survey on the situation of mathematics and sciences in secondary schools identified the following problems: negative attitude towards mathematics and sciences; poor mastery of teaching and learning content; teacher-centred teaching methodology; lack of interactive fora for teachers; failure to develop teaching and learning materials; and administrative factors. The SMASSE INSET was hence supposed to address these shortcomings, while the ASEI-PDSI approach was specifically meant to address the problem of teaching methodology. The survey was conducted in 15 districts.

In Nyamira District, where Nyamaiya Division is found, the SMASSE INSET was introduced in 2004. The fourth Cycle, which was the last, was concluded in 2007.

1.3 Problem Statement

Despite the significance attached to mathematics, poor performance in the subject has been a perennial problem. The poor performance has been attributed to negative attitude among students towards mathematics and sciences; poor mastery of teaching and learning content on the part of teachers; teacher-centred teaching methodology; lack of interactive fora for teachers; failure to develop teaching and learning materials; and administrative factors (SMASSE, 2004). To upgrade the quality of mathematics and science education in secondary schools and address the problem of poor performance, the Ministry of Education Science and Technology (MoEST) in collaboration with the Japanese
International Cooperation Agency (JICA) initiated the SMASSE INSET project in July 1998 on a pilot basis, and later as a nationwide programme. A lot of resources, both financial and material, have been invested in the programme. However, since the conclusion of the fourth Cycle, not much is known about the extent of implementation of the ASEI-PDSI approach in mathematics lessons in Nyamaiya Division. One will hence ask the question: To what extent is the approach being implemented in mathematics lessons? It was in view of this that this study sought to assess the implementation of the ASEI-PDSI approach in mathematics lessons in secondary schools of Nyamaiya Division, Nyamira District, with the purpose of making suggestions that will help bring about improvement in the implementation of the approach.

1.4 Purpose of the Study

The purpose of the study was to assess the implementation of the ASEI-PDSI approach in mathematics lessons in secondary schools of Nyamaiya Division, Nyamira District, with the purpose of making suggestions that will help bring about improvement in the implementation of the approach.

1.5 Specific Objectives of the Study

The specific objectives of the study were to:

(i) establish mathematics teachers’ understanding of the ASEI-PDSI approach

(ii) establish the extent to which mathematics teachers use the ASEI-PDSI
approach

(iii) determine the extent to which secondary school head teachers supervise the implementation of the ASEI-PDSI approach in mathematics lessons

(iv) identify the constraints encountered during the implementation of the ASEI-PDSI approach

1.6 Research Questions

The study addressed the following questions:

(i) What is the extent of mathematics teachers’ understanding of the ASEI-PDSI approach?

(ii) To what extent do teachers of mathematics use the ASEI-PDSI approach?

(iii) To what extent do secondary school head teachers supervise the implementation of the ASEI-PDSI approach in mathematics lessons?

(iv) What constraints are encountered in the implementation of the ASEI-PDSI approach?

1.7 Significance of the Study

The findings of this study would help the Ministry of Education, Science and Technology to improve the SMASSE INSET programme. They would also be utilized by the Kenya...
Institute of Education (K.I.E) in making decisions regarding what areas covered in the SMASSE INSET could be included in the pre-service teacher curriculum. In addition, teachers and school principals would use the findings to improve implementation of the ASEI-PDSI approach. Finally, the study will form a base on which other researchers can develop their studies.

1.8 Limitations of the Study

The following were the limitations of the study:

(i) There was limited literature on the extent of implementation of the ASEI-PDSI approach in mathematics lessons.

1.9 Delimitations of the Study

The following were the delimitations of the study:

(i) Only teachers who had fully undergone the SMASSE INSET took part in the study. This was meant to facilitate an objective assessment of the ASEI-PDSI approach in mathematics lessons

(ii) The study confined itself to public secondary schools. Private schools were not included in the study since the SMASSE INSET was not compulsory for private schools.

1.10 Assumptions of the Study

The following assumptions were made:

(i) All the respondents were to be cooperative in providing appropriate responses
(ii) Mathematics teachers who had completed all the cycles of the SMASSE INSET were using the ASEI-PDSI approach in their lessons.

1.11 Theoretical Framework of the Study

The study was grounded in Piaget’s constructivism theory. Constructivism is a theory based on observation and scientific study about how people learn. (Educational Broadcasting Corporation, 2004) (http://www.thirteen.org/edonline/concept2class/constructivism/index.html). It says that people construct their own understanding and knowledge of the world, through experiencing things and reflecting on those experiences. The concept of constructivism has roots in classical antiquity, going back to Socrates's dialogues with his followers, in which he asked directed questions that led his students to realize for themselves the weaknesses in their thinking (www.thirteen.org/edonline/concept2class/constructivism/index_sub6.html).

In the words of Demetriou, Shayer and Efklides (1992), constructivism characterizes the acquisition of knowledge as a product of the individual’s creative self-organizing activity in particular environments. The constructivist framework portrays an active human agent who knows the world by transforming it and actively adapting to its constraints. When something new is encountered, it has to be reconciled with previous ideas and experience. In a constructivist classroom, it means encouraging students to use active techniques such as experiments to create more knowledge. Constructivist teachers encourage students to
constantly assess how an activity is helping them gain understanding. When they continuously reflect on their experiences, students find their ideas gaining in complexity and power, and they develop increasingly strong abilities to integrate new information. One of the teacher’s main roles becomes to encourage this learning and reflection process.

Constructivism has a number of benefits: children learn more, and enjoy learning more when they are actively involved, rather than passive listeners; education works best when it concentrates on thinking and understanding, rather than on rote memorization—constructivism concentrates on learning how to think and understand; constructivist learning is transferable; constructivism gives students ownership of what they learn, since learning is based on students’ questions and explorations, and often the students have a hand in designing the assessments as well; by grounding learning activities in an authentic, real-world context, constructivism stimulates and engages students; and it promotes social and communication skills by creating a classroom environment that emphasizes collaboration and exchange of ideas (www.thirteen.org/edonline/concept2class/constructivism/index_sub6.html).

Associated with constructivism is discovery learning. Discovery learning is an inquiry-based constructivist learning theory that takes place in problem-solving situations where the learner draws on his or her own past experience and existing knowledge to discover facts and relationships and new truths to be learned. Students interact with the world by
exploring and manipulating objects, wrestling with questions and controversies, or
performing experiments. As a result, students may be more likely to remember concepts
and knowledge discovered on their own. This has many advantages including:
encouraging active engagement; promoting motivation; promoting autonomy,
independence; and development of creativity and problem solving skills (www.learning-
theories.com/discovery-learning-bruner.html).

Constructivism is also closely associated with heuristic teaching. Heuristic teaching
refers to styles of teaching which emphasize the development of self-initiated and self-
directed pupil learning; stress the pupil’s discovering rather than absorbing knowledge;
and place the pupil in the role of inquirer. There is no spoon-feeding or acceptance of
facts which are given by the teacher (www.preservearticles.com/2011521696/heuristic-
method-of-teaching-science.html). The ASEI-PDSI approach favours the heuristic
approach of teaching.

The above mentioned theory suited this study since the ASEI-PDSI approach advocated
by the SMASSE INSET advocates for discovery learning and heuristic teaching, where
learners are expected to acquire knowledge through inquiry. The teacher is expected to
play the role of a facilitator. Learners are supposed to constantly reflect on their
experiences. The learners are also expected to acquire new ideas by reconciling such
ideas with the previously acquired ideas.
1.12 Conceptual Framework

The SMASSE INSET programme is intended to equip mathematics teachers with knowledge and skills relating to the ASEI-PDSI approach. It is expected that teachers who have fully undergone the training should fully employ the ASEI-PDSI approach in their mathematics lessons. For the approach to be properly employed, supervision of implementation by head teachers of secondary schools is essential. However, in the course of implementing the approach, both mathematics teachers and head teachers encounter some constraints.

In the conceptual framework illustrated in figure 1.1, implementation of the ASEI-PDSI approach in mathematics lessons is the dependent variable, while the independent variables are the degree of understanding and usage of the ASEI-PDSI approach by mathematics teachers; degree of supervision of implementation of the approach by head teachers; and constraints encountered by teachers and head teachers during implementation of the approach. This relationship can be illustrated as shown in the model below.
Figure 1.1: Conceptual Framework on the Extent of Implementation of ASEI-PDSI Approach in Mathematics Lessons.

Source: Researcher’s Own (2013)
1.13 Operational Definitions of Terms

**Actualization:** This refers to actual teaching by teachers attending INSET sessions in schools that are adjacent to INSET centres to put the ASEI-PDSI approach into practice.

**Approach:** Refers to the ASEI-PDSI approach

**ASEI-PDSI:** This is an innovative approach of conducting mathematics lessons characterized by activity-based, student-centred and experiment-oriented learning, and improvisation on the part of the teacher. This is tied with proper planning, lesson delivery, evaluation and improvement during the lesson and in subsequent lessons.

**Co-educational schools:** Schools with students of both the male and female gender

**Innovation:** This refers to a species of change in which something new is added to an existing phenomenon

**INSET:** This refers to the SMASSE INSET programme

**Government:** This refers to the Government of Kenya

**Programme:** This refers to the SMASSE INSET programme.

**Project:** This refers to the SMASSE INSET project.

**Science:** Refers to the three science subjects, namely chemistry, physics, biology

**SMASSE:** Refers to the SMASSE INSET Programme.

**Trained teacher:** A teacher who has completed all the four cycles of the SMASSE INSET programme
CHAPTER TWO

Literature Review

2.1 Introduction

This chapter presents a review of literature under the following sub-headings: teachers’ understanding of the ASEI-PDSI approach, teachers’ usage of the ASEI-PDSI approach, and head teachers’ supervision of implementation of the ASEI-PDSI approach. A summary of the literature review is presented at the end of the chapter.

2.2. Teachers’ Understanding of the ASEI-PDSI Approach and its Implementation

It has been pointed out that the ASEI-PDSI approach is innovative approach of teaching championed by the SMASSE INSET programme. As Shiundu and Omulando (1992) observe, innovation is one major type of change in which something new is added to an existing phenomenon; it means introducing something new that deviates from the standard practice. They stress that an innovation must be simple enough to be understood and utilized.

Innovation as a deliberate attempt to improve practice in relation to certain desired objectives; it is a form of change (www.amazon.com). Innovation as a form of change should be technically sound; require change in structure of a traditional school; must be manageable; must be flexible; and must be focused on efforts, timing and resources
according to the stated objectives (Spalding, Januszewski, Rodigas & Vijver, 1996).

As Daft (2004) points out, implementation of change is often the most difficult part of the change process. Until people use the new idea, he observes, no change would have actually taken place. Innovations are sometimes not implemented as planned due to resistance to change. One of the factors that can lead to resistance to change is a lack of adequate resources. He observes that implementation and institutionalization of new practices typically demand more resources that are used to support the existing practice. Innovations are also impeded by a multiplicity and a lack of specificity of objectives; systemic implications, whereby an innovation in one part of a system will have implications for the rest of the system; obsolete incentive structure, whereby an obsolete incentive structure may a negative influence on an innovation; lack of knowledge, whereby those who have to implement ban innovation are generally faced with a lack of knowledge about effective practices or the consequences of alternative plans; time constraint, whereby unrealistic demands are placed upon institutions due to pressure for change within a short period of time; and psychological barriers, whereby people tend to continue with activities which are known and which provide a certain security, rather than enter into activities with unknown consequences.

Craft (2005) adds that creativity enhances learning and makes teaching more effective. Teaching for creativity requires practitioners to be creative themselves and to foster a culture among learners, that values creativity (Simplicio, 2000).
Implementation of the ASEI-PDSI approach means putting the approach, which is an innovation, into practice. According to Oluoch (1982), implementation means taking the innovation to schools after the try-out has been completed. It involves among other things, persuading a variety of people to accept the innovation, keeping the general public informed, training the teachers, provision of necessary facilities, supply of materials and equipment, actual practice of the innovation, and providing continuous support for teachers.

In order for the ASEI-PDSI approach to be effectively implemented, teachers require an adequate understanding of the approach and its components. The approach entails Activity focused teaching and learning, which calls for use of varied, appropriate and interesting teaching and learning activities by teachers, as well as having students conduct practical work; Student-centred teaching and learning, which calls for greater involvement of the learner in the learning process-this is done through effectively encouraging students to give their prior experiences and explaining their ideas related to the content; effectively encouraging students to give their own hypotheses/predictions and helped to discuss how they differed from those held by others and to verify them through experiments; effectively encouraging students to give their own observations and results in experiments and to discuss how they differed from those of others; and encouraging students to evaluate the lesson; Experiments: students should be given opportunities to perform experiments which enhance understanding of concepts in
mathematics and science- this is evidenced by the ability of students to solve related problems; ability of students to make deductions from practical work; and the ability of students to verify hypotheses and predictions; and **Improvisation**: this calls for innovativeness and creativity on the part of the teacher and it involves improvising using materials available in the immediate environment of the students to give experiments and also arouse interest and curiosity in the learners-this is evidenced by the conduct of modified/simplified experiments; utilization of materials available in the students’ immediate environment; teacher producing and or utilizing improvised materials; ability of the students to effectively use improvised materials; and enhanced students’ participation. The following are the principles of ASEI: Knowledge-based teaching to be replaced by activity-based teaching; Student-centred learning to prevail over teacher-centred teaching; Experiment and research-based approaches to replace the traditional lecture approach; and Improvisation and small-scale experiments to replace large-scale experiments ([www.SMASSE.org/E/indexe.html](http://www.SMASSE.org/E/indexe.html)).

For the principles of ASEI to be put into effective use, the PDSI (Plan, Do, See, and Improve) approach is recommended. This entails: **Planning**: this involves proper planning of the lesson based on the ASEI principles- lessons should cater for learners’ background, needs, interests, misconceptions and prior knowledge related to the lesson content; work plan should be appropriate and realistic in light of the lesson content and students’ abilities, skills and interests; and the teacher should prepare appropriate and adequate materials for students’ use; **Doing**: this is concerned with lesson delivery; the
instructional process based on the plan-introduction of the lesson should incorporate previous knowledge, skills and everyday experience and linked the topic; the introduction should be clear on what the teacher wants the students to learn besides being stimulating enough to arouse the interest and curiosity of the students; the lesson should encourage students to express their prior experiences and explain their ideas related to the content; students should be encouraged to give their own hypotheses and predictions and helped to discuss how they differ from those held by others and to verify them through experiments; students should be encouraged to give their own observations and results in experiments and to discuss how they differ from those of others; teacher should deal with students’ questions, misconceptions and reinforce learning at each step; lesson should encourage active participation of students as much as possible in the main teaching steps; lesson should encourage students to draw conclusions; teacher should summarize the lesson and give follow-up activities; teacher should check the accuracy, correctness, depth and appropriateness of the content through question and answer techniques; teacher should organize and conduct the lesson taking into account the individual differences in student capability; and the teacher should make effective use of the teaching and learning materials and media; Seeing: this involves evaluation of the lesson at all stages of its development- teacher should supervise class work; teacher should be attentive to the needs of students; teacher should keep eye contact on students to monitor their feelings; teacher should invite questions from students; and the teacher should ask questions to check quality of understanding; and Improvement: this involves making appropriate improvements during the development of the lesson and/or in the subsequent lessons
based on the feedback obtained in the See component of this approach. This is evidenced by the teacher rephrasing questions or instructional statements as necessary; teacher interjecting rightly and calling to attention inattentive students; teacher giving further guidance to students on lesson activities; and the teacher making appropriate adjustments in the conduct of the lesson (www.SMASSE.org/E/indexe.html)[Retrieved on 15th Jan, 2013].

Studies have shown that teachers who have a sound understanding of an innovative teaching approach implement it effectively. In their study to measure the extent and ability to which the Teaching English for Life Learning (TELL) strategies and methods were being implemented in Ethiopian schools, USAID-AIR(2010) established that the TELL strategies and methods were being effectively implemented as a result of a high understanding of the strategies and methods by teachers who had undergone the TELL training.

In a related study, Conco (2004) found out that teachers who undergone an In-Service education and training programme in languages, social sciences and mathematics were not able to effectively implement the programme procedures. This was attributed to failure to understand the new procedures of teaching the above subject areas. In addition, the study established that the new teaching procedures could not be implemented within the teaching time allocated to the respective learning areas. Teachers also felt that the paperwork involved in the implementation of the new procedures had increased their
workload unnecessarily. Equally, the training failed to prepare them for The Study, titled “How effective is In-Service Training for Teachers in Rural School Context?” was aimed at determining whether Grade Nine teachers benefitted from the training in Curriculum 2005 assessment techniques. The training was organized by the Department of Education, Republic of South Africa. It was also aimed at determining whether the training contributed to meeting the intellectual and professional challenges facing South Africans in the 21st century. The study followed a qualitative approach. Data was collected from Grade Nine Teachers responsible for teaching languages, social sciences and mathematics in three rural schools.

Studies by Wambui (2006) and Sifuna and Kaime (2007) show that teachers who had undergone the SMASSE INSET programme had a good understanding of the ASEI-PDSI approach.

2.3 Teachers’ Usage of the ASEI-PDSI Approach

Evaluation relating to the extent of usage of an innovative teaching approach is critical in any programme or training. According to Mulwa and Nguluu (2003), evaluation facilitates informed decision-making that will lead to improvement. They also observe that evaluation attempts to show the cause-effect relationships between programme activities, and the change they may have observed; is important for accountability; and is an educational process that assesses the extent of people’s participation, how well participants are doing, and what effect the programme is having on the intended
beneficiaries.

The SMASSE INSET conducts monitoring and evaluation to improve the quality of programme activities and also to provide justification for continued allocation of resources into the programme (SMASSE, 2009). The monitoring and evaluation instruments developed by SMASSE are aimed at: measuring change of attitudes among INSET participants; measuring the extent to which content mastery and pedagogical skills have been upgraded; measuring upgrading in quality of teaching and learning; determining the quality of INSET sessions; and monitoring prudent financial practices.

According to Wambui (2006), the nationwide SMASSE project impact assessment survey conducted in 2004 established that teachers who had been exposed to the ASEI-PDSI approach planned better and more consistently, attended to students’ needs better, were more open to teamwork, were more confident, tried out new methods of teaching, and faced the challenge of large classes and lack of resources better. Equally, it was established that students being handled by such teachers were actively involved in the learning process, showed great interest and responsiveness, did their assignments more readily and promptly, carried discussions beyond class time, had an improved relationship with the teacher, developed teamwork, and their attitude towards mathematics had changed for the better. In the study, quantitative data was collected using questionnaires for students, teachers and head teachers. In addition, students wrote an achievement test based on mathematics and science subjects. It was found out that
there was a statistically significant positive effect on students’ achievement (as measured by the achievement tests) as a result of implementation of the SMASSE INSET. Equally, it was found out that the students’ ability was significantly predicted by the students’ attitude towards the subject. In addition, it was found out that school head teachers had significant effect on teachers’ teaching practices. It should be noted that this kind of evaluation is internal.

Evaluation for funded programmes is carried out for two reasons (Baker 2004). Firstly, it is done to fulfill a contract or grant commitment. And secondly, it may be a kind of delaying tactic or a way to shift responsibility or get favourable publicity for the programme. For the case of SMASSE, the evaluation is possibly done to justify the continued allocation of resources into the programme. This calls for independent studies to verify the evaluation results obtained by SMASSE’s internal evaluators.

Some external studies relating to the usage of the ASEI-PDSI approach have also been carried out. In their study titled ‘The Impact of In-Service Education and Training (INSET) Programmes in Mathematics and Science on Classroom Interaction: A Case of Primary and Secondary Schools in Kenya’, Sifuna and Kaime (2007) found out that while teachers perceived the SMASSE INSET programme as having been effective in exposing them to a student-centred approach, this was not reflected in their classroom practices which were largely teacher-dominated. This was partly attributed to large classes, the use of English as second language, and pressure to cover the syllabuses in preparation of the
national examinations. The study, whose purpose was to assess the effectiveness of the SMASSE and School-based Teacher Development programmes in the Kenyan primary and secondary schools sampled four districts and held interviews with 185 teachers. The researchers equally observed lessons and held focus group discussions with pupils and students. The study recommended that the Ministry of Education should mainstream INSET programmes in its policy for teacher development.

Studies whose focus includes the use of the ASEI-PDSI approach have been conducted by some researchers. According to Macharia (2008), a majority of the mathematics teachers (over 80%) in Murang’a District were using the ASEI-PDSI approach in the teaching and learning of mathematics. Besides, the instructional materials used by mathematics teachers who had undergone the SMASSE training differ from those used by mathematics teachers who had not attended the SMASSE INSET. In his study titled ‘The Impact of SMASSE Programme on teaching of Mathematics in Selected Schools in Murang’a district, Kenya’, he identified lack of adequate time and materials for improvisation as the cardinal challenges in the implementation of the ASEI principle and PDSI approach. The study had employed proportional sampling to obtain a sample of 49 mathematics teachers who filled out questionnaires, and purposive sampling to select 10 teachers whose lessons were observed. An observation schedule was used to collect the observed data. Similar findings emerged from studies conducted by Muthemi (2008) and Oirere (2008).
2.4 Head Teachers’ Supervision of Implementation of ASEI-PDSI Approach

Modern school supervision can be defined as a positive action aimed at the improvement of classroom instruction through the continual growth of all concerned - the child, the teacher, the supervisor, the administrator, and the parent or other interested lay person (Glickman, 1990). He adds that the major purpose of instructional supervision can be said to be to oversee the implementation of educational policies and to ascertain whether the implementation is being done effectively.

According to Sushila (2004), the head-teacher is the leader in a school, the pivot around which many aspects of the school revolve, and the person in charge of every detail of the running of the school, be it academic or administrative. One of the roles of the head teacher as an instructional supervisor is to supply learning-teaching materials. Teachers as well as students need to be supplied with the materials necessary for the effective teaching-learning process. The materials should not only be available but must be of good quality. The head teacher should make sure that such materials and any other are in the school before teachers and students require utilizing them. A good system for prompt delivery is therefore essential.

According to Rogan and Grayson (2003), effective management of curriculum implementation depends on the availability, control and monitoring of human, financial and physical resources. These resources include learners, staff members, supplies,
timetables, textbooks, teaching aids, facilities and so forth. Earley and Bubb (2004) further emphasize the importance of adequate financial resources as a crucial implementation indicator in curriculum implementation management. Rogan and Grayson (2003) highlight the importance of management of physical resources, as the nature and availability of these resources directly affect the teachers’ and the learners’ ability to engage in effective teaching and learning.

Carrying out classroom visits to observe lessons is another role of the head teacher. The Manual of Heads of Secondary Schools in Kenya (1987) stresses this role by noting that in particular, the head teacher must check the teaching standards by reference to the schemes of work, lesson notes, pupils’ exercise books, records of work done; and by actual visits to the classroom to see the work of individual teachers.

Rhodes, Stokes & Hampton (2004) also promote classroom observation as a form of performance management. However, these authors strongly believe that this should be done by trained mentors who are able to provide support regarding teaching, learning and classroom management to the observed teachers before, during and after the observation session. In this regard, Earley and Bubb (2004) stress the importance of regular and constructive feedback to the monitored and evaluated parties.

Another role of the head teacher in instructional supervision is to hold individual conferences with teachers. These are usually held after classroom visits or at the request
of the teacher or supervisor. They can be most valuable in providing for an exchange of ideas, and in identifying possible areas for curriculum study or for the teachers’ professional growth (Glickman, 1990).

It is also the role of the head teacher to carry out evaluation of curriculum implementation. Through evaluation, the supervisor will enable the educational process within the organization to be more effective in achievement of set goals and objectives. A good programme is not complete without an evaluation report (Ibid).

According to SMASSE Project (2000), the specific roles of head teachers in the SMASEE programme include: utilizing scarce resources at their disposal more rationally towards academic activities for the benefit of the learners; mobilize all available resources, both human and physical, for enhancement of teaching and learning activities; conduct regular school-based supervision of teaching and learning activities; and organize regular seminars and workshops for mathematics and science teachers through science congress.

Studies conducted reveal that head teachers indeed have a significant role to play in a teacher’s teaching practices. In her study, Wambui (2006) found that school head teachers had a significant effect on teachers’ teaching practices.
Though the roles of the head teachers are clearly spelt out, it has been revealed that some head teachers never carry them out as required, with the result being poor curriculum implementation as reflected in performance in national examinations. Studies show that head-teachers who focus on other issues rather than internal supervision record poor results in examinations. According to Musungu and Nasongo (2008) many head-teachers of schools spend more time with finance management than with the curriculum and instruction, and student personnel. Head teachers seem to believe that they are only accountable for financial management of their schools because they are liable for prosecution if financial mismanagement is discovered.

Competency of the head teacher is essential for proper supervision. Some studies have established that head teachers lack of effective training in educational administration, hence lacking the competency to effectively carry out effective supervision. In a study conducted by Onyango (2001), “Competencies Needed by Head Teachers and Implications for Pre-service and In-service Teacher Education: A Case of Nairobi and Kakamega Districts, Kenya”, it was found that school heads lack effective training in educational administration, thus lacking the expertise to carry out effective supervision and evaluation of the curriculum practice in the schools. The study recommended the need to train educational administrators at school level in management knowledge and skills which will enable them to carry out effective supervision and evaluation of the curriculum.
2.5 Constraints Encountered in Implementation of Innovative teaching Approaches

Studies on implementation of innovative teaching approaches have attempted to identify constraints teachers encounter in the course of implementation. In their study titled ‘The Impact of In-Service Education and Training (INSET) Programmes in Mathematics and Science on Classroom Interaction: A Case of Primary and Secondary Schools in Kenya’, Sifuna and Kaime (2007) identified large classes, the use of English as second language, and pressure to cover the syllabuses in preparation of the national examinations as the major constraints teachers faced during the implementation of the ideals of the SMASSE INSET. Other constraints included lack of adequate teaching and learning resources, lack of cooperation from the school administration, heavy teaching load and student absenteeism (Macharia, 2008; Muthemi, 2008; and Oirere, 2008).

According to Calderhead (1992) teachers are not reflective; they are satisfied with their practices and do not tend to question educational processes. Moreover, they often disregard data that is inconsistent with their beliefs and practice and tend to avoid new experiences. Instead, they prefer to stick to only those practices that match their existing system of beliefs.

2.6 Summary of the Literature Reviewed

From the literature reviewed, it has been noted that for the ASEI-PDSI approach to be effectively implemented, a sound understanding of the approach and its components is essential; and that supervision of the implementation process by head teachers is very
crucial. Nonetheless, the review of the literature revealed some gaps which this study addressed. They are:

(i) Most of the studies reviewed focused on either the impact or effectiveness of the SMASSE INSET, which is a whole programme. None of the studies has specifically focused on the implementation of the ASEI-PDSI approach. This study solely focused on the implementation of the ASEI-PDSI approach, which is a subset of the SMASSE INSET programme.

(ii) Some of the empirical studies reviewed were conducted in situations outside Kenya. Such foreign literature may not always be applicable to Kenyan context.

(iii) The researcher did not identify any study focusing on implementation of the ASEI-PDSI approach conducted in Nyamaiya Division, Nyamira District.

(iv) None of the studies reviewed used lesson observation as a method of data collection.

This explains why this study sought to fill theses gaps in our knowledge by assessing the implementation of the ASEI-PDSI approach in mathematics lessons in Nyamaiya Division, Nyamira District.
CHAPTER THREE

Research Methodology

3.1 Introduction

This chapter presents the research design; location of the study; target population; and sampling procedure and sample size. Research instruments; piloting; data collection procedure and methods of data analysis are also included in the chapter.

3.2 Study Design

This study adopted descriptive survey design. Mugenda and Mugenda (1999) observe that survey studies are conducted to determine a situation and report things the way they are. A survey study is also used to collect data about people’s opinions, attitudes and practices and to make suggestions for improvement of educational practice. The survey was appropriate for this study as it focused on establishing the degree to which the ASEI-PDSI approach was understood and practiced, and also on establishing the degree to which secondary school head teachers supervised the implementation of the ASEI-PDSI approach in mathematics lessons. The information obtained was reported the way it was without manipulating the respondents. Suggestions on how the implementation of the ASEI-PDSI approach could be improved were made based on the findings of this study.
3.3 Study Location

The location of the study was Nyamaiya Division, Nyamira District. The Division was selected since it had a population that was heterogeneous in nature thus yielding rich results.

3.4 Target Population

Nyamaiya Division currently has a total of fifteen (15) public secondary schools. Out of these, two are single sex schools-one for boys and one for girls, while the remaining are co-educational schools. There were forty (40) mathematics teachers out of which, twenty-one had completed the four cycles of the SMASSE INSET by the time of conducting this study. The student enrolment was 3689 by the time of conducting this study.

The target population in this study constituted twenty-one (21) secondary school mathematics teachers who had completed the four cycles of the SMASSE INSET, and fifteen (15) secondary school head teachers of Nyamaiya Division. This yielded a total population of 36 subjects. Mathematics teachers who had completed the four cycles of the SMASSE INSET were included in this study since they were expected to fully implement the ASEI-PDSI approach in the teaching and learning of mathematics after going through the training. Secondary school head teachers were included since they were expected to mobilize all available resources for enhancement of teaching and learning activities, and also conduct regular school-based supervision of teaching and learning activities
3.5 Sampling Procedure and Sample Size

In this study, purposive sampling technique was used to choose Nyamaiya Division. Due to their small number, all the secondary schools of Nyamaiya Division, except one that was used for piloting, were included in the study. Thus a total of fourteen (14) head teachers were involved in the study. All the twenty-one (21) mathematics teachers who had completed the four cycles of the SMASSE INSET, except one who was used during piloting, were also sampled. Hence a total of 20 mathematics teachers were involved in the study. Purposive sampling was used to select the participating class(es) or stream(s) in each school. The total sample size was 34 respondents, representing 94.4 % of the target population. This was considered sufficient for the study. As Gay (1992) points out, 10 % of the target population is the minimum acceptable for a study sample.

3.6 Research Instruments

A questionnaire for mathematics teachers and head teachers, and a lesson observation rating scale were used to collect data in this study.

3.6.1 Questionnaire for Mathematics Teachers

The purpose of this instrument was to seek the views of mathematics teachers regarding the implementation of the ASEI-PDSI approach in mathematics lessons. The questionnaire for mathematics teachers had a mixture of both open and closed-ended questions and had three sections. Open-ended questions allowed unusual responses to be derived while the closed-ended questions helped to limit the respondent’s choices.
Section A collected data about the mathematics teachers’ background, while section B collected information about teachers’ understanding of the ASEI-PDSI approach. Teachers were asked to rate their understanding of each component of the ASEI-PDSI approach, using the indicators of usage of each component. Each indicator was allocated a numerical scale ranging from 1 to 4 as follows: 1 for little, 2 for medium, 3 for high, and 4 for very high. Section C collected information about constraints encountered in the implementation of the ASEI-PDSI approach, and how the ASEI-PDSI approach implementation could be improved.

### 3.6.2 Questionnaire for Head Teachers

This instrument sought views from head teachers regarding the implementation of the ASEI-PDSI approach by mathematics teachers. Items on this instrument sought information about the supervision of mathematics teachers, preparation of ASEI lesson plans, improvisation in mathematics lessons by mathematics teachers, constraints experienced in the implementation of the ASEI-PDSI approach, and how implementation of ASEI-PDSI approach could be enhanced. The interview schedule had three sections. Section A collected background information about the head teachers while section B required head teachers to rate their degree of supervision of the implementation of the ASEI-PDSI approach. Each aspect of supervision was allocated a numerical scale ranging from 1 to 4 as follows: 1 for never, 2 for rarely, 3 for often, and 4 for very often. The last section sought information regarding constraints encountered in the course of implementing the ASEI-PDSI approach and how the implementation of the ASEI-PDSI
approach could be improved.

3.6.3 Lesson Observation Rating Scale

An observation rating scale is considered appropriate where observation is used as a method of data collection. Information about the behaviours and actions of mathematics teachers during lessons will be gathered. As Nachmias et al (1992) observes, observation makes it possible to study behaviour as it occurs. The observation rating scale helped to gather information about the extent to which teachers were using the various components of the ASEI-PDSI approach, through the indicators of usage of each component. Each indicator was allocated a numerical scale ranging from 1 to 4 as follows: 1 for not at all, 2 for inadequate, 3 for adequate and 4 for a great deal. An observation rating scale was considered suitable since it allowed the researcher to judge performance along a continuum. As Airasian (1996) avers, rating scales allow the observer to judge performance along a continuum rather than as a dichotomy.

3.7 Piloting of Research Instruments

Piloting refers to the pre-testing of research instruments to a selected sample, which is identical to the actual sample to be used in the study (Orodho, 2005). He adds that piloting helps to detect deficiencies in the research instruments such as insufficient space and vague questions, and also helps to reveal if the anticipated analytical techniques are appropriate. A pilot study was conducted in one secondary school which was randomly selected from the division to validate the research instruments and also test the reliability
of the instruments. This school was not among the sampled schools. The head teacher and one purposively sampled mathematics teacher were involved in the pilot study. Purposive, followed by simple random sampling were used to pick one class or stream for purposes of observation.

### 3.7.1 Reliability of Instruments

Bryman (2008) defines reliability as the consistency of a measure of a concept. The test-retest method was used in this study to establish the consistency with which the research instruments generated the same information on repeated attempts. This involved administering the research instruments in the pilot school; scoring the instruments manually; administering the same instruments to the same group of subjects after two weeks and scoring the instruments manually; then comparing the responses obtained in the two occasions. Pearson’s product moment correlation coefficient was computed in order to determine the extent to which the research instruments were consistent in eliciting the same responses every time the instruments were administered. A correlation coefficient of 0.76 was obtained for the mathematics teachers’ questionnaire, and 0.8 for the head teachers’ questionnaire. The research instruments were hence accepted as being reliable.

### 3.7.2 Validity of the Instruments

Validity refers to the issue of whether an indicator (or set of indicators) that is devised to gauge a concept really measures that concept (Bryman, 2008). Orodho (2005) views
validity as the degree to which the empirical measure or several measures of a concept, accurately measure the concept. The mathematics teacher and head teacher of the pilot school helped in determining the content validity of the research instruments. The researcher’s supervisors were also requested to determine the validity of the research instruments. The recommendations of the supervisors together with suggestions of the head teacher and mathematics teacher of the pilot school were incorporated in the final research instruments.

3.8 Data Collection Procedure

The researcher obtained a letter of introduction from the Graduate School, Kenyatta University and took to the National Council of Science and Technology (NCST) to obtain a research permit. The researcher then visited the District Commissioner and District Education Officer to inform them about the study and seek their clearance before visiting each of the schools in Nyamaiya Division to explain the purpose of the study to the head teachers and arrange for the conduct of the study. After clearing with the head teachers, the researcher arranged and met mathematics teachers to brief them about the study. The research instruments were personally administered by the researcher in all the schools.

3.9 Methods of Data Analysis

The data from the questionnaires and observation rating scales were manually analyzed using descriptive statistics such as means, percentages and frequencies. To get the mean score for each indicator or aspect in the tables, the number of respondents for that
indicator or aspect is multiplied by their “weightage” rank, added up and divided by the total number of respondent teachers. To get the average score for a component, the mean scores of indicators or aspects are added up and divided by the total number of indicators or aspects. The findings were presented and discussed according to themes derived from the objectives of the study.
CHAPTER FOUR
Data Presentation, Analysis, Results and Discussions

4.1 Introduction
This chapter analyzes and presents the findings of the study. The purpose of the study was to assess the implementation of the ASEI-PDSI approach in mathematics lessons in secondary schools of Nyamaiya Division, Nyamira District, Kenya.

The specific objectives of the study were to:

(i) establish mathematics teachers’ understanding of the ASEI-PDSI approach

(ii) establish the extent to which mathematics teachers use the ASEI-PDSI approach

(iii) determine the extent to which secondary school head teachers supervise the implementation of the ASEI-PDSI approach in mathematics lessons

(iv) identify the constraints encountered during the implementation of the ASEI-PDSI approach

4.2 Teachers’ Understanding of ASEI-PDSI Approach
The mathematics teacher interview schedule was used to gather sampled teachers’ own opinions on how well they understood the ASEI-PDSI approach of the SMASSE training. Using a four-point scale (1= little, 2=medium, 3=high, and 4=very high), teachers indicated their level of understanding of the various components of the ASEI-PDSI
approach. In the tables shown, the number of respondent teachers is indicated for each indicator, out of a total of 20 respondent teachers. Teacher responses on the level of understanding are presented below.

**4.2.1 Teachers’ Understanding of the Activity Component**

Teachers were asked to rate their understanding of the indicators of the Activity component of the ASEI-PDSI approach. Their responses are presented in table 4.1.

**Table 4.1 Teachers’ Responses on Degree of Understanding of the Activity Component (N=20)**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson is activity-focused as practical work is given</td>
<td>13</td>
<td>6</td>
<td>1</td>
<td>0</td>
<td>3.6</td>
</tr>
<tr>
<td>Teacher gives learners appropriate tasks were given for discussion</td>
<td>7</td>
<td>9</td>
<td>4</td>
<td>0</td>
<td>3.6</td>
</tr>
</tbody>
</table>

From table 4.1, it is evident that mathematics teachers had a very high (Average score=3.6) understanding of the Activity component of the ASEI-PDSI approach. On giving practical work during lessons, the teachers rated their understanding as very high (Mean =3.6) with a majority of the teachers (nineteen out of twenty) indicating that they had either a high or very high understanding of this indicator. Equally, on giving learners appropriate tasks for discussion, the teachers rated their understanding as very high.
(Mean=3.6), with over three-quarters of the teachers indicating that they had either a high or very high understanding of this indicator.

This finding agrees with findings by Wambui (2006), and Sifuna and Kaime (2007) in which it was established that teachers had a sound understanding of the ASEI-PDSI approach of the SMASSE INSET. The finding also agrees with a finding by USAID-AIR (2010). In their study to measure the extent and ability to which the Teaching English for Life Learning (TELL) strategies and methods were being implemented in Ethiopian schools, USAID-AIR(2010) established that the TELL strategies and methods were being effectively implemented as a result of a high understanding of the strategies and methods by teachers who had undergone the TELL training. It was also established that such teachers were comfortable in using the strategies and methods as they had understood them well. Non-implementation or ineffective implementation of the component will, therefore, be due to other factors other than low understanding of the component.

The finding is also in agreement with the results of a study by Conco (2004) in which teachers were not able to implement new teaching procedures championed in the INSET because they did not understand them.

The finding means that the teachers are better placed to effectively implement the Activity component of the ASEI-PDSI approach in mathematics lessons. Studies have shown that teachers who have a sound understanding of an innovative teaching approach implement it effectively.
4.2.2 Teachers’ Understanding of the Student-involvement Component

Respondents were also asked to rate their understanding of the indicators of the Student involvement component. Their responses are presented in table 4.2.

Table 4.2 Teachers’ Responses on Degree of Understanding of the Student-Involvement Component (N=20)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher effectively encourages students to give their prior experiences.</td>
<td>6</td>
<td>9</td>
<td>2</td>
<td>3</td>
<td>2.9</td>
</tr>
<tr>
<td>Teacher effectively encourages students to give their own hypotheses/predictions</td>
<td>8</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>2.9</td>
</tr>
<tr>
<td>Teacher effectively encourages students to give their own results/observations in experiments.</td>
<td>10</td>
<td>6</td>
<td>4</td>
<td>0</td>
<td>3.3</td>
</tr>
<tr>
<td>Teacher effectively encourages students to evaluate the lesson.</td>
<td>7</td>
<td>5</td>
<td>3</td>
<td>5</td>
<td>2.7</td>
</tr>
</tbody>
</table>

Average score for Student involvement Component 3.0

Table 4.2 reveals that teachers had a high (Average score=3.0) understanding of the Student-involvement component, with all the indicators rated high (Mean ranging between 2.5 and 3.4). Effectively encouraging students to give their own results and observations received the highest understanding rating (Mean=3.3), with over three-quarters of the teachers indicating that they had either a high or very high understanding of this indicator.
This finding implies that the teachers will be comfortable to implement the Student-involvement component in mathematics lessons. This is evidenced by USAID-AIR (2010), where it was established that teachers who had a high understanding of the TELL strategies and methods effectively implemented them. Non-implementation or ineffective implementation of the component will, therefore, be due to other factors other than low understanding of the component.

### 4.2.3 Teachers’ Understanding of the Experiment Component

The study investigated the extent of teachers’ understanding of the indicators of the Experiment component. The responses are presented in table 4.3.

| Table 4.3 Teachers’ Responses on Degree of Understanding of the Experiment Component (N=20) |
|---------------------------------------------------------------|--------|--------|--------|--------|--------|
| **Indicator**                                                 | **4**  | **3**  | **2**  | **1**  | **Mean** |
| The experiment(s) helped to achieve the objectives of the lesson as reflected in:  |  |  |  |  |  |
| Students’ ability to solve related problems                    | 12     | 7      | 1      | 0      | 3.6     |
| Students’ ability to make deductions from practical work.      | 7      | 6      | 6      | 1      | 3.0      |
| Students’ ability to verify hypotheses/predictions             | 13     | 5      | 3      | 0      | 3.7      |
| Average score for Experiment Component                         |        |        |        |        | 3.4      |

Teachers had a high (Average score=3.4) understanding of the Experiment component as shown in table 4.3. Students’ ability to verify hypotheses and predictions received the
highest rating (Mean=3.7), with a majority (thirteen out of twenty) of the teachers rating their understanding as very high.

The above finding mirrors a finding by USAID-AIR (2010) study in which it was found that teachers who had undergone the TELL training had either a high or very high understanding of the training strategies and methods. The finding means that the teachers are capable of effectively and comfortably implementing the Experiment-effectiveness component of the ASEI-PDSI approach. Non-implementation or ineffective implementation of the component will, therefore, be due to other factors other than low understanding of the component.

4.2.4 Teachers’ Understanding of the Improvisation Component

The interview equally required teachers to rate their understanding of the indicators of the Improvisation component. Their responses are presented in table 4.4.

Table 4.4 Teachers’ Responses on Degree of Understanding of the Improvisation Component (N=20)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Doing of modified/small-scale experiments</td>
<td>15</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>3.7</td>
</tr>
<tr>
<td>Utilization of materials available in the students’ immediate environment.</td>
<td>14</td>
<td>4</td>
<td>2</td>
<td>0</td>
<td>3.6</td>
</tr>
<tr>
<td>Production and or utilization of improvise materials by the teacher</td>
<td>10</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>3.3</td>
</tr>
<tr>
<td>Students’ ability to use improvised materials effectively</td>
<td>9</td>
<td>7</td>
<td>4</td>
<td>0</td>
<td>3.3</td>
</tr>
<tr>
<td>Average score for Improvisation Component</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.5</td>
</tr>
</tbody>
</table>
According to table 4.4, teachers had a very high (Average score=3.5) understanding of the Improvisation component. Doing of modified or small-scale experiments received the highest (Mean=3.7) understanding rating, with a majority (nine out of ten) of the teachers rating their understanding as either high or very high. The table shows that teachers rated their understanding of the indicators as either high or very high (Mean above 3.0).

This finding agrees with findings by Wambui (2006), and Sifuna and Kaime (2007) in which it was established that teachers had a sound understanding of the ASEI-PDSI approach of the SMASSE INSET. It also agrees with a finding in a USAID-AIR (2010) study in which it was found that teachers who had undergone the TELL training had either a high or very high understanding of the TELL strategies and methods. The finding suggests that the teachers are capable of effectively and comfortably implementing the Improvisation component of the ASEI-PDSI approach. Non-implementation or ineffective implementation of the component will, therefore, be due to other factors other than low understanding of the component.

4.2.5 Teachers’ Understanding of the Plan Component

Teachers were asked to rate their understanding of the indicators of the Plan component of the ASEI-PDSI approach. Their responses are presented in table 4.5.
Table 4.5 Teachers’ Responses on Degree of Understanding of the Plan Component (N=20)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work plan taking into account students’ background</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>0</td>
<td>3.0</td>
</tr>
<tr>
<td>Work plan being appropriate and realistic in light of lesson content and students’ abilities/interest/skills.</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Preparation of appropriate and adequate materials for students’ use by the teacher</td>
<td>11</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>3.6</td>
</tr>
</tbody>
</table>

Table 4.5 indicates that teachers rated their understanding of the Do component as high (Average score=3.2). All the indicators were either highly or very highly understood, with preparation of appropriate and adequate materials for students’ use receiving the highest rating (Mean =3.6).

The above finding concurs with a finding by USAID-AIR (2010) in which it was found that teachers who had undergone the TELL training had either a high or very high understanding of the training strategies and methods. The finding means that the teachers are capable of effectively and comfortably implementing the Plan component of the ASEI-PDSI approach. Non-implementation or ineffective implementation of the component will, therefore, be due to other factors other than low understanding of the component.
4.2.6 Teachers’ Understanding of the Do Component

Teachers rated their understanding of the indicators of the Do component. Their responses are presented in table 4.6.

Table 4.6 Teachers’ Responses on Degree of Understanding of the Do Component (N=20)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incorporation of previous knowledge/skills/everyday experience.</td>
<td>13</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>3.5</td>
</tr>
<tr>
<td>Clear on what the teacher wants students to learn.</td>
<td>14</td>
<td>1</td>
<td>5</td>
<td>0</td>
<td>3.5</td>
</tr>
<tr>
<td>Stimulating enough to arouse the interest and curiosity of learners</td>
<td>9</td>
<td>6</td>
<td>4</td>
<td>1</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>Lesson Development:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lesson encourages learners to give their prior experiences.</td>
<td>10</td>
<td>5</td>
<td>3</td>
<td>2</td>
<td>3.2</td>
</tr>
<tr>
<td>Learners give their own hypotheses/predictions.</td>
<td>10</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>3.4</td>
</tr>
<tr>
<td>Lesson encourages learners to give their own observations/results in experiments.</td>
<td>9</td>
<td>5</td>
<td>5</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Lesson facilitates process skills such as observing and measuring.</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td>0</td>
<td>3.4</td>
</tr>
<tr>
<td>Teacher deals with students’ misconceptions and reinforces learning at every step.</td>
<td>9</td>
<td>5</td>
<td>4</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td>Active participation of students in main teaching steps.</td>
<td>11</td>
<td>9</td>
<td>0</td>
<td>0</td>
<td>3.6</td>
</tr>
<tr>
<td><strong>Conclusion:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lesson encourages learners to draw conclusions.</td>
<td>12</td>
<td>5</td>
<td>3</td>
<td>0</td>
<td>3.5</td>
</tr>
<tr>
<td>Teacher summarizes lesson and gives follow-up activities.</td>
<td>7</td>
<td>9</td>
<td>4</td>
<td>0</td>
<td>3.2</td>
</tr>
<tr>
<td>Teacher checks accuracy, correctness and depth of content through question and answer technique</td>
<td>13</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>3.7</td>
</tr>
<tr>
<td>Lesson encourages learners to view content in relation to what they come across in the society.</td>
<td>7</td>
<td>8</td>
<td>5</td>
<td>0</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>Class management:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher conducts lesson taking into account the individual differences in student capability.</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td><strong>Use of instructional materials:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher makes effective use of the teaching/learning materials and media</td>
<td>7</td>
<td>10</td>
<td>3</td>
<td>0</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>Average score for Do Component</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.3</td>
</tr>
</tbody>
</table>
According to table 4.6, teachers had a high (Average score=3.3) understanding of the Do component, with teachers indicating they had either a high or very high understanding of each of the indicators. Checking of accuracy, correctness and depth of content through question and answer technique received the highest (Mean =3.7) rating, with all the teachers rating their understanding as either high or very high.

This finding mirrors a finding by USAID-AIR (2010) in which it was established that teachers who had gone through the TELL training had either a high or very high understanding of the TELL strategies and methods. The finding means that the teachers are capable of effectively and comfortably implementing the Do component of the ASEI-PDSI approach. Non-implementation or ineffective implementation of the component will, therefore, be due to other factors other than low understanding of the component.

### 4.2.7 Teachers’ Understanding of the See Component

Teachers rated their understanding of the indicators of the See component. Their responses are presented in table 4.7.
Table 4.7 Teachers’ Responses on Degree of Understanding of the See Component (N=20)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher supervises class work</td>
<td>5</td>
<td>12</td>
<td>2</td>
<td>1</td>
<td>3.1</td>
</tr>
<tr>
<td>Teacher is attentive to needs of students of both low and high academic ability.</td>
<td>8</td>
<td>11</td>
<td>1</td>
<td>0</td>
<td>3.4</td>
</tr>
<tr>
<td>Teacher keeps eye contact on students to monitor their feelings.</td>
<td>5</td>
<td>9</td>
<td>4</td>
<td>1</td>
<td>2.8</td>
</tr>
<tr>
<td>Teacher invites questions from students.</td>
<td>4</td>
<td>10</td>
<td>6</td>
<td>0</td>
<td>2.9</td>
</tr>
<tr>
<td>Teacher asks questions to check quality of understanding.</td>
<td>11</td>
<td>8</td>
<td>1</td>
<td>0</td>
<td>3.5</td>
</tr>
</tbody>
</table>

Average score for See Component                                           | 3.2 |

From table 4.7, it is evident that teachers highly (Average score=3.2) understand the See component. The table also reveals that asking questions to check quality of understanding received the highest rating (Mean=3.5), with an overwhelming majority (nineteen out of twenty) of the teachers rating their understanding as either high or very high. Table 4.7 also depicts that teachers rated their understanding of each of the components as either high or very high (Mean greater than 2.5).

This finding agrees with findings by Wambui (2006), and Sifuna and Kaime (2007) in which it was established that teachers had a sound understanding of the ASEI-PDSI approach of the SMASSE INSET. It also agrees with a finding by USAID-AIR (2010) in which it was reported that teachers who had undergone the TELL training had either a
high or very high understanding of the TELL strategies and methods. The finding means that the teachers are capable of effectively and comfortably implementing the See component of the ASEI-PDSI approach. Non-implementation or ineffective implementation of the component will, therefore, be due to other factors other than low understanding of the component.

### 4.2.8 Teachers’ Understanding of the Improve Component

Teachers rated their understanding of the indicators of the Improve component and their responses are presented in Table 4.8.

**Table 4.8 Teachers’ Responses on Degree of Understanding of the Improve Component (N=20)**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher rephrases questions or instructional statements as necessary.</td>
<td>11</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>Teacher rightly interjects and calls to attention inattentive students.</td>
<td>9</td>
<td>7</td>
<td>3</td>
<td>1</td>
<td>3.2</td>
</tr>
<tr>
<td>Teacher gives further guidance to students on lesson activities.</td>
<td>14</td>
<td>5</td>
<td>1</td>
<td>0</td>
<td>3.7</td>
</tr>
<tr>
<td>Teacher makes appropriate adjustments in the conduct of the lesson.</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>Average score for Improve Component</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3.3</td>
</tr>
</tbody>
</table>

Table 4.8 reveals that teachers rated their understanding of the Improve component as high (Average score=3.3), and that their understanding of each of the indicators of the
Improve component was either high or very high (Mean greater than 2.5). Giving further guidance to students on lesson activities received the highest rating (Mean=3.7), with close to three-quarters of the teachers indicating they had a very high understanding, and a quarter indicating they had a high understanding. Teachers also reported they had at least a high understanding of each of the indicators.

The above finding mirrors a finding by USAID-AIR (2010) in which it was found that teachers who had undergone the TELL training had either a high or very high understanding of the TELL strategies and methods. The finding means that the teachers are capable of effectively and comfortably implementing the Improve component of the ASEI-PDSI approach. Non-implementation or ineffective implementation of the component will, therefore, be due to other factors other than low understanding of the component.

4.2.9 Summary of Findings on Teachers’ Understanding of the ASEI-PDSI Approach

The study reveals that teachers have either a high or very high understanding of the ASEI-PDSI approach. The teachers indicated they had a high understanding of Student-involvement, Experiment-effectiveness, Plan, Do, See, and Improve components of the approach. They also indicated they had a very high understanding of Activity and Improvisation components. As Shiundu and Omulando (1992) stress, an innovation must be understood for it to be utilized by teachers.
This finding agrees with findings by Wambui (2006), and Sifuna and Kaime (2007) in which it was established that teachers had a sound understanding of the ASEI-PDSI approach of the SMASSE INSET. The finding also agrees a finding by USAID-AIR (2010) established that the TELL strategies and methods were being effectively implemented as a result of a high understanding of the strategies and methods by teachers who had undergone the TELL training. The finding is also in agreement with the results of a study by Conco (2004) in which teachers were not able to implement new teaching procedures championed in the INSET because they did not understand them.

The findings mean that the teachers are better placed to effectively implement the ASEI-PDSI approach in mathematics lessons. Studies (USAID-AIR, 2010) have shown that teachers who have a sound understanding of an innovative teaching approach implement it effectively.

4.3 Teachers’ Usage of the ASEI-PDSI Approach

This section presents and discusses findings about the extent of use of the ASEI-PDSI approach in mathematics lessons in secondary schools of Nyamaiya Division, Nyamira District. One of the objectives of this study was to find out the extent to which mathematics teachers implemented the ASEI-PDSI approach in their lessons. Lessons of twenty (20) mathematics teachers of secondary schools within the Division were observed. Observation of lessons was done with regard to the degree of usage of the various components of the ASEI-PDSI approach. The components observed were: Activity, Student-involvement, Experiment-effectiveness, Improvisation, Plan, Do, See,
and Improve. Observation was done using a four-point scale (1=Not at all, 2=Inadequate, 3=adequate, 4=A great deal). In the scale, ‘Not at all’ implies complete lack of evidence of use of the indicator, ‘Inadequate’ use implies the use of the indicator is unsatisfactory and therefore requires improvement, ‘Adequate’ use implies satisfactory evidence of use of the indicator, while ‘A great deal’ in usage implies usage that is exemplary. The findings are presented and discussed below.

4.3.1 Teachers’ Usage of the Activity Component

To find out the extent of usage of the activity component of the ASEI-PDSI approach, the researcher observed lessons with a view to determine the extent to which various indicators that fall under the Activity component were being used. The study focused on the following indicators: giving learners practical work during lessons; and giving them appropriate tasks for discussion. The findings are presented in table 4.9.

<table>
<thead>
<tr>
<th>Table 4.9 Degree of Usage of the Activity Component (N=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Indicator</strong></td>
</tr>
<tr>
<td>Lesson was activity-focused as practical work is given</td>
</tr>
<tr>
<td>Teacher gave learners appropriate tasks were given for discussion</td>
</tr>
<tr>
<td>Average score for Activity component</td>
</tr>
</tbody>
</table>
The findings revealed that mathematics teachers used the Activity component of the ASEI-PDSI approach inadequately (Average score=1.5) as indicated in table 4.9. The table shows that mathematics teachers did not give practical work at all (Mean=1.3), with a majority (sixteen out of twenty) of the teachers not giving practical work at all, two out of twenty teachers inadequately giving practical work, and another two out of twenty teachers giving adequate practical work. It was also noted that giving learners appropriate tasks for discussion was inadequate (Mean=1.6), with a majority (thirteen out of twenty) of the teachers not doing it at all; three out of twenty teachers doing it inadequately; and four out of twenty teachers doing it adequately.

This finding mirrors a finding by Sifuna and Kaime (2007) in which it was established that while teachers perceived the SMASSE INSET programme as having been effective in exposing them to a student-centred approach, this was not reflected in their classroom practices which were largely teacher-dominated. This was partly attributed to large classes, the use of English as second language, and pressure to cover the syllabuses in preparation of the national examinations.

Prior to the introduction of the SMASSE programme, mathematics lessons were not activity-oriented and this made them look dull and boring (http://www.jica.go.jp). This in turn negatively affected the way students learnt mathematics. The SMASSE INSET stresses the need for mathematics teachers to enrich their lessons with a variety of meaningful and interesting teaching and learning activities. The revelation, therefore, that
the Activity component of the ASEI-PDSI approach was being used inadequately (Average score=1.5) is worrying. It is equally worrying that over three-quarters of the teachers did not give practical work at all, and that nearly three-quarters of the teachers did not give learners appropriate tasks for discussion. The inadequate use of the component may be partly attributed to large classes, inadequate time for preparation, pressure to cover syllabuses and inadequate teaching and learning resources. This calls for urgent intervention to address the constraints.

4.3.2 Teachers’ Usage of the Student-involvement Component
This study sought to find out the extent to which teachers used the ‘Student-involvement’ component, with focus being on the following indicators: students being effectively encouraged to give their prior experiences; students being effectively encouraged to give their own hypotheses and predictions; students being effectively encouraged to give their own results and observations in experiments; and students being effectively encouraged to evaluate the lesson. Table 4.10 presents the findings.
Table 4.10 Degree of Usage of the Student-involvement Component  (N=20)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher effectively encouraged students to give their prior experiences.</td>
<td>13</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>1.5</td>
</tr>
<tr>
<td>Teacher effectively encouraged students to give their own hypotheses/predictions</td>
<td>15</td>
<td>3</td>
<td>2</td>
<td>0</td>
<td>1.4</td>
</tr>
<tr>
<td>Teacher effectively encouraged students to give their own results/observations in experiments.</td>
<td>9</td>
<td>4</td>
<td>7</td>
<td>0</td>
<td>1.9</td>
</tr>
<tr>
<td>Teacher effectively encouraged students to evaluate the lesson.</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1.0</td>
</tr>
<tr>
<td>Average score for Student-involvement Component</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.5</td>
</tr>
</tbody>
</table>

It emerged that mathematics teachers used the Student-involvement component of the ASEI-PDSI approach inadequately (Average score=1.5) as revealed in table 4.10. It was also established that effective encouragement of learners to give their own hypotheses and predictions, and evaluate lessons were not at all (Mean of less than 1.5) done by mathematics teachers. According to table 4.10, encouraging students to evaluate lessons was the worst practiced (Mean=1.0), with all the twenty teachers not doing it at all. The table also shows that students were only encouraged to give their observations and results of experiments inadequately (Mean = 1.9), with nine out of twenty teachers not doing at all; four out of twenty teachers doing it inadequately; and seven out of twenty teachers doing it adequately.
This result tallies with the result of a study by Sifuna and Kaime (2007) that while teachers perceived the SMASSE INSET programme as having been effective in exposing them to a student-centred approach, this was not reflected in their classroom practices which were largely teacher-dominated. This was partly attributed to large classes, the use of English as second language, and pressure to cover the syllabuses in preparation of the national examinations.

In this study, large classes, inadequate time for preparation, pressure to cover syllabuses and inadequate teaching and learning resources have been cited as the constraints behind the dismal usage of the Student-involvement component.

The SMASSE INSET had a goal of making mathematics lessons student-centred by ensuring that students are actively involved during the learning process (www.SMASSE.org/E/indexe.html)[Retrieved on 24th Nov.2009]. This was to be achieved through ensuring that students are actively involved during lessons. The results of this study, however, show teachers used this component inadequately, implying that mathematics lessons are still largely teacher-centred.

This finding means there is need to carry out further investigation into the dismal use of this component in spite of this study depicting that teachers had a high (Average score=3.0) understanding of this component.
4.3.3 Teachers’ Usage of the Experiment Component

The SMASSE INSET aspired to ensure that students are given adequate opportunities to perform simplified and small-scale experiments which enhance understanding of mathematics. On this basis, this study investigated the extent to which teachers used the Experiment component, with focus being on the following indicators: students’ ability to solve related problems; students’ ability to make deductions from practical work; and students’ ability to verify hypotheses and predictions. The findings are presented in table 4.11.

**Table 4.11 Degree of Usage of the Experiment Component (N=20)**

<table>
<thead>
<tr>
<th>Indicator</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>The experiment(s) helped to achieve the objectives of the lesson as:</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students were able to solve related problems</td>
<td>2</td>
<td>7</td>
<td>7</td>
<td>0</td>
<td>1.9</td>
</tr>
<tr>
<td>Students were able to make deductions from practical work.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Students were able to verify hypotheses/predictions</td>
<td>15</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1.3</td>
</tr>
<tr>
<td>Average score for Experiment effectiveness Component</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.8</td>
</tr>
</tbody>
</table>

The study revealed that mathematics teachers used the ‘Experiment-effectiveness’ component inadequately (Average score=1.8) as depicted in table 4.11. As to whether the experiments helped to achieve lesson objectives, table 4.11 shows that mathematics teachers gave experiments that enabled students to solve related problems inadequately.
(Mean =1.9), with two out of twenty teachers having their students being totally unable to solve related problems; seven out of twenty teachers having their students being able to solve related problems inadequately; and seven out of twenty teachers having their students being able to solve related problems adequately. Students’ ability to make deductions from practical work was inadequate (Mean =2.0), with six out of twenty teachers having students who were totally unable to make predictions from practical work; eight out of twenty teachers having students who were able to make predictions from practical work inadequately; while six out of twenty teachers had students who were able to make predictions from practical work adequately. On students’ ability to verify hypotheses and predictions, the study established that mathematics teachers had students who were totally unable (Mean=1.3) to verify hypotheses and predictions, with a majority (three-quarters) of the teachers having students who could not verify hypotheses and predictions at all; four out of twenty teachers having students who could verify hypotheses and predictions inadequately; and one out of twenty teachers having students who could verify hypotheses and predictions adequately.

This finding is in agreement with a finding by Sifuna and Kaime (2007) that teachers were hardly using the ASEI-PDSI approach in their classrooms despite having been well exposed to the SMASSE programme.

The SMASSE INSET had an aim of ensuring that modified and simplified experiments which enhanced understanding are performed during mathematics lessons as opposed to
large-scale, recipe-type of experiments which do not foster understanding of mathematical concepts (http://www.jica.go.jp).

This study did reveal that teachers had a high (Average score=3.4) understanding of this component of the ASEI-PDSI approach. It has, however, been reported that teachers were using the component inadequately (Average score=1.8). This has been partly attributed to factors such as large classes, inadequate time for preparation, pressure to cover syllabuses, inadequate teaching and learning resources, and inadequate supervision by head teachers. This calls for urgent intervention as it means that learners are not reaping the benefits of experiments out of their mathematics lessons.

4.3.4 Teachers’ Usage of the Improvisation Component

The degree to which teachers used the Improvisation component was a subject of this study, with focus being on the extent of usage of the following indicators: doing of modified and small-scale experiments; utilization of materials available in the students’ immediate environment; teacher producing and or utilizing improvised materials; students’ ability to use improvised materials effectively. Table 4.12 presents findings on the Improvisation component.
Table 4.12 Degree of Usage of the Improvisation Component (N=20)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Modified/small-scale experiments were done</td>
<td>16</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>1.3</td>
</tr>
<tr>
<td>Materials available in the students’ immediate environment were utilized</td>
<td>17</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>1.2</td>
</tr>
<tr>
<td>Teacher produced and or utilized improvised materials.</td>
<td>15</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>1.4</td>
</tr>
<tr>
<td>Students were able to use improvised materials effectively</td>
<td>13</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>1.6</td>
</tr>
<tr>
<td>Average score for Improvisation Component</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.4</td>
</tr>
</tbody>
</table>

Table 4.12 depicts that the Improvisation component was not at all (Average score=1.4) being used by mathematics teachers. The table reveals that utilization of materials available in the students’ immediate environment was the least done (Mean =1.2), with seventeen out of twenty teachers not utilizing the materials at all, and only three out of twenty teachers utilizing such materials inadequately.

This finding is in agrees with a finding by Sifuna and Kaime (2007) that teachers were hardly using the ASEI-PDSI approach in their classrooms despite having been well exposed to the SMASSE programme, with reasons for this situation including large classes, the use of English as second language, and pressure to cover the syllabuses in preparation of the national examinations.
The SMASSE INSET strives to inculcate in the mathematics teachers a culture of creativity and innovativeness (www.SMASSE.org/E/indexe.html). The creativity and innovativeness are expected to be demonstrated by mathematics teachers through improvisation and utilization of locally available materials in their lessons. Nonetheless, it has been reported that teachers were not at all (Average score=1.4) using this component, despite having a very high (Average score=3.5) understanding of it. This has been partly attributed to factors such as large classes, inadequate time for preparation, pressure to cover syllabuses, inadequate teaching and learning resources, and inadequate supervision by head teachers.

This finding suggests that the current mathematics lessons resemble the pre-ASEI-PDSI mathematics lessons in which mathematics teachers heavily relied upon conventional teaching and learning materials. In the absence of these conventional materials, there was little or no improvisation at all on the part of teachers; thus teachers would conduct lessons with no teaching and learning aids. This made mathematical concepts to look abstract, dull and boring (http://www.jica.go.jp). Hence this finding necessitates the need to find out reasons behind the low usage of this component.

4.3.5 Teachers’ Usage of the Plan Component

This study sought to assess the extent to which mathematics teachers used the Plan component. The following indicators were rated during observation: work plan taking into account students’ background; work plan being appropriate and realistic in light of
lesson content and students’ abilities, interest and skills; and teachers’ preparation of
appropriate and adequate materials for students’ use. Table 4.13 presents findings on the
Plan component.

Table 4.13 Degree of Usage of the Plan Component (N=20)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Work plan took into account students’ background</td>
<td>0</td>
<td>3</td>
<td>17</td>
<td>0</td>
<td>2.9</td>
</tr>
<tr>
<td>Work plan was appropriate and realistic in light of lesson content and students’ abilities/interest/skills.</td>
<td>1</td>
<td>5</td>
<td>14</td>
<td>0</td>
<td>2.7</td>
</tr>
<tr>
<td>Teacher prepared appropriate and adequate materials for students’ use.</td>
<td>0</td>
<td>15</td>
<td>5</td>
<td>0</td>
<td>2.3</td>
</tr>
</tbody>
</table>

Average score for Plan Component 2.6

As revealed in table 4.13, mathematics teachers plan for their lessons adequately
(Average score=2.6). According to the table, teachers adequately (Mean=2.9) take into
account the backgrounds of their students during planning, with a majority (seventeen out
of twenty) of them catering for those backgrounds adequately; and three out of twenty
teachers catering for them inadequately. The table also indicates that teachers adequately
(Mean=2.7) take into account the lesson content and students’ abilities, interests, and
skills during planning, with fourteen out of twenty teachers doing so adequately; a quarter
of the teachers doing so inadequately; and one out of twenty teachers not doing so at all.
On preparation of appropriate and adequate materials for students’ use, the table depicts
that teachers did so inadequately (Mean=2.3), with three quarters of the teachers doing it inadequately and only a quarter doing it adequately.

The finding is in agreement with findings by Wambui (2006), Macharia (2008), Oirere (2008) and Muthemi (2008) that mathematics teachers carried out proper and adequate planning for their lessons. It also agrees with the finding of a study by USAID-AIR (2010) that teachers who underwent the TELL training were using the strategies and methods learnt in the training.

The SMASSE INSET advocates that mathematics teachers should properly plan for their lessons for effective teaching and learning to take place (www.SMASSE.org/E/indexe.html). Through planning, SMASSE points out, a teacher is able to: carefully select tried out activities for the students; select activities to replace those that do not work; improvise materials; understand basic operations better; enhance his/her confidence; utilize time properly; determine his/her achievements; and identify safety precautions that may require to be taken (http://www.jica.go.jp). This study revealed that teachers plan for their lessons adequately (Average score=2.6), a finding which might be attributed to the possibility that teachers were comfortable in using the component. The usage of this component by teachers, therefore, calls for further strengthening.
4.3.6 Teachers’ Usage of the Do Component

A mathematics teacher is expected to appropriately deliver a lesson after planning as per the SMASSE training. Lesson delivery involves the interaction between the learners and the teacher. How well a teacher facilitates the teaching and learning process determines how much is learnt in a lesson. This study, therefore, assessed the extent to which mathematics teachers used the various indicators of the Do component of the ASEI-PDSI approach. The indicators included: introduction incorporating previous knowledge, skills and everyday experience; introduction being clear on what the teacher wanted students to learn; introduction being stimulating enough to arouse the interest and curiosity of learners; lesson encouraging learners to give their prior experiences; lesson encouraging learners to give their own hypotheses and predictions; lesson encouraging learners to give their own observations and results in experiments; lesson facilitating development of process skills such as observing and measuring; teacher dealing with students’ misconceptions and reinforcing learning at every step; active participation of students in main teaching steps; lesson encouraging learners to draw conclusions; teacher summarizing lesson and giving follow-up activities; teacher checking accuracy, correctness and depth of content through question and answer technique; lesson encouraging learners to view content in relation to what they come across in the society; teacher conducting lesson taking into account the individual differences in student capability; and teacher making effective use of the teaching and learning materials and media. The findings are presented in table 4.14.
Table 4.14 Degree of Usage of the Do Component  \( (N=20) \)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Introduction:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incorporation of previous knowledge/skills/everyday experience.</td>
<td>5</td>
<td>7</td>
<td>8</td>
<td>0</td>
<td>2.2</td>
</tr>
<tr>
<td>Clear on what the teacher wanted students to learn.</td>
<td>0</td>
<td>2</td>
<td>18</td>
<td>0</td>
<td>2.9</td>
</tr>
<tr>
<td>Stimulating enough to arouse the interest and curiosity of learners</td>
<td>3</td>
<td>7</td>
<td>10</td>
<td>0</td>
<td>2.4</td>
</tr>
<tr>
<td><strong>Lesson Development:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lesson encouraged learners to give their prior experiences.</td>
<td>6</td>
<td>5</td>
<td>9</td>
<td>0</td>
<td>2.2</td>
</tr>
<tr>
<td>Learners gave their own hypotheses/predictions.</td>
<td>12</td>
<td>4</td>
<td>4</td>
<td>0</td>
<td>1.6</td>
</tr>
<tr>
<td>Learners encouraged to give their own observations/results in experiments.</td>
<td>0</td>
<td>10</td>
<td>9</td>
<td>1</td>
<td>2.4</td>
</tr>
<tr>
<td>Lesson facilitated process skills such as observing and measuring.</td>
<td>0</td>
<td>7</td>
<td>13</td>
<td>0</td>
<td>2.7</td>
</tr>
<tr>
<td>Teacher dealt with students’ misconceptions and reinforces learning at every step.</td>
<td>0</td>
<td>2</td>
<td>18</td>
<td>0</td>
<td>2.9</td>
</tr>
<tr>
<td>Active participation of students in main teaching steps.</td>
<td>0</td>
<td>3</td>
<td>16</td>
<td>1</td>
<td>3.0</td>
</tr>
<tr>
<td><strong>Conclusion:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lesson encouraged learners to draw conclusions</td>
<td>0</td>
<td>2</td>
<td>18</td>
<td>0</td>
<td>2.9</td>
</tr>
<tr>
<td>Teacher summarized lesson and gave follow-up activities.</td>
<td>3</td>
<td>5</td>
<td>10</td>
<td>2</td>
<td>2.7</td>
</tr>
<tr>
<td>Teacher checked accuracy, correctness and depth of content through question and answer technique</td>
<td>0</td>
<td>7</td>
<td>13</td>
<td>0</td>
<td>2.7</td>
</tr>
<tr>
<td>Lesson encouraged learners to view content in relation to what they come across in the society.</td>
<td>3</td>
<td>9</td>
<td>8</td>
<td>0</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>Class management:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher conducted lesson taking into account the individual differences in student capability.</td>
<td>13</td>
<td>4</td>
<td>3</td>
<td>0</td>
<td>1.5</td>
</tr>
<tr>
<td><strong>Use of instructional materials:</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher made effective use of the teaching/learning materials and media</td>
<td>2</td>
<td>10</td>
<td>8</td>
<td>0</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>Average score for Do Component</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.5</td>
</tr>
</tbody>
</table>
It was revealed that mathematics teachers adequately (Average score=2.5) used the Do component as shown in table 4.14. The table shows that in the introduction, the lesson was adequately (Mean=2.9) clear on what teachers wanted students to learn, with a majority (fourteen out of twenty) of the teachers doing it adequately. However, the table reveals that incorporation of previous knowledge, skills, and everyday experience was inadequate (Mean=2.2), with eight out of twenty teachers doing it adequately; seven out of twenty doing it inadequately; and a quarter of the teachers not doing it at all.

In lesson development, table 4.14 depicts that active participation of students in main teaching steps was the best done (Mean=3.0), with three out of twenty teachers doing it inadequately, sixteen out of twenty teachers doing it adequately; and one out of twenty teachers doing it a great deal. Teachers did not do well in encouraging learners to give their own hypotheses and predictions as the table reveals that this done by teachers inadequately (Mean=1.6), with a majority (twelve out of twenty) of the teachers not doing it at all; four out of twenty teachers doing it inadequately; and four out of twenty teachers doing it adequately.

In lesson conclusion, table 4.14 shows that teachers adequately (Mean=2.9) allowed learners to draw lesson conclusions, with eighteen out of twenty teachers doing it adequately; and two out of twenty teachers doing it inadequately. Encouraging learners to view content learnt in relation to what they came across in the society was the worst practiced as table 4.14 indicates that teachers did so inadequately (Mean=2.3), with three
out of twenty teachers not doing it at all; nine out of twenty teachers doing it inadequately; and eight out of twenty teachers doing it adequately.

In handling class management and use of instructional media, table 4.14 reveals that teachers took into account individual differences of student capability inadequately (Mean =1.5), with a majority (thirteen out of twenty) of the teachers not doing it at all; four out of twenty teachers doing it inadequately; and three out of twenty teachers doing it adequately. Equally, effective use of media was inadequate (Mean =2.3), with a half of the teachers doing it inadequately; eight out of twenty teachers doing it adequately; and two out of twenty teachers not doing it at all.

This finding concurs with the findings of studies by Wambui (2006), Macharia (2008) and Oirere (2008) that a majority of the SMASSE trained teachers appropriately delivered their lessons. It also agrees with the finding of a study by USAID-AIR (2010) that teachers who underwent the TELL training were using the strategies and methods learnt in the training.

The ASEI-PDSI approach expects mathematics teachers to appropriately deliver their lessons after preparation (www.SMASSE.org/E/indexe.html)[Retrieved on 11th Oct. 2008]. The finding that teachers adequately (Average score=2.5) used the Do component is, therefore, encouraging. This might partly be attributed to the possibility that teachers
were comfortable in using the component. The usage of this component by teachers, therefore, calls for further strengthening.

4.3.7 Teachers’ Usage of the See Component

The ASEI-PDSI approach advocates for evaluation of lessons both as they progress and after the lessons. The evaluation is expected to yield feedback that enables a teacher to improve both the current and subsequent lessons. As such, this study sought to investigate the extent to which mathematics teachers evaluated their lessons. Specifically, teachers were rated on their extent of practice of the following indicators: teacher supervising class work; teacher being attentive to needs of students of both low and high academic ability; teacher keeping eye contact on students to monitor their feelings; teacher inviting questions from students; and teacher asking questions to check quality of understanding. Table 4.15 presents findings on the See component.

Table 4.15 Degree of Usage of the See Component (N=20)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher supervised class work</td>
<td>0</td>
<td>0</td>
<td>18</td>
<td>2</td>
<td>3.1</td>
</tr>
<tr>
<td>Teacher was attentive to needs of students of both low and high academic ability.</td>
<td>8</td>
<td>9</td>
<td>3</td>
<td>0</td>
<td>1.8</td>
</tr>
<tr>
<td>Teacher kept eye contact on students to monitor their feelings.</td>
<td>0</td>
<td>4</td>
<td>16</td>
<td>0</td>
<td>2.8</td>
</tr>
<tr>
<td>Teacher invited questions from students.</td>
<td>0</td>
<td>6</td>
<td>14</td>
<td>0</td>
<td>2.7</td>
</tr>
<tr>
<td>Teacher asked questions to check quality of understanding.</td>
<td>0</td>
<td>0</td>
<td>20</td>
<td>0</td>
<td>3.0</td>
</tr>
</tbody>
</table>

Average score for See Component  
2.7
It emerged that mathematics teachers used the See component adequately (Average score=2.7) as depicted in table 4.15. Of the various indicators of the See component, table 4.15 indicates that the best done was supervision of class work by teachers. The table shows that teachers supervised class work adequately (Mean =3.2), with two out of twenty teachers doing it a great deal; and eighteen out of twenty teachers doing it adequately. The table also reveals that teachers attending to the needs of learners of learners of both low and high academic ability. According to the table, teachers paid attention to the needs of learners of learners of both low and high academic ability inadequately (Mean=1.8), with eight out of twenty teachers not doing it at all; nine out of twenty teachers doing it inadequately; and three out of twenty teachers doing it adequately.

This finding is consistent with findings of studies by Wambui (2006), Macharia (2008) and Oirere (2008) that a majority of the SMASSE trained teachers adequately evaluated their lessons thus providing feedback that is crucial for improvement of both the current and subsequent lessons. It also agrees with the finding of a study by USAID-AIR (2010) that teachers who underwent the TELL training were using the strategies and methods learnt in the training.

This study established that teachers evaluated their lessons adequately (Average score=2.7). This might partly be attributed to the possibility that teachers were comfortable in using the component. The finding means that teachers are able to get
feedback that is important for making improvement either during the lesson or in subsequent lessons. There is need, therefore, to strengthen usage of this component.

4.3.8 Teachers’ Usage of the Improve Component

This study sought to unveil the extent to which mathematics teachers improved their lessons. Teachers’ extent of usage of the Improve component was rated on the following indicators: teacher rephrasing questions or instructional statements as necessary; teacher interjecting rightly and calling to attention inattentive students; teacher giving further guidance to students on lesson activities; teacher giving further guidance to students on lesson activities. The findings are presented in table 4.16.

Table 4.16 Degree of Usage of the Improve Component (N=20)

<table>
<thead>
<tr>
<th>Indicator</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher rephrased questions or instructional statements as necessary.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.0</td>
</tr>
<tr>
<td>Teacher rightly interjected and called to attention inattentive students.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.5</td>
</tr>
<tr>
<td>Teacher gave further guidance to students on lesson activities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.6</td>
</tr>
<tr>
<td>Teacher made appropriate adjustments in the conduct of the lesson.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.9</td>
</tr>
<tr>
<td>Average score for Improve Component</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2.2</td>
</tr>
</tbody>
</table>
From table 4.16, it is evident that mathematics teachers improved their lessons inadequately (Average score=2.2). The table also shows that teachers gave learners further guidance on lesson activities adequately (Mean =2.6), with three-quarters of the teachers doing this adequately; one out of twenty teachers doing it inadequately; and four out of twenty teachers not doing it at all. The table also shows that teachers made appropriate adjustments in the conduct of lessons inadequately (Mean =1.9), with a half of the teachers not doing it at all; three out of twenty teachers doing it inadequately; and seven out of twenty teachers doing it adequately.

This result tallies with the result of a study by Sifuna and Kaime (2007) that while teachers perceived the SMASSE INSET programme as having been effective in exposing them to a student-centred approach, this was not reflected in their classroom practices which were largely teacher-dominated.

Improvement in mathematics lessons not only creates but also sustains interest in the learning of the subject (www.SMASSE.org/E/indexe.html)[Retrieved on 11th Oct. 2008]. Improvement is based on the feedback obtained from evaluation of lessons. As it was revealed in this study, mathematics teachers improved their lessons inadequately (Average score=2.2), which suggests that minimal improvements are made to the lessons. This is in spite of the revelations in this study that teachers had a high (Average score=3.3) understanding of this component, and that teachers evaluated their lessons adequately (Average score=2.7). This implies teachers fail to sufficiently improve their lessons for reasons other than a lack of understanding. It also implies that though useful
feedback may be obtained during evaluation of lessons, only a small fraction of it is used to improve lessons. This could easily take away interest from the learning of mathematics thus hampering learning.

**4.3.9 Summary of Study Findings on Usage of the ASEI-PDSI Approach**

From the study data and based on the measures on the rating scale 1-4(where 1= Not at all and 4=A Great Deal), it emerged that the ASEI-PDSI approach was inadequately (Average score=2.0) used in secondary schools of Nyamaiya Division as reflected in table 4.20. On the extent of usage of various components of the ASEI-PDSI approach, it was revealed that mathematics teachers used a half of the components inadequately (Average score ranging between 1.5 and 2.4). These were: Activity, Student-involvement, Experiment, and Improve. It also emerged that teachers implemented the Plan, Do, and See components adequately (Average score ranging between 2.5 and 3.4). The study also revealed that two of the Improvisation component was not being used at all (Average score=1.4). This summary is presented in table 4.17.
Table 4.17 Degree of Usage of the ASEI-PDSI Approach

<table>
<thead>
<tr>
<th>Component</th>
<th>Average score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activity component</td>
<td>1.5</td>
</tr>
<tr>
<td>Student- involvement component</td>
<td>1.5</td>
</tr>
<tr>
<td>Experiment component</td>
<td>1.8</td>
</tr>
<tr>
<td>Improvisation component</td>
<td>1.4</td>
</tr>
<tr>
<td>Plan component</td>
<td>2.6</td>
</tr>
<tr>
<td>Do component</td>
<td>2.5</td>
</tr>
<tr>
<td>See component</td>
<td>2.7</td>
</tr>
<tr>
<td>Improve component</td>
<td>2.2</td>
</tr>
</tbody>
</table>

Average score for ASEI-PDSI Approach 2.0

This finding is in agreement with a finding by Sifuna and Kaime (2007) in which it was established that while teachers perceived the SMASSE INSET programme as having been effective in exposing them to a student-centred approach, this was not reflected in their classroom practices which were largely teacher-dominated. This was partly attributed to large classes, the use of English as second language, and pressure to cover the syllabuses in preparation of the national examinations.

The finding may suggest that teachers have not embraced the ASEI-PDSI approach despite the SMASSE impact assessment surveys indicating so. Internalization of an innovative teaching and learning approach is critical for effective and adequate implementation of the approach.
4.4. Supervision of Implementation of the ASEI-PDSI Approach

It was the objective of this study to determine the extent to which secondary school head teachers supervised and supported the implementation of the ASEI-PDSI approach in mathematics lessons. Secondary school head teachers are expected to mobilize all available resources for enhancement of teaching and learning activities, motivate teachers and also conduct regular school-based supervision of teaching and learning activities. For these reasons, the SMASSE INSET considers head teachers as very crucial players in the implementation of the ASEI-PDSI approach. As such, this study sought to determine the extent to which secondary school head teachers were supervising the implementation of the ASEI-PDSI approach in mathematics lessons.

The study asked head teachers to rate their degree of practice of aspects of supervision and support that are instrumental to success in the implementation of the ASEI-PDSI approach. A four-point scale (1=Never, 2=Rarely, 3=Often, and 4=Very Often) was used to rate the degree of practice. ‘Never’ implies the aspect is not practiced at all, ‘Rarely’ implies the aspect is practiced once or twice in a school term, ‘Often’ implies the aspect is practiced once or twice in a fortnight, while ‘Very Often’ implies once or twice in each school week. Specifically, the head teachers were asked to rate their extent of supervision of: conducting classroom evaluations of mathematics lessons; holding of individual conferences with mathematics teacher(s); provision of mathematics teaching and learning resources; ensuring adequacy of the teaching and learning resources; acquisition of teaching and learning materials in advance; checking schemes of work; checking of ASEI
lesson plans; checking of students’ progress records; and checking of students’ exercise books. To get the mean score for each supervision aspect, the number of respondent head teachers for that aspect is multiplied by their “weightage” choice, added up and divided by the total number of respondent teachers. To get the average score for supervision of implementation of the ASEI-PDSI approach, the mean scores of the supervision aspects are added up and divided by the total number of aspects. The responses of head teachers are presented in table 4.18.

**Table 4.18 Degree of Supervision of ASEI-PDSI Approach by Head Teachers**

<table>
<thead>
<tr>
<th>Supervision Aspect</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Conducting classroom evaluations of mathematics lessons</td>
<td>0</td>
<td>0</td>
<td>9</td>
<td>5</td>
<td>1.6</td>
</tr>
<tr>
<td>Holding of individual conferences with mathematics teacher(s)</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>10</td>
<td>1.3</td>
</tr>
<tr>
<td>Provision of mathematics teaching and learning resources</td>
<td>2</td>
<td>6</td>
<td>6</td>
<td>0</td>
<td>2.7</td>
</tr>
<tr>
<td>Ensuring adequacy of the teaching and learning resources</td>
<td>0</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Acquisition of teaching and learning materials in advance</td>
<td>0</td>
<td>2</td>
<td>12</td>
<td>0</td>
<td>2.1</td>
</tr>
<tr>
<td>Checking schemes of work</td>
<td>1</td>
<td>11</td>
<td>3</td>
<td>0</td>
<td>3.1</td>
</tr>
<tr>
<td>Checking of ASEI lesson plans</td>
<td>0</td>
<td>2</td>
<td>8</td>
<td>4</td>
<td>1.9</td>
</tr>
<tr>
<td>Checking of students’ progress records</td>
<td>2</td>
<td>5</td>
<td>7</td>
<td>0</td>
<td>2.6</td>
</tr>
<tr>
<td>Checking of students’ exercise books</td>
<td>3</td>
<td>9</td>
<td>2</td>
<td>0</td>
<td>3.1</td>
</tr>
</tbody>
</table>

Average score for Supervision of ASEI-PDSI Approach 2.3
Table 4.18 depicts that head teachers rarely (Average score=2.3) supervise the implementation of the ASEI-PDSI approach in mathematics lessons. Holding of individual conferences with mathematics teacher(s) recorded the lowest rating (Mean=1.3), with all the head teachers ranking their degree of supervision as either rare or never. Ensuring adequacy of the teaching and learning resources; acquisition of teaching and learning materials in advance; and checking of ASEI lesson plans were rated as rarely supervised (Mean ranging between 1.5 and 2.4). Checking of schemes of work and students’ exercise books received the highest rating (Mean=3.1), with table 4.18 showing that head teachers often practiced the two aspects.

This study revealed that a majority of the aspects of supervision are rarely practiced by head teachers, a finding which was in line with a finding by Itolondo (2008) that observation of teachers during instruction- which is an aspect of supervision, is done in very few schools. This may partly explain why the ASEI-PDSI approach is used inadequately in mathematics lessons. Head teachers may equally be lacking the expertise to carry out effective supervision. As Onyango (2001) points, school heads lack effective training in educational administration, thus lacking the expertise to carry out effective supervision and evaluation of the curriculum practice in the schools. He recommended the need to train educational administrators at school level in management knowledge and skills which will enable them to carry out effective supervision and evaluation of the curriculum. It has also been established that other head teachers do not spend adequate time in the supervision of curriculum implementation. According to Musungu and
Nasongo (2008) point out, many head-teachers of schools spend more time with finance management than with the curriculum and instruction, and student personnel. They argue that head teachers seem to believe that they are only accountable for financial management of their schools because they are liable for prosecution if financial mismanagement is discovered. There is, therefore, an urgent need to devise mechanisms that will ensure that this vital role is undertaken by head teachers.

The SMASSE INSET expects head teachers of secondary schools to play a pivotal role in the implementation of the ASEI-PDSI approach. Hence the finding that head teachers rarely supervise the implementation of the ASEI-PDSI approach was a setback to the institutionalization of the approach.

4.5 Constraints Encountered in implementation of ASEI-PDSI approach and Suggestions for Improvement

4.5.1 Constraints Encountered by Teachers and Suggestions for Improvement

The inadequate usage of the ASEI-PDSI approach may be partly attributed to constraints teachers indicated they faced in the implementation of the approach. These include pressure to cover the syllabus, large classes, lack of adequate time, heavy teaching load, inadequate teaching resources, lack of cooperation from the school administration, student absenteeism, discouragement from other teachers, and low students’ entry marks. The constraints reported by teachers are presented in table 4.19.
Table 4.19 Constraints Faced by Mathematics Teachers in the Implementation of the ASEI-PDSI Approach (N=20)

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pressure to cover syllabus</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Large classes</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Lack of adequate time</td>
<td>17</td>
<td>85</td>
</tr>
<tr>
<td>Heavy teaching load</td>
<td>16</td>
<td>80</td>
</tr>
<tr>
<td>Inadequate teaching and learning resources</td>
<td>13</td>
<td>65</td>
</tr>
<tr>
<td>Lack of cooperation from the school administration</td>
<td>12</td>
<td>60</td>
</tr>
<tr>
<td>Student absenteeism</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Discouragement from other teachers</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Low students’ entry marks</td>
<td>8</td>
<td>40</td>
</tr>
</tbody>
</table>

According to table 4.19, all the respondent teachers cited pressure to cover the syllabus and large classes as the major constraints they faced while implementing the ASEI-PDSI approach in mathematics lessons. This made it difficult for the teachers to give individual attention to learners.

This finding is consistent with findings by Oirere (2008) in which it was established that pressure to cover syllabuses and large classes were the main constraints in the implementation of the ASEI-PDSI approach. The finding is also in agreement with a finding by USAID-AIR (2010) in which it was reported that the two constraints were hampering the implementation of the TELL strategies and methods.

Table 4.19 also shows that 17 (85%) of the respondent mathematics teachers lacked adequate time as a constraint. Heavy teaching load was mentioned by 16 (80%) of the respondent mathematics teachers. This made it difficult for the teachers to plan
effectively, improvise appropriate teaching and learning resources, and for learners to evaluate the lessons. Other constraints included lack of adequate teaching and learning resources as mentioned by 13(65%) of the respondent teachers, lack of cooperation from the school administration as reported by 12(60%) of the respondent teachers, and student absenteeism as reported by 10(50%) of the respondent teachers. Discouragement from the other teachers was mentioned by 10(50%) of the respondent teachers while low students’ entry marks was cited by eight (40%) of the respondent teachers.

The findings concurred with findings by Oirere (2008) and USAID-AIR (2010) where similar constraints were identified. The constraints encountered in Nyamaiya Division require urgent intervention in order to ensure smooth implementation of the ASEI-PDSI approach.

This study sought mathematics teachers’ suggestions that would lead to improvement in the implementation of the ASEI-PDSI approach. Table 4.20 presents their views.
According to table 4.20, all the respondent teachers suggested a reduction in the teaching load as one way of improving the implementation of the ASEI-PDSI approach in mathematics lessons. This would create more time for planning of lessons and improvisation of appropriate teaching and learning resources. It was also suggested by 18 (90%) of the respondent teachers that the student-teacher ratio be reduced, while 16 (80%) of the respondent teachers proposed timely provision of adequate teaching and learning resources. According to 12 (60%) of the respondent teachers, some form of motivation should be devised for mathematics teachers to make them develop a positive attitude towards the implementation of ASEI-PDSI approach; they considered the approach to be too demanding in terms of implementation thus making them to have a negative attitude towards the approach. Nine (45%) of the respondent teachers suggested a reduction in the teaching load as one way of improving the implementation of the ASEI-PDSI approach in mathematics lessons. This would create more time for planning of lessons and improvisation of appropriate teaching and learning resources. It was also suggested by 18 (90%) of the respondent teachers that the student-teacher ratio be reduced, while 16 (80%) of the respondent teachers proposed timely provision of adequate teaching and learning resources. According to 12 (60%) of the respondent teachers, some form of motivation should be devised for mathematics teachers to make them develop a positive attitude towards the implementation of ASEI-PDSI approach; they considered the approach to be too demanding in terms of implementation thus making them to have a negative attitude towards the approach. Nine (45%) of the respondent teachers proposed

<table>
<thead>
<tr>
<th>Suggestion</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduction of teaching load</td>
<td>20</td>
<td>100</td>
</tr>
<tr>
<td>Reduction of student-teacher ratio</td>
<td>18</td>
<td>90</td>
</tr>
<tr>
<td>Timely provision of adequate teaching/learning materials</td>
<td>16</td>
<td>80</td>
</tr>
<tr>
<td>Motivation of mathematics teachers</td>
<td>12</td>
<td>60</td>
</tr>
<tr>
<td>Implementation of ASEI-PDSI approach at primary level</td>
<td>9</td>
<td>45</td>
</tr>
<tr>
<td>Close supervision of mathematics teachers by head teachers</td>
<td>7</td>
<td>35</td>
</tr>
</tbody>
</table>
that the ASEI-PDSI approach should be implemented right from the primary level of education. Seven (35%) of the respondent teachers gave the suggestion that mathematics teachers should be closely supervised to monitor the implementation of the ASEI-PDSI approach. This would ensure that weaknesses and challenges in the implementation process are identified and corrected in time.

### 4.5.2 Constraints Encountered by Head Teachers and Suggestions for Improvement

The rare supervision of the implementation of the ASEI-PDSI approach may be partly attributed to the constraints head teachers face while carrying out supervision. Head teachers were interviewed on the constraints they encountered and their responses are presented in table 4.21.

<table>
<thead>
<tr>
<th>Constraint</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Untimely release of Tuition Money from the Ministry of Education</td>
<td>14</td>
<td>100</td>
</tr>
<tr>
<td>Negative attitude by mathematics teachers</td>
<td>12</td>
<td>86</td>
</tr>
<tr>
<td>Discouragement from other teachers</td>
<td>10</td>
<td>71</td>
</tr>
<tr>
<td>Lack of adequate time for supervision of ASEI-PDSI approach</td>
<td>9</td>
<td>64</td>
</tr>
<tr>
<td>Suspicion from teachers during supervision</td>
<td>9</td>
<td>64</td>
</tr>
<tr>
<td>Lazy mathematics teachers</td>
<td>6</td>
<td>43</td>
</tr>
</tbody>
</table>

As shown in table 4.21, it emerged that all the respondent head teachers felt the untimely release of Tuition Money from the Ministry of Education was the biggest constraint of all. This made it difficult to procure the necessary teaching and learning resources at the
right time, hence hindering the smooth implementation of the ASEI-PDSI approach. According to 12 (86%) of the respondent head teachers, teachers’ negative attitude towards learning mathematics was another constraint. Their negative attitude had the potential of eliciting a negative attitude towards the learning of mathematics among students. Discouragement of mathematics teachers by other teachers was reported by 10 (71%) of the respondent head teachers while suspicion from teachers during supervision, and lack of enough time for supervision were cited by nine (64%) of the respondent head teachers. Laziness on the part of the mathematics teachers was reported by six (43%) of the respondent head teachers.

The findings that head teachers lack adequate time to supervise implementation of the ASEI-PDSI approach, and the discouragement of mathematics teachers by their colleagues are in agreement with findings by Oirere (2008) and USAID-AIR (2010) in which the two factors were cited as constraints to implementation of teaching and learning innovative approaches.

To address the constraints head teachers encounter, this study interviewed head teachers on suggestions that would lead to improvement in the implementation of the ASEI-PDSI approach. Table 4.22 presents their views.
Table 4.22 Suggestions by Head Teachers on Improvement in Implementation of ASEI-PDSI Approach

<table>
<thead>
<tr>
<th>Suggestion</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Release of Tuition Money by the Ministry of Education in advance</td>
<td>14</td>
<td>100</td>
</tr>
<tr>
<td>Increase the Tuition Money</td>
<td>13</td>
<td>93</td>
</tr>
<tr>
<td>Recruitment of more mathematics teachers</td>
<td>10</td>
<td>71</td>
</tr>
<tr>
<td>Change of attitude by mathematics teachers</td>
<td>9</td>
<td>64</td>
</tr>
<tr>
<td>Payment of responsibility allowance to head teachers</td>
<td>6</td>
<td>43</td>
</tr>
</tbody>
</table>

As depicted in table 4.22, all the respondent head teachers suggested that the release of Tuition Money from the Ministry of Education should be done in advance to facilitate timely procurement of the required teaching and learning resources. According to 13 (93%) of the respondent head teachers, the amount of Tuition Money from the government should be increased to enable schools buy enough teaching and learning resources. To ease pressure on mathematics teachers, 10 (71%) of the respondent head teachers proposed that more mathematics teachers should be recruited by the Teachers Service Commission (TSC). On negative attitude of mathematics teachers, nine (64%) of the respondent head teachers suggested that mathematics ought to change their attitude towards the teaching and learning of the subject. To motivate head teachers so that they could take supervision of the implementation of ASEI-PDSI approach seriously, six (43%) of the respondent head teachers proposed that head teachers should be paid a responsibility allowance.
CHAPTER FIVE

Summary, Conclusions and Recommendations

5.1 Introduction

This chapter gives the summary of the findings, conclusion, recommendations and suggestions for further research. The purpose of this study was to assess the extent of implementation of the ASEI-PDSI approach in mathematics lessons in secondary schools of Nyamaiya Division. The study was conducted using descriptive survey design. To achieve the objectives of the study, the researcher collected data from head teachers and mathematics teachers using interview schedules and a lesson observation rating scale. The findings presented in chapter four have shed some light regarding the degree of understanding and usage of the ASEI-PDSI approach by mathematics teachers, the degree of supervision of the ASEI-PDSI approach by head teachers, constraints encountered in the implementation of the ASEI-PDSI approach, and suggestions offered by head teachers and mathematics teachers on how the implementation of the ASEI-PDSI approach could be improved.

5.2 Summary of the Study Findings

The following is the summary of the study findings.

5.3 Teachers’ Understanding of ASEI-PDSI Approach

From the study data it was revealed that teachers had either a high or very high understanding of the ASEI-PDSI approach. The teachers indicated they had a high
understanding of Student-involvement, Experiment, Plan, Do, See, and Improve components of the approach. They also indicated they had a very high understanding of Activity and Improvisation components.

5.4 Teachers’ Usage of ASEI-PDSI Approach

From the study data, it emerged that the ASEI-PDSI approach was inadequately used in secondary schools of Nyamaiya Division. On the degree of usage of various components of the ASEI-PDSI approach, it was revealed that mathematics teachers used a half of the components inadequately. These were: Activity; Student-involvement, Experiment; and Improve components. It also emerged that teachers implemented the Plan, Do, and See components adequately. The study also revealed that the Improvisation component was not being used at all.

5.5 Supervision of Implementation the ASEI-PDSI Approach

The study found that head teachers rarely supervise the implementation of the ASEI-PDSI approach in mathematics lessons. Holding of individual conferences with mathematics teachers was the least practiced, with all the head teachers ranking their degree of supervision as either rare or never.

5.6 Constraints Encountered and Suggestions for Improvement

The study revealed that pressure to cover the syllabus and large classes were the major constraints on the implementation of the ASEI-PDSI approach. Others included lack of
adequate time, heavy teaching load, inadequate teaching resources, lack of cooperation from the school administration, student absenteeism, discouragement from other teachers, and low students’ entry marks.

To improve the implementation of the ASEI-PDSI approach, reduction of the teaching load and reduction of the student to teacher ratio were put forward as the main suggestions. Others include timely provision of adequate teaching and learning materials, motivation of mathematics teachers, implementation of the ASEI-PDSI approach at primary level, and close supervision of teachers by head teachers.

Head teachers cited untimely release of tuition funds from the government and negative attitude by mathematics teachers as the major constraints. Others include discouragement from other teachers, laziness of mathematics teachers and suspicion from teachers during supervision.

To improve the implementation of the ASEI-PDSI approach, timely release of tuition money by the government and increasing the Tuition money allocation by the government were advanced by head teachers as the main suggestions. Others include recruitment of more mathematics teachers, change of attitude by mathematics teachers, and payment of a handsome responsibility allowance to head teachers.
5.7 Conclusions

From the findings, it can be concluded that mathematics teachers have a high understanding of the ASEI-PDSI approach and hence well prepared to implement the approach in their lessons. However, teachers’ use of the ASEI-PDSI approach in their lessons is inadequate as revealed in this study. From the study, it can also be concluded that head teachers rarely supervise the implementation of the ASEI-PDSI approach in mathematics lessons thus impeding upon effective implementation of the approach. It can also be concluded that implementation of the approach faces some constraints as revealed in this study. Such constraints include pressure to cover the syllabus, large classes, lack of adequate time, heavy teaching load, inadequate teaching resources, lack of cooperation from the school administration, student absenteeism, and discouragement from other teachers.

5.8 Recommendations

Based on the findings from this study, the researcher makes the following recommendations in order to address the challenges of implementation of ASEI-PDSI approach in mathematics lessons not only in the secondary schools of Nyamaiya Division but also in all the schools in the country:

(i) This study revealed that teachers have a high understanding of the ASEI-PDSI approach. Strengthening of that understanding will therefore be worthwhile. Consequently, this study recommends that follow-up efforts should be made to further improve teachers’ understanding in using the ASEI-PDSI approach. Follow-up efforts
could take various forms, from school-level professional development activities to future nationwide in-service refresher training.

(ii) As this study revealed, some components of the ASEI-PDSI approach were adequately practiced while others were either inadequately practiced or not practiced at all. It is, therefore, recommended that the Ministry of Education should organize an INSET focusing on components of the ASEI-PDSI approach whose extent of implementation was inadequate.

(iii) This study identified large classes as a major constraint to the implementation of the ASEI-PDSI approach. To address this challenge, it is recommended that the Teachers Service Commission should recruit more mathematics teachers.

(iv) It was revealed in this study that secondary school head teachers rarely supervise the implementation of the ASEI-PDSI approach. As such, this study recommends that an INSET should be organized for secondary school headteachers so that they could be taken through the requirements of supervision with regard to the implementation of the ASEI-PDSI approach.

5.9 Suggestions for Further Research

The following studies are recommended by the researcher:

(i) An ethnographic study focusing on how well mathematics teachers utilize their time in school. Lack of adequate time for proper lesson preparation was identified by teachers as a constraint to the implementation of the ASEI-PDSI approach.
(ii) A study on the level of preparedness of headteachers with regard to supervision of implementation of the ASEI-PDSI approach. This study revealed that supervision of implementation of the ASEI-PDSI approach was rare.

(iii) The current study was carried out in only one division. Similar studies should be carried out in other parts of the country to gather adequate information on implementation of the ASEI-PDSI approach, for generalization to be made.
REFERENCES:


Muthemi, T.K (2004). ‘The Impact of Smasse Programme on Teaching of


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Nairobi: MOEST.
SMASSE (2009). SMASSE Newsletter. Issue No. 1
APPENDIX I: QUESTIONNAIRE FOR MATHEMATICS TEACHERS

This is a study that seeks to assess the implementation of the ASEI-PDSI approach in mathematics lessons in secondary schools of Nyamaiya Division. You have been selected to participate in this study. I will appreciate it if you could take your time to respond to this interview. Your views will be kept strictly confidential and will only be used for the purpose of this study. Your honest response to this interview schedule will make this study a success. Thank you for taking your time.

Section A: Background Information

1. Gender:  
   A. Male  
   B. Female

2. What is your academic qualification?  
   A. Dip. Ed  
   B. B. Ed  
   C. B.A/B.Sc  
   D. B.A/B.Sc with PGDE  
   E. Masters  
   F. Any Other___________

3. What is your teaching experience?  
   A: 4 years and below  
   B: 5-9 years  
   C: 10-14 years  
   D: 15-19 years  
   E: 20 years and above

4. What is your total teaching load per week?

Section B: Teachers’ Level of Understanding of ASEI-PDSI Components and Indicators

Please rate your level of understanding of the ASEI-PDSI approach by ticking in the appropriate box for each indicator. Use the scale: 1 for little, 2 for medium, 3 for high, and 4 for very high.

<table>
<thead>
<tr>
<th>Indicator</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson is activity-focused as practical work is given</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher gives learners appropriate tasks were given for discussion</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Teacher effectively encourages students to give their prior experiences.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>4.</td>
<td>Teacher effectively encourages students to give their own hypotheses/predictions</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>Teacher effectively encourages students to give their own results/observations in experiments.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6.</td>
<td>Teacher effectively encourages students to evaluate the lesson.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>The experiment(s) helped to achieve the objectives of the lesson as:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7.</td>
<td>Students’ ability to solve related problems</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8.</td>
<td>Students’ ability to make deductions from practical work.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9.</td>
<td>Students’ ability to verify hypotheses/predictions.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10.</td>
<td>Doing of modified/small-scale experiments</td>
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<td>11.</td>
<td>Utilization of materials available in the students’ immediate environment.</td>
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<td>12.</td>
<td>Production and or utilization of improvised materials by the teacher</td>
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<tr>
<td>13.</td>
<td>Students’ ability to use improvised materials effectively</td>
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<td>14.</td>
<td>Work plan taking into account students’ background</td>
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<tr>
<td>15.</td>
<td>Work plan being appropriate and realistic in light of lesson content and students’ abilities/interest/skills.</td>
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<td>16.</td>
<td>Preparation of appropriate and adequate materials for students’ use by the teacher</td>
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</tbody>
</table>

**Introduction:**

17. Incorporation of previous knowledge/skills/everyday experience.  
18. Clear on what the teacher wants students to learn.  
19. Stimulating enough to arouse the interest and curiosity of learners

**Lesson Development:**

20. Lesson encourages learners to give their prior experiences.  
21. Learners give their own hypotheses/predictions.  
22. Learners encouraged to give their own observations/results in experiments.  
23. Lesson facilitates process skills such as observing and measuring.  
24. Teacher deals with students’ misconceptions and reinforces learning at every step.  
25. Active participation of students in main teaching steps.

**Conclusion:**

26. Lesson encourages learners to draw conclusions  
27. Teacher summarizes lesson and gives follow-up activities.  
28. Teacher checks accuracy, correctness and depth of content through question and answer technique  
29. Lesson encourages learners to view content in
relation to what they come across in the society.

**Class management:**
30. Teacher conducts lesson taking into account the individual differences in student capability.

**Use of instructional materials:**
31. Teacher makes effective use of the teaching/learning materials and media
32. Teacher supervises class work
33. Teacher is attentive to needs of students of both low and high academic ability.
34. Teacher keeps eye contact on students to monitor their feelings.
35. Teacher invites questions from students.
36. Teacher asks questions to check quality of understanding.
37. Teacher rephrases questions or instructional statements as necessary.
38. Teacher rightly interjects and calls to attention inattentive students.
39. Teacher gives further guidance to students on lesson activities.
40. Teacher makes appropriate adjustments in the conduct of the lesson.

### Section C: Constraints and Improvement of ASEI-PDSI Approach

1. What constraints do you encounter while implementing the ASEI-PDSI approach?

2. How can the implementation of the ASEI-PDSI approach be improved?
APPENDIX II: QUESTIONNAIRE FOR HEAD TEACHERS

This is a study that seeks to assess the implementation of the ASEI-PDSI approach in mathematics lessons in secondary schools of Nyamaiya Division. You have been selected to participate in this study. I will appreciate it if you could take your time to respond to this interview. Your views will be kept strictly confidential and will only be used for the purpose of this study. Your honest response to this interview schedule will make this study a success. Thank you for taking your time.

Section A: Background Information

1. Gender: A. Male  
   B. Female

2. What is your academic qualification? A. Dip. Ed  
   B. B. Ed  
   C. B.A/B.Sc  
   D. B.A/B.Sc with PGDE  
   E. Masters  
   F. Any Other ________

3. What is your headship experience?  
   A: 4 years and below  
   B: 5-9 years  
   C: 10-14 years  
   D: 15-19 years  
   E: 20 years and above

Section B: Supervision of Implementation of the ASEI-PDSI Approach

Please rate your frequency of supervision of the ASEI-PDSI approach by ticking in the appropriate box for each aspect. Use the scale: 1 for Never, 2 for Rarely, 3 for Often, and 4 for Very Often.

<table>
<thead>
<tr>
<th>Supervision Aspect</th>
<th>4</th>
<th>3</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Conducting classroom evaluations of mathematics lessons</td>
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<tr>
<td>2. Holding of individual conferences with mathematics teacher(s)</td>
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<tr>
<td>3. Provision of mathematics teaching and learning resources</td>
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<tr>
<td>4. Ensuring adequacy of the teaching and learning resources</td>
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<tr>
<td>5. Acquisition of teaching and learning materials</td>
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in advance

6. Checking schemes of work
7. Checking of ASEI lesson plans
8. Checking of students’ progress records
9. Checking of students’ exercise books

Section C: Constraints and Improvement of ASE-PDSI Approach

1. What constraints do you encounter while supervising the implementation of the ASEI-PDSI approach?

2. How can the implementation of the ASEI-PDSI approach be improved?
APPENDIX III: MATHEMATICS LESSON OBSERVATION RATING SCALE

School type…………………… Class…………………… Date of observation………………

No. of Students in the observed class…………………. Duration of Lesson………………

Time of observation…………………

<table>
<thead>
<tr>
<th>Indicator</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
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<tbody>
<tr>
<td>1. Lesson was activity-focused as practical work was given</td>
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<td>2. Appropriate tasks were given for discussion</td>
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<td>3. Students were effectively encouraged to give their prior experiences.</td>
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<td>4. Students were effectively encouraged to give their own hypotheses/predictions</td>
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<td>5. Students were effectively encouraged to give their own results/observations in experiments.</td>
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<tr>
<td>6. Students were effectively encouraged to evaluate the lesson.</td>
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<tr>
<td>The experiment(s) helped to achieve the objectives of the lesson as:</td>
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<td>7. Students were able to solve related problems</td>
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<td>8. Students were able to make deductions from practical work.</td>
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<tr>
<td>9. Students were able to verify hypotheses/predictions.</td>
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<tr>
<td>10. Modified/small-scale experiments were done</td>
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<td>11. Utilization of materials available in the students’ immediate environment.</td>
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<td>12. Teacher produced and or utilized improvised materials.</td>
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<td>13. Students were able to use improvised materials effectively</td>
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<td>14. Work plan took into account students’ background</td>
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<tr>
<td>16. Teacher prepared appropriate and adequate materials for students’ use.</td>
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<tr>
<td><strong>Introduction:</strong></td>
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<tr>
<td>17. Incorporated previous knowledge/skills/everyday experience.</td>
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<td>18. Was clear on what the teacher wanted students to</td>
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learn.

19. Was stimulating enough to arouse the interest and curiosity of learners

**Lesson Development:**
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39. Teacher gave further guidance to students on lesson activities.
40. Teacher made appropriate adjustments in the conduct of the lesson.
APPENDIX IV: RESEARCH AUTHORIZATION

NATIONAL COUNCIL FOR SCIENCE AND TECHNOLOGY

Our Ref:

NCST/RR1/12/1/SS/765/3

Mr. Benedict Ochonga Obonyo
Kenyatta University
P. O. Box 43844
NAIROBI

Dear Sir,

RE: RESEARCH AUTHORIZATION

Following your application for authority to carry out research on “Activity, student, experiment, improvisation plan, do, see, improve approach in Mathematics lessons in Nyamaiya Division, Nyamira District, Kenya,” I am pleased to inform you that you have been authorized to undertake research in Nyamira District for a period ending 31st December 2010.

You are advised to report to the District Commissioner and the District Education Officer, Nyamira District before embarking on the research project.

On completion of the research, you are expected to submit two copies of the research report/thesis to our office.

P. N. NYAKUNDI
FOR: SECRETARY/CEO

Copy to:
The District Commissioner
Nyamira District
The District Education Officer
Nyamira District

23rd August 2010

P. O. Box 30423-00100
NAIROBI-KENYA
Website: www.ncst.go.ke
APPENDIX V: RESEARCH CLEARANCE PERMIT

CONDITIONS

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

GPK6055Jmt10/2010
(CONDITIONS—see back page)

APPENDIX V: RESEARCH CLEARANCE PERMIT

PAGE 2

THIS IS TO CERTIFY THAT:

Prof. / Dr. / Mr. / Mrs. / Miss: BENDICT

ONYO ONCHUMA

of (Address): KENYATTA UNIVERSITY

P.O. BOX 43844, N.B.T.

has been permitted to conduct research in

Location,

District,

Province,

on the topic: Activity student experiment improvisation plan, e.g., improve approach in Mathematics.

lessons in Nyamira Division, Nyamira

District, Kenya

for a period ending 31st December, 2010...

Applicant's Signature

Date of issue: 23/08/2010

Fee received: Shs. 1,000

NCST/RET/12/3/88/1765

Secretory

National Council for Science and Technology
APPENDIX VI: LETTER OF AUTHORITY TO CONDUCT RESEARCH

OFFICE OF THE PRESIDENT

Telegrams: “DISTRICTER.” Nyamira
Telephone: 058-6144085

When replying please quote our

Ed.12/14/175
REF: ....................................................

DISTRICT COMMISSIONER
NYAMIRA DISTRICT
P.O. BOX 2
NYAMIRA.

27TH September, 2010

The District Officer,
NYAMAIYA DIVISION

BENDICT ONCHONGA OBONYO

The above named person has been authorized to conduct research on ACTIVITY STUDENT EXPERIMENT, IMROVISATION PLAN, DO, SEE, improve approach in Mathematics lessons within your division. The research period ends on 31st December, 2010.

This is therefore to ask you to him the support he may require once in your division.

F. NDUNGE
FOR: DISTRICT COMMISSIONER
NYAMIRA
APPENDIX VII: DEO’S LETTER OF INTRODUCTION

MINISTRY OF EDUCATION

Telegram: “EDUCATION”, Nyamira
Telephone: (058) 6144224

When replying please quote

REF: NYED/ADM/119/45

DISTRICT EDUCATION OFFICE
NYAMIRA DISTRICT
P.O.BOX 4
NYAMIRA.

Date: 29th September 2010

Mr. Bendict Onchonga Obonyo
Kenyatta University
P. O. Box 43844
NAIROBI

RE: RESEARCH AUTHORISATION

Reference is made to the letter from the National Council for Science and Technology ref: NCST/RR1/12/1/SS/765/3 dated 23rd August 2010 on the above subject and which allowed you to carry out research on “Activity, student, experiment, improvisation, plan, do, see, improve approach in mathematics lessons in Nyamaiya Division, Nyamira District, Kenya” up to 31st December 2010.

You are here allowed to carry out the said research in Secondary schools in Nyamira District.

All concerned parties are requested to accord him the necessary assistance.

James Omwenga
For: District Education Officer
Nyamira District
APPENDIX VIII: SKETCH MAP OF STUDY SITE

Source: Nyamira District Physical Planning Office